SUBCHAPTER 13-4

COMMERCIAL BUILDING COMPLIANCE METHODS

SECTION 13-400 ADMINISTRATION

13-400.0 Scope, Methods of compliance. The provisions of this chapter apply to all new commercial occupancy buildings, additions to existing commercial occupancy buildings, and multiple-family residential buildings over three stories in height. Building type classifications shall be those defined in Subchapter 13-2 of this code under "occupancy classification." This subchapter provides two methods by which commercial buildings may be brought into compliance with this code.

13-400.0.A Method A, the Whole Building Performance Method. This is a computer-based energy code budget method which may be used for determining the compliance of all proposed designs, except designs with no mechanical system. Under this method, cost performance is calculated for the entire building based on the envelope and major energy-consuming systems specified in the design and simultaneously for a baseline building of the same configuration, but with baseline systems. Compliance is met if the *design energy cost* does not exceed the *energy cost budget* when calculated in accordance with this section; and the energy efficiency level of components specified in the building design meet or exceed the efficiency levels used to calculate the *design energy cost.* Compliance calculations are those utilized in the EnergyGauge Summit–Fla/Com computer program and are as described in Appendix 13-B. Basic prescriptive requirements described in the sections called Mandatory Requirements shall also be met.

***Note*:** The *energy cost budget* and the *design energy cost* calculations are applicable only for determining compliance with this standard. They are not predictions of actual energy consumption or costs of the *proposed design* after construction. Actual experience will differ from these calculations due to variations such as occupancy, building operation and maintenance, weather, energy use not covered by this standard, changes in energy rates between design of the building and occupancy, and precision of the calculation tool.

13-400.0.B Method B, the Building Prescriptive Method. This is a prescriptive methodology that is allowed for shell buildings, renovations, change of occupancy, limited or special use buildings and building system changeouts. The *building envelope* complies with the standard if the proposed building meets or exceeds the Mandatory Requirements and all relevant criteria on Form 400B or the EnergyGauge Summit Fla/Com computer printout. Only the prescriptive envelope measures of Method B are permitted for shell buildings.

13-400.0.B.1 Renovated buildings. Renovated buildings shall, when applicable (see Section 13-202), meet the efficiencies listed on Form 400B for components being changed or shall comply with the envelope or systems criteria in Method B of EnergyGauge Summit–Fla/Com for the components being changed. Existing buildings not meeting the definition of a renovation in which new heating, cooling, water heating, electrical or lighting systems are installed shall meet the Mandatory minimum efficiencies listed in this code for the system(s) being changed.

13-400.1 Types of requirements. Mandatory requirements shall be met for all buildings. The section number followed by the combined number and letters ".AB" indicates these Mandatory Requirements (i.e., requirements that shall be met by buildings complying by either Method A or B) in Sections 13-401 through 13-415. Requirements specific to Method A or B (i.e. ".B" is specific to Method B) shall be met when complying with the code by that Method. Where a requirement specific to a method is more stringent than the Mandatory Requirement, the more stringent requirement shall be met.

13-400.2 Performance calculation procedures. The calculation procedures contained in the personal computer-based program entitled EnergyGauge Summit Fla/Com and those described in Appendix 13-B, shall be used to demonstrate code compliance of the design for commercial buildings complying by Method A of this chapter. The building components' efficiency levels specified in the Method A performance compliance calculation are the minimum efficiencies allowed to be installed in the building. Shell buildings complying by Method B are limited to the envelope features only.

13-400.2.A.1 Additions. Additions to existing buildings shall follow the same Method A calculation procedure as new construction with the following qualifications:

1. Calculations shall be conducted using only the components of the addition itself, including those preexisting components which separate the addition from other spaces.
2. Efficiencies for heating and cooling systems shall be assumed to be the minimum efficiency allowed by the code for that type and size of equipment unless new equipment is installed to replace existing equipment or to service the addition specifically or higher equipment efficiencies can be documented.

13-400.2.A.2 Shell buildings. Shell buildings shall comply with this code by Method A or Method B. If Method B is used and once all energy-related design parameters are known, a Method A calculation must be submitted.

13-400.3 Certification of compliance.

13-400.3.AB.1 Code compliance preparation. The EnergyGauge Summit–Fla/Com performance calculation procedures demonstrating code compliance for Method A and Form 400B shall be prepared, signed and

sealed by an architect or engineer registered in the state of Florida, with the exception of buildings excluded by Section 481.229, *Florida Statutes*, or Section 471.003, *Florida Statutes*. Calculations for buildings falling within the exception of Section 471.003, *Florida Statutes,* may be performed by air conditioning or mechanical contractors licensed in accordance with Chapter 489, *Florida Statutes*, or by state of Florida certified commercial building energy raters.

The person preparing the compliance calculation shall certify that the calculation, or amendments thereto, is true and accurate and demonstrates that the building is in compliance with the requirements of Chapter 13 of this code.

13-400.3.AB.2 Code compliance certification. The building's owner, the owner's architect, or other authorized agent legally designated by the owner shall certify to the building official that the building is in compliance with the requirements of Chapter 13 of this code prior to receiving the permit to begin construction or renovation.

If, during the building's construction or renovation, alterations are made in the building's design or in materials or equipment installed in the building which would diminish it's energy performance, an amended copy of the compliance certification shall be submitted to the building official on or before the date of final inspection by the building owner or his or her legally authorized agent.

The certified EnergyGauge Summit Fla/Com calculation printout or Form 400B shall be a part of the plans and specifications submitted for permitting.

The party responsible under Subsections 471.003 and 481.228 and Chapter 489, *Florida Statutes*, for the design and specification of each building system shall certify that the plans and specifications for that system comply with the requirements of Chapter 13 of this code (see also Section 13-103.2).

13-400.3.AB.3 Forms. Forms referenced in Table 13-400.3.AB.3 shall be used to demonstrate code compliance with this chapter. Climate zones used in Subchapter 13-4 shall be as defined in Section 13-202 under ASHRAE Climate Zone.

13-400.3.A Method A Forms. An accurately completed Form 400A-08 (generated by the EnergyGauge Summit Fla/Com computer program) demonstrating that code compliance has been achieved shall be submitted to the building official for Method A compliance. Calculations shall be performed for the building's location.

13-400.3.B Method B Forms. An accurately completed Form 400B-08 or EnergyGauge Summit–Fla/Com computer printout demonstrating that code compliance has been achieved shall be submitted to the building official for Method B compliance.

13-400.4.AB Reporting. A copy of the front page of the 400 series form submitted to demonstrate code compliance shall be sent by the building official to the Florida Building Commission on a quarterly basis for reporting purposes.

TABLE 13-400.AB.3
INDEX TO COMMERCIAL CODE COMPLIANCE FORMS

METHOD	FORM NO.
Method A Whole Building Performance	Form 400A-08 (the EnergyGauge Summit Fla/Com Computer printout)
Method B Building Prescriptive	Form 400B-08 (or EnergyGauge Summit Fla/Com Computer printout)

SECTION 13-401
FENESTRATIONS (Glazing)

13-401.AB Mandatory requirements for Methods A and B. The requirements of Section 13-104.4.5 and general criteria contained in Appendix 13-B relevant to fenestrations shall be met.

13-401.A Requirements specific to Method A. The fenestrations' solar heat gain coefficient and *U*-factor determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance levels allowed (maximum SHGC and *U*-factor).

13-401.B Requirements specific to Method B. The fenestrations' solar heat gain coefficient and *U*-factor specified on Form 400B or on the EnergyGauge Summit Fla/Com Method B printout shall be the minimum levels allowed (maximum SHGC and *U*-value).

SECTION 13-402
WALLS

13-402.AB Mandatory requirements for Methods A and B. General criteria contained in Appendix 13-B relevant to walls shall be met.

13-402.A Requirements specific to Method A. Efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in walls.

13-402.B Requirements specific to Method B. Efficiencies specified on Form 400B or on the EnergyGauge Summit Fla/Com Method B printout shall be the minimum level(s) installed in walls.

SECTION 13-403
DOORS

13-403.AB Mandatory requirements for Methods A and B. General criteria contained in Appendix 13-B relevant to doors shall be met.

13-403.AB.1 Door types allowed. All *exterior* and *adjacent* doors other than glass doors shall meet the *U*-factor specified on Form 400A or B. Hollow core doors shall not be used in either *exterior* or *adjacent walls*. Doors may have glass sections.

13-403.A Requirements specific to Method A. Efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in doors.

13-403.B Requirements specific to Method B. Efficiencies specified on Form 400B or on the EnergyGauge Summit Fla/Com Method B printout shall be the minimum level(s) installed in doors.

SECTION 13-404
ROOFS/CEILINGS

13-404.AB Mandatory requirements for Methods A and B. General criteria contained in Appendix 13-B relevant to roofs/ceilings shall be met.

13-404.AB.1 Roof/ceiling thermal envelopes. The roof or ceiling which functions as the building's thermal envelope shall be insulated to an *R*-value of at least R-10. Roof insulation shall not be installed on a suspended ceiling with removable ceiling panels. Where cavities beneath a roof deck are ventilated, the ceiling shall be considered the envelope component utilized in the EnergyGauge Summit Fla/Com calculation.

13-404.AB.2 Cavities used as plenums. Cavities beneath a roof deck which will be used as supply or return plenums shall have an insulated roof. The insulation shall have a *R*-value of at least R-19.

13-404.AB.3 Vented cavities above dropped ceilings. Where cavities beneath a roof deck are not sealed from the outside environment, the ceiling shall be treated as the exterior thermal and pressure envelopes of the building.

13-404.A Requirements specific to Method A. Efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in roofs/ceilings.

Multiple-family residential roofs/ceilings shall be insulated to an *R*-value of at least R-19, space permitting.

13-404.B Requirements specific to Method B. Efficiencies specified on Form 400B or on the EnergyGauge Summit Fla/Com Method B printout shall be the minimum level(s) installed in roofs/ceilings. Multiple-family residential roofs/ceilings shall be insulated with an insulation *R*-value of at least R-19, space permitting.

SECTION 13-405
FLOORS

13-405.AB Mandatory requirements for Methods A and B. General criteria contained in Appendix 13-B relevant to floors shall be met.

13-405.A Requirements specific to Method A. Efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in floors.

13-405.B Requirements specific to Method B. Efficiencies specified on Form 400B or on the EnergyGauge Summit Fla/Com Method B printout shall be the minimum level(s) installed in floors.

SECTION 13-406
AIR INFILTRATION

13-406.AB Mandatory requirements for Methods A and B. The requirements of this section shall apply only to those locations that separate interior building conditioned space from the outdoors or from unconditioned space or crawl spaces. Compliance with the criteria for air leakage through building components shall be determined by tests conducted in accordance with ASTM E 283.

13-406.AB.1 Minimum infiltration levels allowed.

13-406.AB.1.1 Exterior doors and windows. Air leakage for *fenestration* and *doors* shall be determined in accordance with NFRC 400. Air leakage shall be determined by a laboratory accredited by a nationally recognized accreditation organization, such as the National Fenestration Rating Council, and shall be *labeled* and certified by the manufacturer. Air leakage shall not exceed 1.0 cubic foot per minute (cfm) per square foot [.005 $m^3/(s \cdot m^2)$] for glazed swinging entrance doors and for revolving doors and 0.4 cubic foot per minute (cfm) per square foot [.005 $m^3/(s \cdot m^2)$]for all other products.

Exceptions:

(a) Field-fabricated fenestration and doors.
(b) For garage *doors*, air leakage determined by test at standard test conditions in accordance with ANSI/DASMA 105 shall be an acceptable alternate for compliance with air leakage requirements.

13-406.AB.1.2 Exterior joints in the envelope. The following areas of the *building envelope* shall be sealed, caulked, gasketed, or weather-stripped to minimize air leakage:

a. Joints around *fenestration* and *door* frames.
b. Junctions between *walls* and foundations, between *walls* at building corners, between *walls* and structural *floors* or *roofs*, and between *walls* and *roof* or *wall* panels.
c. Openings at penetrations of utility services through *roofs*, *walls*, and *floors*.
d. Site-built *fenestration* and *doors*.
e. Building assemblies used as ducts or plenums.
f. Joints, seams, and penetrations of vapor retarders.
g. All other openings in the *building envelope*.

13-406.AB.2 Apertures in the building envelope. Any intentional apertures or openings in walls, ceilings or floor between conditioned and unconditioned space (such as hydrostatic openings in stairwells for coastal buildings) shall have dampers which limit air flow between the spaces.

13-406.AB.3 Building cavities.

13-406.AB.3.1 Where vented dropped ceiling cavities occur over conditioned spaces, the ceiling shall be considered to be both the upper thermal envelope and pressure envelope of the building and shall contain a continuous air barrier between the conditioned space and the vented unconditioned space that is also sealed to the air barrier of the walls.

IMPORTANT NOTE: See the definition of "Air barrier" in Section 13-202.

13-406.AB.3.2 Where unvented dropped ceiling cavities occur over conditioned spaces that do not have an air barrier between the conditioned and unconditioned space (such as T-bar ceilings), they shall be completely sealed from the exterior environment (at the roof plane) and adjacent spaces by a continuous air barrier that is also sealed to the air barrier of the walls. In that case, the roof assembly shall constitute both the upper thermal envelope and pressure envelope of the building.

13-406.AB.3.3 Unconditioned spaces above separate tenancies shall contain dividing partitions between the tenancies to form a continuous air barrier that is sealed at the ceiling and roof to prevent air flow between them.

13-406.AB.3.4 Building cavities designed to be air distribution system components shall be sealed according to the criteria for air ducts, plenums, etc., in Section 13-410.AB.3.6.

SECTION 13-407
SPACE COOLING SYSTEMS

13-407.0 Applicability. This section covers the determination of minimum cooling system design requirements and efficiencies. The requirements of this section apply to equipment and mechanical component performance of all air conditioning systems installed in new and renovated buildings including, but not limited to: unitary (central) cooling equipment (air-cooled, water-cooled and evaporatively cooled); the cooling mode of unitary (central) and packaged terminal heat pumps (air source and water source); packaged terminal air conditioners; roof air conditioners; room air conditioners; and heat-operated cooling equipment such as absorption equipment, engine-driven equipment and turbine-driven equipment.

13-407.AB Mandatory requirements for Methods A and B.

13-407.AB.1 Sizing. A cooling load calculation shall be performed for newly installed units as per criteria of Section B3.1 of Appendix 13-B of this chapter. This calculation shall be attached to the code compliance form submitted to the building department when the building is permitted or, in the event the mechanical permit is obtained at a later time, the sizing calculation shall be submitted with the application for the mechanical permit.

Exceptions:

1. Where mechanical systems are designed by an engineer registered in the state of Florida, the engineer has the option of submitting a signed and sealed summary sheet in lieu of the complete sizing calculation(s). Such summary sheet shall include the following (by zone):

Project name/owner	Outdoor dry bulb used	Total heating required with outside air
Project address	Outdoor wet bulb used	Total sensible gain
Sizing method used	Relative humidity	Total latent gain
Area in square feet.	Indoor dry bulb	Grains water (difference)

Total cooling required with outside air

2. Systems installed in existing buildings not meeting the definition of renovation in Section 13-202.

13-407.AB.1.1 HVAC systems and equipment shall be sized to provide no more than the space and system loads calculated in accordance with Section 13-407.AB.1.A single piece of equipment providing both cooling and heating shall satisfy this provision when the cooling function meets the provisions of Section 13-407.AB.1, and the heating function is sized as small as possible to meet the load within available equipment options.

Exceptions:

1. When the equipment selected is the smallest size needed to meet the load within available options of the desired equipment line.
2. Stand-by equipment provided with controls and devices that allow such equipment to operate automatically only when the primary equipment is not operating.
3. Multiple units of the same equipment type with combined capacities exceeding the design load and are provided with controls that sequence or otherwise optimally control the operation of each unit based on load.

13-407.AB.1.2 Buildings which contain assembly occupancies shall have equipment sized or controlled to prevent continuous space cooling or heating of such spaces with peak capacity equipment by the following options:

1. Equipment is staged to include cooling or heating to the space and stages are controlled by an electronically controlled energy management system.
2. A separate cooling or heating system is utilized to provide cooling or heating to the assembly occupancy.
3. A variable speed compressor is utilized to provide incremental cooling or heating to the assembly occupancy.

13-407.AB.2 Controls.

13-407.AB.2.1 Zone controls. Zone thermostatic controls shall be capable of operating in sequence the supply of heating and cooling energy to the zone. Such controls shall prevent: (1) reheating; (2) recooling; (3) mixing or simultaneously supplying air that has been previously mechanically heated and air that has been previously

cooled, either by mechanical cooling or by economizer systems; and (4) other simultaneous operation of heating and cooling systems to the same zone.

Exceptions:

a. Zones for which the volume of air that is reheated, recooled, or mixed is no greater than the larger of the following:
   1. The volume of outside air required to meet the ventilation requirements of Section 6.1.3 of ASHRAE 62 for the zone.
   2. 0.4 cfm per square foot [.002 $m^3/(s \cdot m^2)$] of the zone conditioned floor area.
   3. Thirty percent of the zone design peak supply rate.
   4. Three-hundred cfm (.14 m^3/s). This exception is for zones whose peak flow rate totals no more than 10 percent of the total fan system flow rate.
   5. Any higher rate that can be demonstrated, to the satisfaction of the authority having jurisdiction, to reduce overall system annual energy usage by offsetting reheat/recool energy losses through a reduction in outdoor air intake in accordance with Method A of this subchapter.

b. Zones where special pressurization relationships, cross-contamination requirements, or code-required minimum circulation rates are such that variable air volume systems are impractical.

c. Zones where at least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered (including condenser heat) or site-solar energy source.

d. Systems that are designed and dedicated to condition only the outdoor ventilation air stream to meet the requirements of ASHRAE 62. Such systems shall be controlled so that they do not allow overcooling of the building. Any building utilizing this exception that has a system that requires reheat, other than reclaimed waste heat, shall comply by Method A of this code.

13-407.AB.2.2 Hot gas bypass limitation. Cooling systems shall not use hot gas bypass or other evaporator pressure control systems unless the system is designed with multiple steps of unloading or continuous capacity modulation. The capacity of the hot gas bypass shall be limited to the following:

Rated Capacity	Max. Hot Gas Bypass Capacity (percent Total Capacity)
≤240,000 Btu/h	50 percent
>240,000 Btu/h	25 percent

Exception: Unitary packaged systems with cooling capacities not greater than 90,000 Btu/h (432 W).

13-407.AB.2.3 Temperature controls.

13-407.AB.2.3.1 General. The supply of heating and cooling energy to each zone shall be individually controlled by thermostatic controls responding to temperature within the zone. For the purposes of this section, a dwelling unit shall be permitted to be considered a single zone.

Exception: Independent perimeter systems that are designed to offset only building envelope loads shall be permitted to serve one or more zones also served by an interior system provided:

1. The perimeter system includes at least one thermostatic control zone for each building exposure having exterior walls facing only one orientation for 50 contiguous feet (15 240 mm) or more, and
2. The perimeter system heating and cooling supply is controlled by a thermostatic control(s) located within the zones(s) served by the system. Exterior walls are considered to have different orientations if the directions they face differ by more than 45 degrees.

13-407.AB.2.3.2 Dead band. Where used to control both heating and cooling, zone thermostatic controls shall be capable of providing a temperature range or dead band of at least 5°F (-15°C) within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

Exceptions:

1. Thermostats that require manual changeover between heating and cooling modes.
2. Special occupancy or special applications where wide temperature ranges are not acceptable (such as retirement homes, process applications, data processing, museums, some areas of hospitals) and are approved by the authority having jurisdiction.
3. In the case of VAV systems, the deadband may be reduced to $2^1/_2$°F
4. (-16°C) if the occupant control of the thermostat is programmed to limit the adjustment of the VAV system zone temperature to plus or minus $1^1/_2$°F (-17°C) from the thermostat set point.

13-407.AB.2.3.3 Set point overlap restriction. Where heating and cooling to a zone are controlled by separate zone thermostatic controls located within the zone, means (such as limit switches, mechanical stops, or, for DDC systems, software programming) shall be provided to prevent the heating set point from exceeding the cooling set point minus any applicable proportional band.

13-407.AB.2.4 Humidity control.

13-407.AB.2.4.1 Dehumidification. Where humidistatic controls are provided, such controls shall prevent reheating, mixing of hot and cold

airstreams, or other means of simultaneous heating and cooling of the same airstream.

Exceptions:

1. The system is capable of reducing supply air volume to 50 percent or less of the design airflow rate or the minimum rate specified in Section 6.1.3 of ASHRAE 62, whichever is larger, before simultaneous heating and cooling takes place.
2. The individual fan cooling unit has a design cooling capacity of 80,000 Btu/h (23 448 W) or less and is capable of unloading to 50-percent capacity before simultaneous heating and cooling takes place.
3. The individual mechanical cooling unit has a design cooling capacity of 40,000 Btu/h (11 724 W) or less. An individual mechanical cooling unit is a single system composed of a fan or fans and a cooling coil capable of providing mechanical cooling.
4. Systems serving spaces where specific humidity levels are required to satisfy process needs, such as computer rooms, museums, surgical suites, and buildings with refrigerating systems, such as supermarkets, refrigerated warehouses, and ice arenas. This exception also applies to other applications for which fan volume controls in accordance with Exception 1 are proven to be impractical to the enforcement agency.
5. At least 75 percent of the energy for reheating or for providing warm air in mixing systems is provided_from a site-recovered (including condenser heat) or site solar energy source.
6. Systems where the heat added to the airstream is the return air enthalpy result of the use of a desiccant system and 75 percent of the heat added by the desiccant system is removed by a heat exchanger, either before or after the desiccant system with energy recovery.

13-407.AB.2.4.2 Humidifier preheat. Humidifiers with preheating jackets mounted in the airstream shall be provided with an automatic valve to shut off preheat when humidification is not required.

13-407.AB.2.4.3 Humidification and dehumidification. Where a zone is served by a system or systems with both humidification and dehumidification capability, means (such as limit switches, mechanical stops, or, for DDC systems, software programming) shall be provided capable of preventing simultaneous operation of humidification and dehumidification equipment.

Exceptions:

1. Zones served by desiccant systems, used with direct evaporative cooling in series.
2. Systems serving zones where specific humidity levels are required, such as computer rooms, museums, and hospitals, and approved by the building official.

13-407.AB.2.5 Off-hour controls. HVAC systems having a design heating or cooling capacity greater than 65,000 Btu/h (19 051W) and fan system power greater than $^3/_4$ hp shall have all of the following off-hour controls: Automatic Shutdown (13-407.AB.2.4.1), Setback Controls (13-408.AB.2.1), Optimum Start Controls (13-407.AB.2.4.2), Shutoff Damper Controls (13-409.AB.3.3), and Zone Isolation (13-407.AB.2.4.3).

Exceptions:

1. HVAC systems serving hotel/motel guest rooms.
2. HVAC systems intended to operate continuously.
3. HVAC systems having a design heating capacity and cooling capacity less than 15,000 Btu/h (4396 W) that are equipped with readily accessible manual on/off controls.

13-407.AB.2.5.1 Automatic shutdown. HVAC systems shall be equipped with at least one of the following:

1. Controls that can start and stop the system under different time schedules for seven different day-types per week, are capable of retaining programming and time setting during loss of power for a period of at least 10 hours, and include an accessible manual override, or equivalent function, that allows temporary operation of the system for up to 2 hours.
2. An occupant sensor that is capable of shutting the system off when no occupant is sensed for a period of up to 30 minutes.
3. A manually operated timer capable of being adjusted to operate the system for up to two hours.
4. An interlock to a security system that shuts the system off when the security system is activated.

Exception: Residential occupancies may use controls that can start and stop the system under two different time schedules per week.

13-407.AB.2.5.2 Optimum start controls. Individual heating and cooling air distribution systems with a total design supply air capacity exceeding 10,000 cfm (5 m^3/s), served by one or more supply fans, shall have optimum start controls. The control algorithm shall, as a minimum, be a function of the difference between space temperature and occupied setpoint and the amount of time prior to scheduled occupancy.

13-407.AB.2.5.3 Zone isolation. HVAC systems serving zones that are intended to operate or be occupied nonsimultaneously shall be divided into isolation areas. Zones may be grouped into a single isolation area provided it does not exceed 25,000 square feet

(2323 m^3) of conditioned floor area nor include more than one floor. Each isolation area shall be equipped with isolation devices capable of automatically shutting off the supply of conditioned air and outside air to and exhaust air from the area. Each isolation area shall be controlled independently by a device meeting the requirements of Section 13-407.AB.5.1 (Automatic Shutdown). For central systems and plants, controls and devices shall be provided to allow stable system and equipment operation for any length of time while serving only the smallest isolation area served by the system or plant.

Exceptions: Isolation devices and controls are not required for the following:

1. Exhaust air and outside air connections to isolation zones when the fan system to which they connect is 5,000 cfm (2.4 m^3/s) and smaller.
2. Exhaust airflow from a single isolation zone of less than 10 percent of the design airflow of the exhaust system to which it connects.
3. Zones intended to operate continuously or intended to be inoperative only when all other zones are inoperative.

13-407.AB.2.6 Controls testing. HVAC control systems shall be tested to ensure that control elements are calibrated, adjusted, and in proper working condition.

13-407.AB.3 Equipment performance standards.

13-407.AB.3.1 Equipment efficiency verification. Equipment efficiency information supplied by manufacturers shall be verified as follows:

1. Equipment covered under the Federal Energy Policy Act of 1992 (EPACT) shall comply with U.S. Department of Energy certification requirements.
2. If a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be listed in the certification program, or
3. If a certification program exists for a covered product, and it includes provisions for verification and challenge of equipment efficiency ratings, but the product is not listed in the existing certification program, the ratings shall be verified by an independent laboratory test report, or
4. If no certification program exists for a covered product, the equipment efficiency ratings shall be supported by data furnished by the manufacturer, or
5. Where components such as indoor or outdoor coils from different manufacturers are used, the system designer shall specify component efficiencies whose combined efficiency meets the minimum equipment efficiency requirements in Section 13-407.AB.3.
6. Products covered in Table 13-407.AB.3.2G shall have efficiency ratings supported by data furnished by the manufacturer.

13-407.AB.3.2 Minimum efficiencies for cooling equipment.

13-407.AB.3.2.1 Minimum equipment efficiencies–listed equipment–standard rating and operating conditions. Equipment shown in Tables 13-407.AB.3.2A through 13-407.AB.3.2D shall have a minimum performance at the specified rating conditions when tested in accordance with the specified test procedure. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements, unless otherwise exempted by footnotes in the table. Equipment covered under the Federal Energy Policy Act of 1992 (EPACT) shall have no minimum efficiency requirements for operation at minimum capacity or other than standard rating conditions. Equipment used to provide water heating functions as part of a combination system shall satisfy all stated requirements for the appropriate space heating or cooling category.

Tables 13-407.AB.3.2.1A through 13-407.AB.3.2.1D and 13-407.AB.3.2.1G contain the minimum efficiency requirements for equipment covered by this section of the standard. The tables are organized to cover the following types of equipment:

Table 13-407.AB.3.2.1A, Air Conditioners and Condensing Units
Table 13-407.AB.3.2.1B, Heat Pumps
Table 13-407.AB.3.2.1C, Water Chilling Packages (see Section 13-407.AB.3.2.2 for water-cooled centrifugal water-chilling packages that are designed to operate at nonstandard conditions).
Table 13-407.AB.3.2.1D, Packaged Terminal and Room Air Conditioners and Heat Pumps.
Table 13-407.AB.3.2.1G Heat Rejection Equipment.

TABLE 13-407.AB.3.2.1A
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[2]	Test Procedure[1]
Air Conditioners, Air Cooled	< 65,000 Btu/h[3]	All	Split System	13.0 SEER	ARI 210/240
			Single Package	13.0 SEER	
	≥ 65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.3 EER	
		All other	Split System and Single Package	10.1 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.7 EER	ARI 340/360
		All other	Split System and Single Package	9.5 EER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER, 9.7 IPLV	
		All other	Split System and Single Package	9.3 EER, 9.5 IPLV	
	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.2 EER, 9.4 IPLV	
		All other	Split System and Single Package	9.0 EER, 9.2 IPLV	
Through-the-Wall, Air Cooled	≤30,000 Btu/h[3]	All	Split System	10.9 SEER	ARI 210/240
			Single Package	10.6 SEER	
Small-Duct High-Velocity, Air Cooled	<65,000 Btu/h[3]	All	Split System or Single Package	11.0 SEER[4]	ARI 210/240
Space constrained products, air conditioners	<65,000 Btu/h[3]	All	Split System or Single Package	12.0 SEER	ARI 210/240
Air Conditioners, Water and Evaporatively Cooled	<65,000 Btu/h	All	Split System and Single Package	12.1 EER	ARI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.5 EER	
		All other	Split System and Single Package	11.3 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER	ARI 340/360
		All other	Split System and Single Package	10.8 EER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER, 10.3 IPLV	
		All other	Split System and Single Package	10.8 EER, 10.1 IPLV	
Condensing Units, Air Cooled	≥135,000 Btu/h			10.1 EER, 11.2 IPLV	ARI 365
Condensing Units, Water or Evaporatively Cooled	≥135,000 Btu/h			13.1 EER, 13.1 IPLV	

1. Subchapter 13-3 contains a complete specification of the reference test procedure, including the referenced year version of the test procedure.
2. IPLVs and part load rating conditions are only applicable to equipment with capacity modulation.
3. Single-phase, air-cooled air-conditioners <65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.
4. As granted by U.S. Department of Energy letter of exception specific to individual companies, SDHV products without a letter of exception shall have the same efficiency as air-cooled air-conditioners.

TABLE 13-407.AB.3.2.1B
ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[2]	Test Procedure[1]
Air Cooled (Cooling Mode)	<65,000 Btu/h[3]	All	Split System	13.0 SEER	ARI 210/240
			Single Package	13.0 SEER	
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.1 EER	
		All other	Split System and Single Package	9.9 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.3 EER	ARI 340/360
		All other	Split System and Single Package	9.1 EER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.0 EER 9.2 IPLV	
		All other	Split System and Single Package	8.8 EER 9.0 IPLV	
Through-the-Wall, Air Cooled (Cooling Mode)	≤30,000 Btu/h[3]	All	Split System	10.9 SEER	ARI 210/240
			Single Package	10.6 SEER	
Small-Duct High-Velocity, Air Cooled, Cooling Mode	<65,000 Btu/h[3]	All	Split System	11.0 SEER[4]	ARI 210/240
Air Cooled (Heating Mode)	<65,000 Btu/h[3] (Cooling Capacity		Split System	7.7 HSPF	ARI 210/240
			Single Package	7.7 HSPF	
Through-the-Wall (Air Cooled, Heating Mode)	≤30,000 Btu/h[3] (Cooling Capacity)		Split System	7.1 HSPF	ARI 210/240
			Single Package	7.0 HSPF	
Small-Duct High-Velocity (Air Cooled, Heating Mode)	<65,000 Btu/h[3] (Cooling Capacity)		Split System or Single Package	7.7 HSPF[4]	ARI 210/240
Space Constrained Products, Heat Pumps	<65,000Btu/h[3]		Split System or Single Package	7.4 HSPF	ARI 210/240
Water Source (Cooling Mode)	<17,000 Btu/h	All	86°F Entering Water	11.2 EER	ISO-13256-1
	≥17,000 Btu/h and <135,000 Btu/h	All	86°F Entering Water	12.0 EER	
Groundwater Source (Cooling Mode)	<135,000 Btu/h	All	59°F Entering Water	16.2 EER	
Ground Source (Cooling Mode)	<135,000 Btu/h	All	77°F Entering Water	13.4 EER	
Air Cooled (Heating Mode)	<65,000 Btu/h[3] (Cooling Capacity)		Split System	7.7 HSPF	ARI 210/240
			Single Package	7.7 HSPF	
	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)		47°F db/43°F wb Outdoor Air 17°F db/15°F wb Outdoor Air	3.2 COP 2.2 COP	
	≥135,000 Btu/h (Cooling Capacity)		47°F db/43°F wb Outdoor Air 17°F db/15°F wb Outdoor Air	3.1 COP 2.0 COP	ARI 340/360
Water-Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		68°F Entering Water	4.2 COP	ISO-13256-1
Groundwater Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		50°F Entering Water	3.6 COP	
Ground Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		32°F Entering Water	3.1 COP	

1. Subchapter 13-3 contains a complete specification of the reference test procedure, including the referenced year version of the test procedure.
2. IPLVs and Part Load rating conditions are only applicable to equipment with capacity modulation.
3. Single-phase, air-cooled heat pumps <65,000 Btu/h are regulated by NAECA. SEER and HSPF values are those set by NAECA.
4. As granted by U.S. Department of Energy letter of exception specific to individual companies. SDHV products without a letter of exception shall have the same efficiency as air-cooled air-conditioners.

TABLE 13-407.AB.3.2.1C
WATER CHILLING PACKAGES MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Air Cooled, with Condenser, Electrically Operated	All Capacities	95°F db Outdoor Air	2.80 COP (1.26 kw/ton) 3.05 IPLV (1.15 kw/ton)	ARI 550/590
Air Cooled, without Condenser, Electrically Operated	All Capacities	95°F db Outdoor Air	3.10 COP (1.13 kw/ton) 3.45 IPLV (1.02 kw/ton)	
Water Cooled, Electrically Operated, Positive Displacement (Reciprocating)	All Capacities	85°F Cond 44°F Evap	4.20 COP (.84 kw/ton) 5.05 IPLV (.70 kw/ton)	ARI 550/590
Water Cooled, Electrically Operated, Positive Displacement (Rotary Screw and Scroll)	<150 tons	85°F Cond 44°F Evap	4.45 COP (.79 kw/ton) 5.20 IPLV (.68 kw/ton)	ARI 550/590
	≥150 tons and <300 tons	85°F Cond 44°F Evap	4.90 COP (.72 kw/ton) 5.60 IPLV (.63 kw/ton)	
	≥300 tons	85°F Cond 44°F Evap	5.50 COP (.64 kw/ton) 6.15 IPLV (.57 kw/ton)	
Water Cooled, Electrically Operated, Centrifugal	<150 tons	85°F Cond 44°F Evap	5.00 COP (.70 kw/ton) 5.25 IPLV (.67 kw/ton)	ARI 550/590
	≥150 tons and <300 tons	85°F Cond 44°F Evap	5.55 COP (.63 kw/ton) 5.90 IPLV (.60 kw/ton)	
	≥300 tons	85°F Cond 44°F Evap	6.10 COP (.58 kw/ton) 6.40 IPLV (.55 kw/ton)	
Air Cooled Absorption Single Effect	All Capacities		0.60 COP	ARI 560
Water Cooled Absorption Single Effect	All Capacities		0.70 COP	
Absorption Double Effect, Indirect-Fired	All Capacities		1.0 COP 1.05 IPLV	
Absorption Double Effect, Direct-Fired	All Capacities		1.0 COP 1.00 IPLV	

1. The chiller equipment requirements do not apply for chillers used in low-temperature applications where the design leaving fluid temperature is <40°F.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

TABLE 13-407.AB.3.2.1D
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE-PACKAGE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS, AND ROOM AIR CONDITIONER HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
SPVAC (Cooling Mode)	All Capacities	95°F db/75°F wb Outdoor Air	8.6 EER	ARI 390
SPVHP (Cooling Mode)	All Capacities	95°F db/75°F wb Outdoor Air	8.6 EER	
SPVHP (Heating Mode)	All Capacities	47°F db/43°F wb Outdoor Air	2.7 COP	
PTAC (Cooling Mode), New Construction	7,000 ≥ Btu/h < 8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 12.5 – (0.213 × Cap/1000)][4]	11.0 EER	ARI 310/380
	8,000 ≤ Btu/h < 9,000		10.8 EER	
	9,000 ≤ Btu/h < 10,000		10.6 EER	
	10,000 ≤ Btu/h < 11,000		10.4 EER	
	11,000 ≤ Btu/h < 12,000		10.2 EER	
	12,000 ≤ Btu/h < 13,000		9.9 EER	
	13,000 ≤ Btu/h < 14,000		9.7 EER	
	14,000 ≤ Btu/h < 15,000		9.5 EER	
	>15,000 Btu/h		9.3 EER	
PTAC (Cooling Mode), Replacements[2]	7,000 ≥ Btu/h < 8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 10.9 – (0.213 × Cap/1000)][4]	9.4 EER	
	8,000 ≤ Btu/h < 9,000		9.2 EER	
	9,000 ≤ Btu/h < 10,000		9.0 EER	
	10,000 ≤ Btu/h < 11,000		8.8 EER	
	11,000 ≤ Btu/h < 12,000		8.6 EER	
	12,000 ≤ Btu/h < 13,000		8.3 EER	
	13,000 ≤ Btu/h < 14,000		8.1 EER	
	14,000 ≤ Btu/h < 15,000		7.9 EER	
	>15,000 Btu/h		7.7 EER	
PTHP (Cooling Mode), New Construction	7,000 ≥ Btu/h < 8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 12.3 – (0.213 × Cap/1000)][4]	10.8 EER	
	8,000 ≤ Btu/h < 9,000		10.6 EER	
	9,000 ≤ Btu/h < 10,000		10.4 EER	
	10,000 ≤ Btu/h < 11,000		10.2 EER	
	11,000 ≤ Btu/h < 12,000		10.0 EER	
	12,000 ≤ Btu/h < 13,000		9.7 EER	
	13,000 ≤ Btu/h < 14,000		9.5 EER	
	14,000 ≤ Btu/h < 15,000		9.3 EER	
	>15,000 Btu/h		9.1 EER	
PTHP (Cooling Mode), Replacements[2]	7,000 ≥ Btu/h < 8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 10.8 – (0.213 × Cap/1000)][4]	9.3 EER	
	8,000 ≤ Btu/h < 9,000		9.1 EER	
	9,000 ≤ Btu/h < 10,000		8.9 EER	
	10,000 ≤ Btu/h < 11,000		8.7 EER	
	11,000 ≤ Btu/h < 12,000		8.5 EER	
	12,000 ≤ Btu/h < 13,000		8.2 EER	
	13,000 ≤ Btu/h < 14,000		8.0 EER	
	14,000 ≤ Btu/h < 15,000		7.8 EER	
	>15,000 Btu/h		7.6 EER	
PTHP (Heating Mode), New Construction	7,000 ≥ Btu/h < 8,000	47°F db Outdoor Air [Based on capacity at lower range using COP= 3.2 – (0.026 × Cap/1000)][4]	3.02 COP	
	8,000 ≤ Btu/h < 9,000		2.99 COP	
	9,000 ≤ Btu/h < 10,000		2.97 COP	
	10,000 ≤ Btu/h < 11,000		2.94 COP	
	11,000 ≤ Btu/h < 12,000		2.91 COP	
	12,000 ≤ Btu/h < 13,000		2.89 COP	
	13,000 ≤ Btu/h < 14,000		2.86 COP	
	14,000 ≤ Btu/h < 15,000		2.84 COP	
	>15,000 Btu/h		2.81 COP	

continued

TABLE 13-407.AB.3.2.1D – continued

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
PTHP (Heating Mode), Replacements[2]	7,000 ≥ Btu/h < 8,000	47°F db Outdoor Air [, Based on capacity at lower range using COP = 2.9 – (0.026 × Cap/1000)][4]	2.72 COP	ARI 310/380
	8,000 ≤ Btu/h < 9,000		2.69 COP	
	9,000 ≤ Btu/h < 10,000		2.67 COP	
	10,000 ≤ Btu/h < 11,000		2.64 COP	
	11,000 ≤ Btu/h < 12,000		2.61 COP	
	12,000 ≤ Btu/h < 13,000		2.59 COP	
	13,000 ≤ Btu/h < 14,000		2.56 COP	
	14,000 ≤ Btu/h < 15,000		2.54 COP	
	> 15,000 Btu/h		2.51 COP	
Room Air Conditioners with Louvered Sides	< 6,000 Btu/h		9.7 SEER	ANSI/AHAM RAC-1
	≥6,000<8,000 Btu/h		9.7 EER	
	≥ 8,000 < 14,000Btu/h		9.8 EER	
	≥ 14,000 < 20,000Btu/h		9.7 EER	
	≥ 20,000 Btu/h		8.5 EER	
Room Air Conditioners, without Louvered Sides	< 8,000 Btu/h		9.0 EER	
	≥ 8,000 Btu/h and <20,000 Btu/h		8.5 EER	
Room Air Conditioner Heat Pumps with Louvered Sides	< 20,000 Btu/h ≥ 20,000 Btu/h		9.0 EER 8.5 EER	
Room Air Conditioner Heat Pumps without Louvered Sides	< 14,000 Btu/h ≥ 14,000 Btu/h		8.5 EER 8.0 EER	
Room Air Conditioner, Casement only	All Capacities		8.7 EER	
Room Air Conditioner, Casement-Slider	All Capacities		9.5 EER	

1. See each subcategory for minimum efficiency equation.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches high and less than 42 inches wide.
4. Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

TABLE 13-407.AB.3.2.1G
PERFORMANCE REQUIREMENTS FOR HEAT REJECTION EQUIPMENT

Equipment Type	Total System Heat Rejection Capacity at Rated Conditions	Sub-Category or Rating Condition	Performance Required[1,2]	Test Procedure[3]
Propeller or Axial Fan Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F wb Outdoor Air	≥38.2 gpm/hp	CTI ATC-105
Centrifugal Fan Cooling Towers	All	95°F Entering Water 85°F Leaving Water 75°F wb Outdoor Air	≥20.0 gpm/hp	CTI ATC-105
Air Cooled Condensers	All	125°F Condensing Temperature R-22 Test Fluid 190°F Entering Gas Temperature 15°F Subcooling 95°F Entering db	≥176,000 Btu/h	ARI 460

1. For purposes of this table, cooling tower performance is defined as the maximum flow rating of the tower divided by the fan nameplate rated motor power.
2. For purposes of this table, air-cooled condenser performance is defined as the heat rejected from the refrigerant divided by the fan nameplate rated motor power.
3. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.

TABLE 13-407.AB.3.2.2H
MINIMUM EFFICIENCIES FOR CENTRIFUGAL CHILLERS <150 TONS
COP_{std} = 5.00; $IPLV_{std}$ = 5.25

Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
		LIFT[1] (°F)	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]
40	75	35	5.11	5.35	5.33	5.58	5.48	5.73	5.67	5.93	5.79	6.06	5.88	6.15
40	80	40	4.62	4.83	4.92	5.14	5.09	5.32	5.27	5.52	5.38	5.63	5.45	5.70
40	85	45	3.84	4.01	4.32	4.52	4.58	4.79	4.84	5.06	4.98	5.20	5.06	5.29
41	75	34	5.19	4.43	5.41	5.66	5.56	5.81	5.75	6.02	5.89	6.16	5.99	6.26
41	80	39	4.73	4.95	5.01	5.24	5.17	5.41	5.35	5.60	5.46	5.71	5.53	5.78
41	85	44	4.02	4.21	4.46	4.67	4.70	4.91	4.94	5.17	5.06	5.30	5.14	5.38
42	75	33	5.27	5.51	5.49	5.74	5.64	5.90	5.85	6.12	6.00	6.27	6.11	6.39
42	80	38	4.84	5.06	5.10	5.33	5.25	5.49	5.43	5.67	5.53	5.79	5.61	5.87
42	85	43	4.19	4.38	4.59	4.80	4.81	5.03	5.03	5.26	5.15	5.38	5.22	5.46
43	75	32	5.35	5.59	5.57	5.82	5.72	5.99	5.95	6.23	6.11	6.39	6.23	6.52
43	80	37	4.94	5.16	5.18	5.42	5.32	5.57	5.50	5.76	5.62	5.87	5.70	5.96
43	85	42	4.35	4.55	4.71	4.93	4.91	5.13	5.12	5.35	5.23	5.47	5.30	5.54
44	75	31	5.42	5.67	5.65	5.91	5.82	6.08	6.07	6.34	6.24	6.53	6.37	6.67
44	80	36	5.03	5.26	5.26	5.50	5.40	5.65	5.58	5.84	5.70	5.96	5.79	6.05
44	85	41	4.49	4.69	4.82	5.04	5.00	5.25	5.20	5.43	5.30	5.55	5.38	5.62
45	75	30	5.50	5.75	5.74	6.00	5.92	6.19	6.19	6.47	6.38	6.68	6.53	6.83
45	80	35	5.11	5.35	5.33	5.58	5.48	5.73	5.67	5.93	5.79	6.06	5.88	6.15
45	85	40	4.62	4.83	4.92	5.14	5.09	5.32	5.27	5.52	5.38	5.63	5.45	5.70
46	75	29	5.58	5.84	5.83	6.10	6.03	6.30	6.32	6.61	6.54	6.84	6.70	7.00
46	80	34	5.19	5.43	5.41	5.66	5.56	5.81	5.75	6.02	5.89	6.16	5.99	6.26
46	85	39	4.73	4.95	5.01	5.24	5.17	5.41	5.35	5.60	5.46	5.71	5.53	5.78
47	75	28	5.66	5.92	5.93	6.20	6.15	6.43	6.47	6.77	6.71	7.02	6.88	7.20
47	80	33	5.27	5.51	5.49	5.74	5.64	5.90	5.85	6.12	6.00	6.27	6.11	6.39
47	85	38	4.84	5.06	5.10	5.33	5.25	5.49	5.43	5.67	5.53	5.79	5.61	5.87
48	75	27	5.75	6.02	6.04	6.32	6.28	6.56	6.64	6.94	6.89	7.21	7.09	7.41
48	80	32	5.35	5.59	5.57	5.82	5.72	5.99	5.95	6.23	6.21	6.39	6.23	6.52
48	85	37	4.94	5.16	5.18	5.42	5.32	5.57	5.50	5.76	5.62	5.87	5.70	5.96
Condenser DT[2]			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: 1 Btu/h = .2931 W, °C=[(°F)-32]/1.8

1. LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature.
2. Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
3. All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature, which is IPLV.

$K_{adj} = 6.1507 – 0.30244(X) + 0.0062692(X)^2 – 0.000045595(X)^3$
Where X = Condenser DT + LIFT
$COP_{adj} = K_{adj} \times COP_{std}$

TABLE 13-407.AB.3.2.2I
MINIMUM EFFICIENCIES FOR CENTRIFUGAL CHILLERS >150 TONS, <300 TONS
COP_{std} = 5.55; $IPLV_{std}$ = 5.90

Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
		LIFT[1] (°F)	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]
40	75	35	5.65	6.03	5.90	6.29	6.05	6.46	6.26	6.68	6.40	6.83	6.51	6.94
40	80	40	5.10	5.44	5.44	5.80	5.62	6.00	5.83	6.22	5.95	6.35	6.03	6.43
40	85	45	4.24	4.52	4.77	5.09	5.06	5.40	5.35	5.71	5.50	5.87	5.59	5.97
41	75	34	5.74	6.13	5.80	6.38	6.14	6.55	6.36	6.79	6.51	6.95	6.62	7.06
41	80	39	5.23	5.58	5.54	5.91	5.71	6.10	5.91	6.31	6.03	6.44	6.11	6.52
41	85	44	4.45	4.74	4.93	5.26	5.19	5.54	5.46	5.82	5.60	5.97	5.69	6.07
42	75	33	5.83	6.22	6.07	6.47	6.23	6.65	6.47	6.90	6.63	7.07	6.75	7.20
42	80	38	5.35	5.71	5.64	6.01	5.80	6.19	6.00	6.40	6.12	6.53	6.20	6.62
42	85	43	4.63	4.94	5.08	5.41	5.31	5.67	5.56	5.93	5.69	6.07	5.77	6.16
43	75	32	5.91	6.31	6.15	6.56	6.33b	6.75	6.58	7.02	6.76	7.21	6.89	7.35
43	80	37	5.46	5.82	5.73	6.11	5.89	6.28	6.08	6.49	6.21	6.62	6.30	6.72
43	85	42	4.81	5.13	5.21	5.55	5.42	5.79	5.66	6.03	5.78	6.16	5.86	6.25
44	75	31	6.00	6.40	6.24	6.66	6.43	6.86	6.71	7.15	6.90	7.36	7.05	7.52
44	80	36	5.56	5.93	5.81	6.20	5.97	6.37	6.17	6.58	6.30	6.72	6.40	6.82
44	85	41	4.96	5.29	5.33	5.68	5.55	5.90	5.74	6.13	5.86	6.26	5.94	6.34
45	75	30	6.08	6.49	6.34	6.76	6.54	6.98	6.84	7.30	7.06	7.53	7.22	7.70
45	80	35	5.65	6.03	5.90	6.29	6.05	6.46	6.26	6.68	6.40	6.83	6.51	6.94
45	85	40	5.10	5.44	5.44	5.80	5.62	6.00	5.83	6.22	5.95	6.35	6.03	6.43
46	75	29	6.17	6.58	6.44	6.87	6.66	7.11	6.99	7.46	7.23	7.71	7.409	7.90
46	80	34	5.74	6.13	5.80	6.38	6.14	6.55	6.36	6.79	6.51	6.95	6.62	7.06
46	85	39	5.23	5.58	5.54	5.91	5.71	6.10	5.91	6.31	6.03	6.44	6.11	6.52
47	75	28	6.26	6.68	6.56	6.99	6.79	7.24	7.16	7.63	7.42	7.91	7.61	8.11
47	80	33	5.83	6.21	6.07	6.47	6.23	6.64	6.47	6.90	6.63	7.07	6.75	7.20
47	85	38	5.35	5.70	5.64	6.01	5.80	6.19	6.00	6.40	6.12	6.52	6.20	6.61
48	75	27	6.36	6.78	6.68	7.12	6.94	7.40	7.34	7.82	7.62	8.13	7.83	8.35
48	80	32	5.91	6.30	6.15	6.56	6.33	6.75	6.58	7.02	6.76	7.21	6.89	7.35
48	85	37	5.46	5.82	5.73	6.10	5.89	6.28	6.08	6.49	6.21	6.62	6.30	6.71
Condenser DT[2]			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: 1 Btu/h = .2931 W, °C=[(°F)-32]/1.8

1. LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature.
2. Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
3. All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature, which is IPLV.

$K_{adj} = 6.1507 – 0.30244(X) + 0.0062692(X)^2 – 0.000045595(X)^3$
Where X = Condenser DT + LIFT
$COP_{adj} = K_{adj} \times COP_{std}$

TABLE 13-407.AB.3.2.2J
MINIMUM EFFICIENCIES FOR CENTRIFUGAL CHILLERS > 300 TONS
COP_{std} = 6.10; $IPLV_{std}$ = 6.40

Leaving Chilled Water Temperature (°F)	Entering Condenser Water Temperature (°F)	Condenser Flow Rate											
			2 gpm/ton		2.5 gpm/ton		3 gpm/ton		4 gpm/ton		5 gpm/ton		6 gpm/ton	
		LIFT[1] (°F)	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]	COP	NPLV[3]
40	75	35	6.23	6.55	6.50	6.83	6.68	7.01	6.91	7.26	7.06	7.42	7.17	7.54
40	80	40	5.63	5.91	6.00	6.30	6.20	6.52	6.43	6.76	6.56	6.89	6.65	6.98
40	85	45	4.68	4.91	5.26	5.53	5.58	5.86	5.90	6.20	6.07	6.37	6.17	6.48
41	75	34	6.33	6.65	6.60	6.93	6.77	7.12	7.02	7.37	7.18	7.55	7.30	7.67
41	80	39	5.77	6.06	6.11	6.42	6.30	6.62	6.52	6.85	6.65	6.99	6.74	7.08
41	85	44	4.90	5.15	5.44	5.71	5.72	6.01	6.02	6.33	6.17	6.49	6.27	6.59
42	75	33	6.43	6.75	6.69	7.03	6.87	7.22	7.13	7.49	7.31	7.68	7.44	7.82
42	80	38	5.90	6.20	6.21	6.53	6.40	6.72	6.61	6.95	6.75	7.09	6.84	7.19
42	85	43	5.11	5.37	5.60	5.88	5.86	6.16	6.13	6.44	6.28	6.59	6.37	6.69
43	75	32	6.52	6.85	6.79	7.13	6.98	7.33	7.26	7.63	7.45	7.83	7.60	7.98
43	80	37	6.02	6.32	6.31	6.63	6.49	6.82	6.71	7.05	6.85	7.19	6.94	7.30
43	85	42	5.30	5.57	5.74	6.03	5.98	6.28	6.24	6.55	6.37	6.70	6.46	6.79
44	75	31	6.61	6.95	6.89	7.23	7.09	7.45	7.40	7.77	7.61	8.00	7.77	8.16
44	80	36	6.13	6.44	6.41	6.73	6.58	6.92	6.81	7.15	6.95	7.30	7.05	7.41
44	85	41	5.57	5.75	5.87	6.17	6.10	6.40	6.33	6.66	6.47	6.79	6.55	6.89
45	75	30	6.71	7.05	6.99	7.35	7.21	7.58	7.55	7.93	7.78	8.18	7.96	8.36
45	80	35	6.23	6.55	6.50	6.83	6.68	7.01	6.91	7.23	7.06	7.42	7.17	7.54
45	85	40	5.63	5.91	6.00	6.30	6.20	6.52	6.43	6.76	6.56	6.89	6.65	6.98
46	75	29	6.80	7.15	7.11	7.47	7.35	7.72	7.71	8.10	7.97	8.37	8.16	8.58
46	80	34	6.33	6.65	6.60	6.93	6.77	7.12	7.02	7.37	7.18	7.55	7.30	7.67
46	85	39	5.77	6.06	6.11	6.42	6.30	6.62	6.52	6.85	6.65	6.99	6.74	7.08
47	75	28	6.91	7.26	7.23	7.60	7.49	7.87	7.89	8.29	8.18	8.59	8.39	8.82
47	80	33	6.43	6.75	6.69	7.03	6.87	7.22	7.13	7.49	7.31	7.68	7.44	7.82
47	85	38	5.90	6.20	6.21	6.53	6.40	6.72	6.61	6.95	6.75	7.09	6.84	7.19
48	75	27	7.01	7.37	7.36	7.74	7.65	8.04	8.09	8.50	8.41	8.83	8.64	9.08
48	80	32	6.52	6.85	6.79	7.13	6.98	7.33	7.26	7.63	7.45	7.83	7.60	7.98
48	85	37	6.02	6.32	6.31	6.63	6.49	6.82	6.71	7.05	6.85	7.19	6.94	7.30
Condenser DT[2]			14.04		11.23		9.36		7.02		5.62		4.68	

For SI: 1 Btu/h = .2931 W, °C=[(°F)-32]/1.8

1. LIFT = Entering Condenser Water Temperature – Leaving Chilled Water Temperature.
2. Condenser DT = Leaving Condenser Water Temperature (°F) – Entering Condenser Water Temperature (°F)
3. All NPLV values shown are NPLV except at conditions of 3 gpm/ton Condenser Flow Rate with 44°F Leaving Chilled Water Temperature and 85°F Entering Condenser Water Temperature, which is IPLV.

$K_{adj} = 6.1507 – 0.30244(X) + 0.0062692(X)^2 – 0.000045595(X)^3$
Where X = Condenser DT + LIFT
$COP_{adj} = K_{adj} \times COP_{std}$

13-407.AB.3.2.2 Minimum equipment efficiencies – listed equipment – nonstandard conditions. Water-cooled centrifugal water-chilling packages that are not designed for operation at ARI 550/590 test conditions (and thus cannot be tested to meet the requirements of Table 13-407.AB.3.2.1C) of 44°F (7°C) leaving chilled water temperature and 85°F (29°C) entering condenser water temperature shall have a minimum full-load COP and a minimum NPLV rating as shown in Tables 13-407.AB.3.2.2H, 13-407.AB.3.2.2I and 13-407.AB.3.2.2J referenced below.

1. Centrifugal chillers <150 tons shall meet the minimum full-load COP and IPLV/NPLV in Table 13-407.AB.3.2.2H.
2. Centrifugal chillers ≥ 150 tons and <300 tons shall meet the minimum full-load COP and IPLV/NPLV in Table 13-407.AB.3.2.2I.
3. Centrifugal chillers ≥300 tons shall meet the minimum full-load COP and IPLV/NPLV in Table 13-407.AB.3.2.2J.

The table values are only applicable over the following full-load design ranges:

Leaving Chiller Water Temperature: 40°F to 48°F (4°C to 9°C).
Entering Condenser Water Temperature: 75°F to 85°F (24°C to 29°C).
Condensing Water Temperature Rise: 5°F to 15°F (-15°C to 9°C).

Chillers designed to operate outside of these ranges or applications utilizing fluids or solutions with secondary coolants (e.g. glycol solutions or brines) with a freeze point of 27°F (-2.8°C) or less for freeze protection are not covered by this standard.

Non-standard part-load value (NPLV) is defined as a single-number part-load efficiency figure of merit for chillers referenced to conditions other than integrated part-load value (IPLV) conditions.

13-407.AB.3.2.3 Equipment not listed. Equipment not listed in the tables referenced in Sections 13-407.AB.3.2.1 and 13-407.AB.3.2.2 may be used.

13-407.AB.3.3 Condensing coils installed in cool air stream of another air-conditioning unit. The condensing coil of one air-conditioning unit shall not be installed in the cool air stream of another air-conditioning unit.

Exceptions:

1. Where condenser heat reclaim is used in a properly designed system including enthalpy control devices to achieve requisite humidity control for process, special storage or equipment spaces and occupant comfort within the criteria of ASHRAE 55. Such systems shall result in less energy use than other appropriate options.
2. For computer or clean rooms whose location precludes the use of systems which would not reject heat into conditioned spaces.

13-407.AB.3.4 Exhaust air energy recovery for cooling systems. Individual fan systems that have both a design supply air capacity of 5,000 cfm (2.4 m^3/s) or greater and have a minimum outside air supply of 70 percent or greater of the design supply air quantity shall have an energy recovery system with at least 50 percent recovery effectiveness. Fifty-percent energy recovery effectiveness shall mean a change in the enthalpy of the outdoor air supply equal to 50 percent of the difference between the outdoor air and return air at design conditions.

Exceptions:

1. Laboratory systems meeting Section 13-409.AB.3.6.2.
2. Systems serving spaces that are not cooled and that are heated to less than 60°F (16°C).
3. Systems exhausting toxic, flammable, paint or corrosive fumes or dust.
4. Commercial kitchen hoods (grease) used for collecting and removing grease vapors and smoke.
5. Where the largest exhaust source is less than 75 percent of the design outdoor airflow.
6. Systems requiring dehumidification that employ series-style energy recovery coils wrapped around the cooling coil.

13-407.A Requirements specific to Method A. Cooling system efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in buildings.

13-407.B Requirements specific to Method B. Cooling system minimum efficiency requirements for buildings complying by Methods B shall meet or exceed the code minimum for the equipment installed per Tables 13-407.AB.3.2.1A through 13-407.AB.3.2.1D, 13-407.AB.3.2.1G and 13-407.AB.3.2.2H ** through 13-407.AB.3.2.2J.

Electric resistance reheat shall not be used when complying with this code by Method B.

SECTION 13-408
SPACE HEATING EQUIPMENT

13-408.0 Applicability. This section covers the determination of minimum heating system design requirements and efficiencies. The requirements of this section apply to equipment and mechanical component performance of all heating systems installed in new and renovated buildings including, but not limited to: unitary central heat pumps, either air or water source in the heating mode; water source (hydronic) heat pumps as used in multiple unit hydronic HVAC systems; packaged terminal heat pumps and room air conditioner heat pumps in the heating mode; and all gas- and oil-fired warm air furnaces, boilers and direct heating equipment.

13-408.AB Mandatory requirements for Methods A and B.

13-408.AB.1 Sizing. Heating equipment and systems shall be sized to provide no more than the space and system loads calculated in accordance with Section 13-407.AB.1, with exceptions.

13-408.AB.2 Controls. Heating equipment and systems shall meet all applicable prescriptive requirements for controls in Section 13-407.AB.2.

13-408.AB.2.1 Setback controls. Heating systems shall be equipped with controls that have the capability to automatically restart and temporarily operate the system as required to maintain *zone* temperatures above a heating set point adjustable down to 55°F (13°C) or lower.

Exception: Buildings located in Miami-Dade, Broward or Monroe Counties.

13-408.AB.2.2 Heat pump auxiliary heat control. Heat pumps equipped with internal electric resistance heaters shall have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery. Supplemental heater operation is permitted during outdoor coil defrost cycles. Two means of meeting this requirement are (1) a digital or electronic thermostat designed for heat pump use that energizes auxiliary heat only when the heat pump has insufficient capacity to maintain setpoint or to warm up the space at a sufficient rate, or (2) a multistage space thermostat and an outdoor air-thermostat wired to energize auxiliary heat only on the last stage of the space thermostat and when outside air temperature is less than 40°F (4°C).

Exception: Heat pumps whose minimum efficiency is regulated by NAECA and whose HSPF rating both meets the requirements shown in Table 13-407.AB.3.2.1B and includes all usage of internal electric resistance heating.

13-408.AB.2.3 Freeze protection. Freeze protection systems, such as heat tracing of outdoor piping and heat exchangers, including self-regulating heat tracing, shall include automatic controls capable of shutting off the systems when outside air temperatures are above 40°F (4°C) or when the conditions of the protected fluid will prevent freezing.

13-408.AB.3 Equipment performance standards.

13-408.AB.3.1 Equipment efficiency verification. If a certification program exists for a product covered in Tables 13-408.AB.3.21E through 13-408.AB.3.2.1F, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be either listed in the certification program or, alternatively, the ratings shall be verified by an independent laboratory test report. If no certification program exists for a product covered in Tables 13-408.AB.3.2.1E through 13-408.AB.3.2.1F, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where equipment is not rated, a Florida-registered engineer shall specify component efficiencies whose combined efficiency meets the minimum equipment efficiency requirements in Section 13-408.AB.3.2.1.

13-408.AB.3.2 Minimum efficiencies for heating equipment.

13-408.AB.3.2.1 Equipment ratings. Tables 13-407.AB.3.2.1B, 13-407.AB.3.2.1D, and 13-408.AB.3.2.1E through 13-408.AB.3.2.1F contain the minimum efficiency requirements for equipment covered by this section of the standard. The tables are organized to cover the following types of equipment:

Table 13-407.AB.3.2.1B, Heat Pumps
Table 13-407.AB.3.2.1D, Packaged Terminal Air Conditioners and Heat Pumps
Table 13-408.AB.3.2.1E, Furnaces, Duct Furnaces and Unit Heaters
Table 13-408.AB.3.2.1F, Boilers

All furnaces with input ratings ≥225,000 Btu/h, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input.

13-408.AB.3.2.2 Radiant heating systems.

13-408.AB.3.2.2.1 Heating unenclosed spaces. Radiant heating shall be used when heating is required for unenclosed spaces.

Exception: Loading docks equipped with air curtains.

13-408.AB.3.2.2.2 Heating enclosed spaces. Radiant heating systems that are used as primary or supplemental enclosed space heating shall be in conformance with the governing provisions of this subchapter, including, but not limited, to the following:

a. Radiant hydronic ceiling or floor panels (used for heating or cooling).
b. Combination or hybrid systems incorporating radiant heating (or cooling) panels.
c. Radiant heating (or cooling) panels used in conjunction with other systems such as variable air volume or thermal storage systems.

13-408.AB.3.2.3 Heating systems having additional functions. Space heating equipment used to provide additional functions (e.g. service water heating) as part of a combination (integrated) system shall comply with minimum performance requirements for the appropriate space heating equipment category. Service water heating equipment used to provide additional functions (e.g. space heating) as part of a combination (integrated) system shall, as a minimum, meet the minimum performance requirements for water heating equipment in Section 13-412.AB.

13-408.A Requirements specific to Method A. Heating system efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in buildings.

TABLE 13-408.AB.3.2.1E
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS. MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Warm Air Furnace, Gas-Fired	<225,000 Btu/h		78 percent AFUE or; 80 percent E_t[4]	DOE 10 CFR, Part 430 or ANSI Z 21.47
	≥225,000 Btu/h	Maximum Capacity[4]	80 percent E_c[3]	ANSI Z21.47
Warm Air Furnace, Oil-Fired	<225,000 Btu/h		78 percent AFUE or; 80 percent E_t[4]	DOE 10 CFR, Part 430 or UL 727
	≥225,000 Btu/h	Maximum Capacity[5]	81 percent E_t[6]	UL 727
Warm Air Duct Furnaces, Gas-Fired	All Capacities	Maximum Capacity[5]	80 percent E_c[7]	ANSI Z83.8
Warm Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity[5]	80 percent E_c[7]	ANSI Z83.8
Warm Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity[5]	80 percent E_c[7]	UL 731

For SI: 1Btu/h = .0048 m3/kw, °C = [(°F) - 32]/1.8.

1. E_t = thermal efficiency. See test procedure for detailed discussion.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. E_c = combustion efficiency. Units must also include an IID, have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
4. Combination units not covered by NAECA (3 phase power or cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating.
5. Minimum and maximum ratings as provided for and allowed by the unit's controls.
6. E_t = thermal efficiency. Units must also include an IID, have jacket losses not exceeding 0.75 percent of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
7. E_c = combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

TABLE 13-408.AB.3.2.1F
GAS- AND OIL-FIRED BOILERS
MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type[4]	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Boilers, Gas-Fired	<300,000 Btu/h	Hot water	80 percent AFUE	DOE 10 CFR Part 430
		Steam	75 percent AFUE	
	>300,000 Btu/h and ≤2,500,000	Maximum Capacity[3]	75 percent E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	80 percent E_c	
	>2,500,000 Btu/h[4]	Steam	80 percent E_c	
Boilers, Oil-Fired	<300,000 Btu/h		80 percent AFUE	DOE 10 CFR Part 430
	>300,000 Btu/h and ≤250,000,000 Btu/h	Maximum Capacity[3]	78 percent E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	83 percent E_c	
	>2,500,000 Btu/h[4]	Steam	83 percent E_c	
Oil-Fired (Residual)	>300,000 Btu/h and ≤250,000,000 Btu/h	Maximum Capacity[3]	78 percent E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	83 percent E_c	
	>2,500,000 Btu/h[4]	Steam	83 percent E_c	

For SI: 1Btu/h = .0048 m3/kw, °C = [(°F) - 32]/1.8.

1. E_t = thermal efficiency. See reference documents for detailed information.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. Minimum and maximum ratings as provided for and allowed by the unit's controls.
4. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers, and to all package boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.

13-408.B Requirements specific to Method B. Heating system minimum efficiency requirements for buildings complying by Method B shall meet or exceed the appropriate code minimum for the equipment installed. See Tables 13-407.AB.3.2.1B, 13-407.AB.3.2.1D, and 13-408.AB.3.2.1E through 13-408.AB.3.2.1F.

SECTION 13-409
VENTILATION

13-409.AB Mandatory requirements for Methods A and B.

13-409.AB.1 Air quality. Sources of pollutants within the conditioned space shall be minimized or eliminated, if possible, in order to minimize the outside air intake required for dilution. Concentrated sources shall be controlled at the source by containment, local exhaust systems, or both.

13-409.AB.1.1 Ventilation systems shall be designed to be capable of reducing the supply of outdoor air to the minimum ventilation rates required by section 6.1.3 of ASHRAE 62. Systems may be designed to supply outside air quantities exceeding minimum levels, but they shall be capable of operating at no more than minimum levels through the use of return ducts, manually or automatically operated control dampers, fan volume controls, or other devices.

Exception: Minimum outdoor air quantities may be greater if required to make up air exhausted for source control of contaminants or if required by process systems.

13-409.AB.2 Building pressures. Mechanical systems shall be designed to assure that buildings are pressurized with respect to outdoors.

13-409.AB.3 Ventilation system controls.

13-409.AB.3.1 Stair and shaft vents. Stair and elevator shaft vents shall be equipped with motorized dampers that are capable of being automatically closed during normal building operation and are interlocked to open as required by fire and smoke detection systems.

13-409.AB.3.2 Gravity hoods, vents, and ventilators. All outdoor air supply and exhaust hoods, vents, and ventilators shall be equipped with motorized dampers that will automatically shut when the spaces served are not in use.

Exceptions:

1. Gravity (nonmotorized) dampers are acceptable in buildings less than three stories in height above grade and for buildings of any height located in climates with less than 2,700 HDD 65.
2. Ventilation systems serving unconditioned spaces.

13-409.AB.3.3 Shutoff damper controls. Both outdoor air supply and exhaust systems shall be equipped with motorized dampers that will automatically shut when the systems or spaces served are not in use. Ventilation outside air dampers shall be capable of automatically shutting off during preoccupancy building warmup, cooldown, and setback, except when ventilation reduces energy costs (e.g., night purge) or when ventilation must be supplied to meet code requirements.

Exceptions:

1. Gravity (nonmotorized) dampers are acceptable in building exhaust air systems.
2. Gravity (nonmotorized) dampers are acceptable in systems with a design outside air intake or exhaust capacity of 300 cfm (.14 m^3/s) or less.

13-409.AB.3.3.1 Damper leakage. Where outdoor air supply and exhaust air dampers are required by Section 13-409.AB.3, they shall have a maximum leakage rate at 1 inches w.g. of 4 cfm per square foot of damper area for motorized dampers when tested in accordance with AMCA Standard 500 as indicated in Table 13-409.AB.3.3.1.

TABLE 13-409.AB.3.3.1
MAXIMUM DAMPER LEAKAGE

Maximum Damper Leakage at 1.0 inches w.g. cfm per ft^2 of damper area	
Motorized	Nonmotorized
4	Not allowed

13-409.AB.3.4 Ventilation controls for high-occupancy areas. Systems with design outside air capacities greater than 3,000 cfm (1.4 m^3/s) serving areas having an average design occupancy density exceeding 100 people per 1,000 square feet (93 m^2) shall include means to automatically reduce outside air intake below design rates when spaces are partially occupied. Ventilation controls shall be in compliance with ASHRAE 62 and local standards.

Exception: Systems with heat recovery complying with Section 13-407.AB.3.4.

13-409.AB.3.5 Exhaust hoods.

13-409.AB.3.5.1 Nonresidential kitchen spaces. Nonresidential kitchen space and areas in dining rooms or open malls where a kitchen exhaust hood is required by NFPA 96 shall comply with the following requirements:

1. Be designed with an exhaust air and make up air balance such that the space is never under a positive pressure, and never under a negative pressure exceeding 0.02 inch w.g. relative to all indoor spaces surrounding the kitchen space, during all cooking hours.
2. All exhaust and makeup air system components (fans, dampers, etc.) shall be interlocked in such a way that the balance prescribed in Item 1 above is maintained throughout all cooking hours, and all variations of cooking operations.

13-409.AB.3.5.2 Fume hoods. Buildings with fume hood systems having a total exhaust rate greater than 15,000 cfm (7 m^3/s) shall include at least one of the following features:

1. Variable air volume hood exhaust and room supply systems capable of reducing exhaust and makeup air volume to 50 percent or less of design values.
2. Direct makeup (auxiliary) air supply equal to at least 75 percent of the exhaust rate, heated no warmer than 2°F (-17°C) below room set point, cooled to no cooler than 3°F (-16°C) above room set point, no humidification added, and no simultaneous heating and cooling used for dehumidification control.
3. Heat recovery systems to precondition makeup air from fume hood exhaust in accordance with Section 13-407.AB.3.4 (Exhaust Air Energy Recovery) without using any exception.

SECTION 13-410
AIR DISTRIBUTION SYSTEMS

13-410.AB Mandatory requirements for Methods A and B.

13-410.AB.1 Sizing and design criteria.

13-410.AB.1.1 Air system design and control. HVAC systems having a total fan system power exceeding 5 hp shall meet the provisions of Table 13-410.AB.1.1.1 and Section 13-410.AB.1.1.2 unless otherwise noted.

13-410.AB.1.1.1 Fan power limitation. Fan power shall be limited by the following:

1. The ratio of the fan system power to the supply fan airflow rate (main fan) of each HVAC system at design conditions shall not exceed the allowable fan system power shown in Table 13-410.AB.1.1.1.
2. Where air systems require air treatment or filtering systems with pressure drops over 1 inches w.c. when filters are clean, or heat recovery coils or devices, or direct evaporative humidifiers/coolers, or other devices to serve process loads in the airstream, the allowable fan system power may be adjusted using the pressure credit in the allowable fan system equation below.
3. If the temperature difference between design room temperature and supply air temperature at cooling design conditions that is used to calculate design zone supply airflow is larger than 20°F (-7°C), the allowable fan system power may be adjusted using the temperature ratio in the Allowable fan system power equation below.

TABLE 13-410.AB.1.1.1
FAN POWER LIMITATION

Supply Air Volume	Allowable Nameplate Motor Power	
	Constant Volume	Variable Volume
<20,000 cfm	1.2 hp/1000 cfm	1.7 hp/1000 cfm
≥20,000 cfm	1.1 hp/1000 cfm	1.5 hp/1000 cfm

For SI: 1Btu/h = .0048 m^3/kw, °C = [(°F) - 32]/1.8.

Allowable fan system power = [fan power limitation ×· (Temperature ratio) + Pressure credit + Relief fan credit]

Where:

Fan power limitation = Table 13-410.AB.1.1.1 Value × CFM_n/1000
Temperature ratio = $(T_{t\text{-}stat} - T_S) / 20$
Pressure credit (hp) = Sum of $[CFM_n \cdot (SP_n - 1.0) / 3718]$ + Sum of $[CFM_{HR} \cdot SP_{HR}/3718]$
Relief fan credit HP (kW) = F_R HP (kW) × $[1 - (CFM_{RF} / CFM_n)]$

CFM_n = supply air volume of the unit with the fil tering system (cfm)

CFM_{HR} = supply air volume of heat recovery coils or direct evaporative humidified/ cooler (cfm)

CFM_{RF} = relief fan air volume at normal cooling design operation

SP_n = air pressure drop of the filtering system when filters are clean (inches w.g.)

SP_{HR} = air pressure drop of heat recovery coils or direct evaporative humidifier/cooler (inches w.g.).

$T_{t\text{-}stat}$ = room thermostat set point

T_S = design supply air temperature for the zone in which the thermostat is located

F_R = name plate rating of the relief fan in hp

13-410.AB.1.1.2 Variable air volume (VAV) fan control. (Including systems using series fan power boxes).

13-410.AB.1.1.2.1 Part-load fan power limitation. Individual VAV fans with motors 15 hp (11 kW) and larger shall meet one of the following:

1. The fan shall be driven by a mechanical or electrical variable-speed drive.
2. The fan shall be a vane-axial fan with variable-pitch blades.
3. The fan shall have other controls and devices that will result in fan motor demand of no more than 30 percent of design wattage at 50 percent of design air volume when static pressure set point equals one-third of the total design static pressure, based on manufacturer's certified fan data

13-410.AB.1.1.2.2 Static pressure sensor location. Static pressure sensors used to control variable air volume fans shall be placed in a position such that the controller set point is no greater than one-third the total design fan static pressure, except for systems with zone reset control complying with Section 13-410.AB.1.1.2.3. If this results in the sensor being located downstream of major duct splits, multiple sensors shall be installed in each major branch to ensure that static pressure can be maintained in each.

13-410.AB.1.1.2.3 Set point reset. For systems with direct digital control of individual zone boxes reporting to the central control panel, static pressure set point shall be reset based on the zone requiring the most pressure; i.e., the set point is reset lower until one zone damper is nearly wide open.

13-410.AB.1.2 Duct sizing and design. Duct systems shall be sized and designed through the use of ASHRAE, ACCA or other nationally recognized design procedure.

13-410.AB.2 Air distribution system insulation. All air distribution system components which move or contain conditioned air including, but not limited to, air filter enclosures, air ducts and plenums that are located in or on buildings shall be thermally insulated in accordance with the criteria of Sections 13-410.AB.2.1 through 13-410.AB.2.5.

13-410.AB.2.1 General. Insulation shall be protected from damage, including that due to sunlight, moisture, equipment maintenance, and wind, but not limited to the following:

1. Insulation exposed to weather shall be suitable for outdoor service, e.g., protected by aluminum, sheet metal, painted canvas, or plastic cover. Cellular foam insulation shall be protected as above or painted with a coating that is water retardant and provides shielding from solar radiation that can cause degradation of the material.
2. Insulation covering chilled water piping, refrigerant suction piping, or cooling ducts located outside the conditioned space shall include a vapor retardant located outside the insulation (unless the insulation is inherently vapor retardant), all penetrations and joints of which shall be sealed.

13-410.AB.2.2 Insulation required. All supply and return ducts and plenums installed as part of an HVAC air distribution system shall be thermally insulated in accordance with Table 13-410.AB.2.2.

Exceptions:

1. Factory-installed plenums, casings, or ductwork furnished as a part of HVAC equipment tested and rated in accordance with Sections 13-407.AB.3.2 and 13-408.AB.3.2.1.
2. Ducts or plenums located in heated spaces, semiheated spaces, or cooled spaces.
3. For runouts less than 10 feet (3048 mm) in length to air terminals or air outlets, the rated *R*-value of insulation need not exceed *R*-4.2.
4. Backs of air outlets and outlet plenums exposed to unconditioned or indirectly conditioned spaces with face areas exceeding 5 square feet (.46 m^2) need not exceed *R*-2; those 5 square feet (.46 m^2) or smaller need not be insulated.
5. Return air ducts meeting all the requirements of Section 13-410.AB.3.6 for building cavities which will be used as return air plenums.

TABLE 13-410.AB.2.2
MINIMUM DUCT INSULATION R-VALUES,
Combined Heating and Cooling Supply and Return Ducts

Location	Supply Duct	Return Duct
Exterior of building	R-6	R-4.2
Ventilated attic	R-6	R-4.2
Unvented attic above insulated ceiling	R-6	R-4.2
Unvented attic with roof insulation	R-4.2	None
Unconditioned spaces[1]	R-4.2	R-4.2
Indirectly conditioned spaces[2]	None	None
Conditioned spaces	None	None
Buried	R-4.2	None

1. Includes crawl spaces, both ventilated and nonventilated.
2. Includes return air plenums with or without exposed roofs above.

13-410.AB.2.3 *R*-value determination. All duct insulation and factory-made ducts shall be labeled with *R*-values based on flat sections of insulation only at installed thickness and excluding any air film resistance. The thermal resistance (R) shall be determined using the relationship R=t/k where t (inches) is the installed thickness and k (Btu-in/hr·ft²°F) is the measured apparent thermal conductivity at 75°F (24°C) mean temperature and at installed thickness tested in accordance with ASTM C 518 or ASTM C 177.

The installed thickness of duct insulation used to calculate *R*-values shall be determined as follows:

1. Duct board, duct liner and factory-made rigid ducts not normally subjected to compression shall use the nominal insulation thickness.
2. Duct wrap shall have an assumed installed thickness of 75 percent of nominal thickness (25-percent compression).
3. Factory-made flexible air ducts shall have the installed thickness and calculated *R*-values determined in accordance with Paragraph 3.4, of the Air Diffusion Council Standard, *Flexible Duct Performance & Installation Standards.*

13-410.AB.2.4 Condensation control. Additional insulation with vapor barrier shall be provided where the minimum duct insulation requirements of 13-410.AB.2.2 are determined to be insufficient to prevent condensation.

13-410.AB.2.5 Fibrous glass duct liner. Fibrous glass duct liner shall be fabricated and installed in accordance with the provisions of the NAIMA *Fibrous Glass Duct Liner Standard*.

13-410.AB.3 Air distribution system construction and installation. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability. All transverse joints, longitudinal seams and fitting connections shall be securely fastened and sealed in accordance with the applicable standards of this section.

13-410.AB.3.0 General. All enclosures which form the primary air containment passageways for air distribution systems shall be considered ducts or plenum chambers and shall be constructed and sealed in accordance with the applicable criteria of this section.

13-410.AB.3.0.1 Mechanical fastening. All joints between sections of air ducts and plenums, between intermediate and terminal fittings and other components of the air distribution system, and between subsections of these components shall be mechanically fastened to secure the sections independently of the closure system(s).

13-410.AB.3.0.2 Sealing. Air distribution system components shall be sealed with approved closure systems.

13-410.AB.3.0.3 Space provided. Sufficient space shall be provided adjacent to all mechanical components located in or forming a part of the air distribution system to assure adequate access for (1) construction and sealing in accordance with the requirements of Section 13-410.AB.3 of this code, (2) inspection and (3) cleaning and maintenance. A minimum of 4 inches (102 mm) is considered sufficient space around air handling units.

Exception: Retrofit or replacement units not part of a renovation are exempt from the minimum clearance requirement.

13-410.AB.3.0.4 Product application. Closure products shall be applied to the air barriers of air distribution system components being joined in order to form a continuous barrier or they may be applied in accordance with the manufacturer's instructions or appropriate industry installation standard where more restrictive.

13-410.AB.3.0.5 Surface preparation. The surfaces upon which closure products are to be applied shall be clean and dry in accordance with the manufacturer's installation instructions.

13-410.AB.3.0.6 Approved mechanical attachments. Approved mechanical attachments for air distribution system components include screws, rivets, welds, interlocking joints crimped and rolled, staples, twist in (screw attachment), and compression systems created by bend tabs or screws tabs and flanges or by clinching straps. Mechanical attachments shall be selected to be appropriate to the duct system type.

13-410.AB.3.0.7 Approved closure systems. The following closure systems and materials are approved for air distribution construction and sealing for the applications and pressure classes prescribed in Sections 13-410.AB.3.1 through 13-410.AB.3.8:

1. Metal closures.
    a. Welds applied continuously along metal seams or joints through which air could leak.
    b. Longitudinal grooved metal seams and snaplock seams that are rolled and crimped by the manufacturer.
2. Gasketing, which achieves a 25/50 flame spread/smoke density development rating under ASTM E 84 or UL 723, provided that it is used only between mated surfaces which are mechanically fastened with sufficient force to compress the gasket and to fill all voids and cracks through which air leakage would otherwise occur.
3. Mastics closures. Mastics shall be placed over the entire joint between mated surfaces. Mastics shall not be diluted. Approved mastics include the following:
    a. Mastic or mastic-plus-embedded fabric systems applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part III.
    b. Mastic or mastic-plus-embedded fabric systems applied to nonmetal flexible duct that are listed and labeled in accordance with UL 181B, Part II.
    c. Mastic ribbons, which achieve a 25/50 flame spread/smoke-density-development rating under ASTM E 84 or UL 723, provided that they may be used only in flange-joints and lap-joints, such that the mastic resides between two parallel surfaces of the air barrier and that those surfaces are mechanically fastened.
4. Tapes. Tapes shall be applied such that they extend not less than 1 inch (25 mm) onto each of the mated surfaces and shall totally cover the joint. When used on rectangular ducts, tapes shall be used only on joints between parallel rigid surfaces and on right angle joints. Approved tapes include the following:
    a. Pressure-sensitive tapes.
        1) Pressure-sensitive tapes applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part I.
        2) Pressure-sensitive tapes applied to nonmetal flexible duct that are listed and labeled in accordance with UL 181B, Part I
    b. Heat-activated tapes applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part II.
5. Aerosol sealant. Such sealants shall be installed by manufacturer-certified installers following manufacturer instructions and shall achieve 25/50 flame spread/smoke- density-development ratings under ASTM E 84 or UL 723.

13-410.AB.3.1 Metal duct, rigid and flexible. All transverse joints, longitudinal seams and duct wall penetration of ducts and joints with other air distribution system components shall be mechanically attached and

sealed using approved closure systems for that pressure class as specified in Section 13-410.AB.3.1.1 or Section 13-410.AB.3.1.2.

13-410.AB.3.1.1 Pressures less than 1 inch water gauge, approved closure systems. The following closure systems are approved for rigid metal duct designed to be operated at pressures less than 1 inch w.g. when they conform to the approved closure and mechanical attachment requirements of Section 13-410.AB.3.0:

1. Continuous welds.
2. Snaplock seams and grooved, standing, double-corner, single-corner and Pittsburgh-lock seams, and all other rolled mechanical seams.
3. Mastic, mastic-plus-embedded fabric or mastic ribbons.
4. Gaskets.
5. Pressure-sensitive tape.
6. Aerosol sealant.

13-410.AB.3.1.2 Pressures 1-inch water gauge or greater, approved closure systems. The following closure systems are approved for rigid metal duct designed to be operated at pressures 1-inch w.g. or greater when they conform to the approved closure and mechanical attachment requirements of Section 13-410.AB.3.0:

1. Continuous welds.
2. Mastic, mastic-plus-embedded fabric systems, or mastic ribbons.
3. Gaskets.

13-410.AB.3.1.3 High pressure duct systems. High pressure duct systems designed to operate at pressures greater than 3-inch water gauge (4-inch water gauge pressure class), shall be tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual*. The tested duct leakage class, at a test pressure equal to the design duct pressure class rating, shall be equal to or less than Leakage Class 6. Leakage testing may be limited to representative sections of the duct system but in no case shall such tested sections include less than 25 percent of the total installed duct area for the designated pressure class.

13-410.AB.3.2 Fibrous glass duct, rigid. All rigid fibrous glass ducts and plenums shall be constructed and erected in accordance with the provisions of the NAIMA *Fibrous Glass Duct Construction Standards*.

All joints, seams and duct wall penetrations including, but not limited to, the joints between sections of duct and the joints between duct and other distribution system components shall be mechanically attached and sealed using approved closure systems as specified in Section 13-410.AB.3.2.1.

13-410.AB.3.2.1 Approved closure systems. The following closure systems are approved for rigid fibrous glass duct when they meet the approved closure and mechanical attachment requirements of Section 13-410.AB.3.0:

1. Heat-activated tapes.
2. Pressure-sensitive tapes.
3. Mastics or mastic-plus-embedded fabric systems.

13-410.AB.3.2.2 Mechanical fastening. Attachments of ductwork to air handling equipment shall be by mechanical fasteners. Where access is limited, two fasteners on one side shall be acceptable when installed in accordance with Section 13-410.AB.3.0.6.

13-410.AB.3.3 Flexible duct systems, nonmetal. Flexible nonmetal ducts shall be joined to all other air distribution system components by either terminal or intermediate fittings. All duct collar fittings shall have a minimum $^5/_8$-inch (16 mm) integral flange for sealing to other component and a minimum 3-inch (76 mm) shaft for insertion into the inner duct core.

Flexible ducts having porous inner cores shall not be used.

Exception: Ducts having a nonporous liner between the porous inner core and the outer jacket. Fastening and sealing requirements shall be applied to such intermediate liners.

All joints of flexible ducts to fittings and fittings to other air distribution system components shall be mechanically attached and sealed as specified in Sections 13-410.AB.3.3.1 through 13-410.AB.3.3.6.

13-410.AB.3.3.1 Duct core to duct fitting, mechanical attachment. The reinforced core shall be mechanically attached to the duct fitting by a drawband installed directly over the wire-reinforced core and the duct fitting. The duct fitting shall extend a minimum of 2 inches (51 mm) into each section of duct core. When the flexible duct is larger than 12 inches (305 mm) in diameter or the design pressure exceeds 1 inch water gauge, the drawband shall be secured by a raised bead or indented groove on the fitting.

13-410.AB.3.3.2 Duct core to duct fitting, approved closure systems. The reinforced core shall be sealed to the duct fitting using one of the following sealing materials which conforms to the approved closure and mechanical attachment requirements of Section 13-410.AB.3.0:

1. Gasketing.
2. Mastic, mastic-plus-embedded fabric systems, or mastic ribbons.
3. Pressure-sensitive tape.
4. Aerosol sealants, provided that their use is consistent with UL 181.

13-410.AB.3.3.3 Duct outer jacket to duct collar fitting. The outer jacket of a flexible duct section shall be secured at the juncture of the air distribution system component and intermediate or terminal fitting in such a way as to prevent excess condensation. The

outer jacket of a flexible duct section shall not be interposed between the flange of the duct collar fitting and the flexible duct, rigid fibrous glass duct board, or sheet metal to which it is mated.

13-410.AB.3.3.4 Duct collar fittings to rigid duct, mechanical attachment. The duct collar fitting shall be mechanically attached to the rigid duct board or sheet metal by appropriate mechanical fasteners, either screws, spin-in flanges, or dovetail flanges.

13-410.AB.3.3.5 Duct collar fitting to rigid duct, approved closure systems. The duct collar fitting's integral flange shall be sealed to the rigid duct board or sheet metal using one of the following closure systems/materials which conforms to the approved closure and mechanical attachment standards of Sections 13-410.AB.3.0:

1. Gasketing.
2. Mastic or mastic-plus-embedded fabric.
3. Mastic ribbons when used to attach a duct collar to sheet metal.
4. Pressure-sensitive tape.
5. Aerosol sealants, provided that their use is consistent with UL 181.

13-410.AB.3.3.6 Flexible duct installation and support. Flexible ducts shall be configured and supported so as to prevent the use of excess duct material, prevent duct dislocation or damage, and prevent constriction of the duct below the rated duct diameter in accordance with the following requirements:

1. Ducts shall be installed fully extended. The total extended length of duct material shall not exceed 5 percent of the minimum required length for that run.
2. Bends shall maintain a center line radius of not less than one duct diameter.
3. Terminal devices shall be supported independently of the flexible duct.
4. Horizontal duct shall be supported at intervals not greater than 5 feet (1524 mm). Duct sag between supports shall not exceed $^1/_2$ inch (12.7 mm) per foot of length. Supports shall be provided within $1^1/_2$ feet (457 mm) of intermediate fittings and between intermediate fittings and bends. Ceiling joists and rigid duct or equipment may be considered to be supports.
5. Vertical duct shall be stabilized with support straps at intervals not greater than 6 feet (1829 mm).
6. Hangers, saddles and other supports shall meet the duct manufacturer's recommendations and shall be of sufficient width to prevent restriction of the internal duct diameter. In no case shall the material supporting flexible duct that is in direct contact with it be less than $1^1/_2$ inches (38 mm).

13-410.AB.3.4 Terminal and intermediate fittings. All seams and joints in terminal and intermediate fittings, between fitting subsections and between fittings and other air distribution system components or building components shall be mechanically attached and sealed using approved closure systems for that joining application as specified in Section 13-410.AB.3.4.1 or Section 13-410.AB.3.4.2.

13-410.AB.3.4.1 Fittings and joints between dissimilar duct types, approved closure systems. Approved closure systems shall be as designated by air distribution system component material type in Section 13-410.AB.3.

Exception: When the components of a joint are fibrous glass duct board and metal duct, including collar fittings and metal equipment housings, the closure systems approved for fibrous glass duct shall be used.

13-410.AB.3.4.2 Terminal fittings and air ducts to building envelope components, approved closure systems. Terminal fittings and air ducts which penetrate the building envelope shall be mechanically attached to the structure and sealed to the envelope component penetrated and shall use one of the following closure systems/materials which conform to the approved closure and mechanical application requirements of Section 13-410.AB.3.0:

1. Mastics or mastic-plus-embedded fabrics.
2. Gaskets used in terminal fitting/grille assemblies which compress the gasket material between the fitting and the wall, ceiling or floor sheathing.

13-410.AB.3.5 Air-handling units. All air-handling units shall be mechanically attached to other air distribution system components. Air-handling units located outside the conditioned space shall be sealed using approved closure systems conforming to the approved closure and mechanical application requirements of Section 13-410.AB.3.1.

13-410.AB.3.5.1 Approved closure systems. Systems conforming to the product and application standards of Section 13-410.AB.3.0 may be used when sealing air handling units.

13-410.AB.3.5.2 Air-handling units. Air-handling units shall not be installed in attics (see definition of "Attic" in Section 13-202).

13-410.AB.3.6 Cavities of the building structure. Cavities in framed spaces, such as dropped soffits and walls, shall not be used to deliver air from or return air to the conditioning system unless they contain an air duct insert which is insulated in accordance with Section 13-410.AB.2 and constructed and sealed in accordance with the requirements of Section 13-410.AB.3 appropriate for the duct materials used.

Exception: Return air plenums.

Cavities designed for air transport such as mechanical closets, chases, air shafts, etc. shall be lined with an air

barrier and sealed in accordance with Section 13-410.AB.3.7 and shall be insulated in accordance with Section 13-410.AB.2.

Building cavities which will be used as return air plenums shall be lined with a continuous air barrier made of durable nonporous materials. All penetrations to the air barrier shall be sealed with a suitable long-life mastic material.

Exception: Surfaces between the plenum and conditioned spaces from which the return/mixed air is drawn.

Building cavities beneath a roof deck that will be used as return air plenums shall have an insulated roof with insulation having an *R*-value of at least R-19.

13-410.AB.3.7 Mechanical closets. The interior surfaces of mechanical closets shall be sheathed with a continuous air barrier as specified in Section 13-410.AB.3.7.1 and shall be sealed with approved closure systems as specified in Section 13-410.AB.3.7.2. All joints shall be sealed between air barrier segments and between the air barriers of walls and those of the ceiling, floor and door framing. All penetrations of the air barrier including but not limited to those by air ducts, service lines, refrigerant lines, electrical wiring, and condensate drain lines shall be sealed to the air barrier with approved closure systems.

Exception: Air passageways into the closet from conditioned space that are specifically designed for return air flow.

Through-wall, through-floor and through-ceiling air passageways into the closet shall be framed and sealed to form an airtight passageway using approved air duct materials and approved closure systems.

Duct penetrations through any part of the ceiling, walls or floor of a mechanical closet shall have sufficient space between surrounding ceiling, walls or floor and any duct or plenum penetration to allow for sealing of the penetration and inspection of the seal.

Clothes washers, clothes dryers, combustion water heaters and atmospheric combustion furnaces shall not be located in mechanical closets used as return air plenums.

13-410.AB.3.7.1 Approved air barriers. The following air barriers are approved for use in mechanical closets:

1. One-half inch (12.7 mm) thick or greater gypsum wallboard;
2. Other panelized materials having inward facing surfaces with an air porosity no greater than that of a duct product meeting Section 22 of UL 181 which are sealed on all interior surfaces to create a continuous air barrier.

13-410.AB.3.7.2 Approved closure systems. The following closure systems are approved for use in mechanical closets:

1. Gypsum wallboard joint compound over taped joints between gypsum wallboard panels.
2. Sealants complying with the product and application standards of Section 13-410.AB.3.2.1 for fibrous glass ductboard;
3. A suitable long-life caulk or mastic compliant with the locally adopted mechanical code for all applications.

13-410.AB.3.8 Enclosed support platforms. Enclosed support platforms located between the return air inlet(s) from conditioned space and the inlet of the air handling unit or furnace, shall contain a duct section constructed entirely of rigid metal, rigid fibrous glass duct board, or flexible duct which is constructed and sealed according to the respective requirements of Section 13-410.AB.3 and insulated according to the requirements of Section 13-410.AB.2.

The duct section shall be designed and constructed so that no portion of the building structure, including adjoining walls, floors and ceilings, shall be in contact with the return air stream or function as a component of this duct section.

The duct section shall not be penetrated by a refrigerant line chase, refrigerant line, wiring, pipe or any object other than a component of the air distribution system.

Through-wall, through-floor and through-ceiling air passageways into the duct section shall contain a branch duct which is fabricated of rigid fibrous glass duct board or rigid metal and which extends to and is sealed to both the duct section and the grille side wall surface. The branch duct shall be fabricated and attached to the duct insert in accordance with Section 13-410.AB.3.2 or Section 13-410.AB.3.1 for the duct type used.

13-410.AB.4 Air distribution system testing, adjusting, and balancing.

13-410.AB.4.1 Duct leakage tests. Air distribution systems shall be tested, adjusted, and balanced by an engineer licensed in this state or a company or individual holding a current certification from a recognized testing and balancing organization.

Exceptions:

1. Buildings with cooling or heating system capacities of 15 tons or less per system may be tested and balanced by a mechanical contractor licensed to design and install such system(s).
2. Buildings with cooling or heating system capacities of 65,000 Btu/h or less per system are exempt from the requirements of this section.

13-410.AB.4.2 General. Construction documents shall require that all HVAC systems be balanced in accordance with generally accepted engineering standards. Construction documents shall require that a written balance report be provided to the owner or the designated representative of the building owner for HVAC systems serving zones with a total conditioned area exceeding 5,000 square feet (465 m^2).

13-410.AB.4.3 Air system balancing shall be accomplished in a manner to first minimize throttling losses, then fan speed shall be adjusted to meet design flow conditions. Balancing procedures shall be in accordance with the National Environmental Balancing Bureau (NEBB) Procedural Standards, the Associated Air Balance Council (AABC) National Standards, or equivalent procedures.

Exception: Damper throttling may be used for air system balancing with fan motors of 1 hp or less, or if throttling results in no greater than $^1/_3$ hp fan horsepower draw above that required if the fan speed were adjusted.

NOTES:

1. Building envelope pressurization should be either neutral or positive to prevent infiltration of excess latent load.
2. Commercial kitchen hood exhaust cfm should be sized to prevent depressurization (see Section 13-409.AB.2 and NFPA 96).

13-410.A Requirements specific to Method A. Air distribution system efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in buildings.

SECTION 13-411
PUMPS AND PIPING

13-411.AB Mandatory requirements for Methods A and B.

13-411.AB.1 Hydronic system design and control. HVAC hydronic systems having a total pump system power exceeding 10 hp shall meet provisions of Sections 13-411.AB.1.1 through 13-411.AB.1.4.

13-411.AB.1.1 Hydronic variable flow systems. HVAC pumping systems that include control valves designed to modulate or step open and close as a function of load shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to 50 percent or less of the design flow rate. Individual pumps serving variable flow systems having a pump head exceeding 100 feet (30 480 mm) and motor exceeding 50 hp shall have controls and/or devices (such as variable speed control) that will result in pump motor demand of no more than 30 percent of design wattage at 50 percent of design water flow. The controls or devices shall be controlled as a function of desired flow or to maintain a minimum required differential pressure. Differential pressure shall be measured at or near the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure.

Exceptions:

1. Systems where the minimum flow is less than the minimum flow required by the equipment manufacturer for the proper operation of equipment served by the system, such as chillers, and where total pump system power is 75 hp or less.
2. Systems that include no more than three control valves.

13-411.AB.1.2 Pump isolation. When a chilled water plant includes more than one chiller, provisions shall be made so that the flow in the chiller plant can be automatically reduced, correspondingly, when a chiller is shut down. Chillers referred to in this section, piped in series for the purpose of increased temperature differential, shall be considered as one chiller. When a boiler plant includes more than one boiler, provisions shall be made so that the flow in the boiler plant can be automatically reduced, correspondingly, when a boiler is shut down.

13-411.AB.1.3 Chilled and hot water temperature reset controls. Chilled and hot water systems with a design capacity exceeding 300,000 Btu/h supplying chilled or heated water (or both) to comfort conditioning systems shall include controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outside air temperature.

Exceptions:

1. Where the supply temperature reset controls cannot be implemented without causing improper operation of heating, cooling, humidifying, or dehumidifying systems.
2. Hydronic systems, such as those required by Section 13-411.AB.1.1 that use variable flow to reduce pumping energy.

13-411.AB.1.4 Hydronic (water loop) heat pump systems. Each hydronic heat pump shall have a two-position automatic valve interlocked to shut off water flow when the compressor is off.

13-411.AB.2 Piping insulation. Piping shall be thermally insulated in accordance with Table 13-411.AB.2

Exceptions:

1. Factory-installed piping within HVAC equipment tested and rated in accordance with Sections 13-407.AB.3.2 and 13-408.AB.3.2.1.
2. Piping that conveys fluids having a design operating temperature range between 60°F and 105°F (16°C and 41°C), inclusive.
3. Piping that conveys fluids that have not been heated or cooled through the use of nonrenewable energy (such as roof and condensate drains, domestic cold water supply, natural gas piping, or refrigerant liquid piping) or where heat gain or heat loss will not increase energy usage.
4. Hot water piping between the shutoff valve and the coil, not exceeding 4 feet (1219 mm) in length, when located in conditioned spaces.
5. Pipe unions in heating systems (steam, steam condensate, and hot water).

13-411.AB.3 Hydronic system testing, adjusting, and balancing. Hydronic systems shall be tested, adjusted and balanced by a company holding a current certification from a nationally recognized testing and balancing organization.

TABLE 13-411.AB.2
MINIMUM PIPE INSULATION (inches)[1]

Fluid Design Operating Temperature Range °F	Insulation Conductivity		Nominal Pipe or Tube Size (inches)				
	Conductivity Btu in/(h ft^2 •°F)	Mean Temperature Rating	<1	1-1 ½	1 ½ to 4	4 to <8	≥8
Heating Systems (Steam, Steam Condensate, and Hot Water)[2,3]							
>350	0.32 - 0.34	250	2.5	3.0	3.0	4.0	4.0
251 - 350	0.29 - 0.32	200	1.5	2.5	3.0	3.0	3.0
201 - 250	0.27 - 0.30	150	1.5	1.5	2.0	2.0	2.0
141 - 200	0.25 - 0.29	125	1.0	1.0	1.0	1.5	1.5
105 - 140	0.22-0.28	100	0.5	0.5	1.0	1.0	1.0
Domestic and Service Hot Water Systems [3]							
>105	0.22-0.28	100	0.5	0.5	1.0	1.0	1.0
Cooling Systems (Chilled Water, Brine, and Refrigerant) [4]							
40 - 60	0.22-0.28	100	0.5	0.5	1.0	1.0	1.0
<40	0.22-0.28	100	0.5	1.0	1.0	1.0	1.5

1. For insulation outside the stated conductivity range, the minimum thickness (T) shall be determined as follows:
   $T = r\,(1+t/r)^{K/k} - 1$
   Where T = minimum insulation thickness (inches), r = actual outside radius of pipe (inches), t = insulation thickness listed in this table for applicable fluid temperature and pipe size, K = conductivity of alternate material at mean rating temperature indicated for the applicable fluid temperature (Btu. inches [h · ft^2 · °F]; and k = upper value of the conductivity range listed in this table for applicable fluid temperature.
2. These thicknesses are based on energy efficiency considerations only. Additional insulation is sometimes required relative to safety issues/surface temperatures.
3. Piping insulation is not required between the control valve and coil on run-outs when the control valve is located within 4 feet of the coil and the pipe size is 1 inch or less.
4. These thicknesses are based on energy efficiency considerations only. Issues such as water vapor permeability or surface condensation sometimes require vapor retarders or additional insulation.

SECTION 13-412
WATER HEATING SYSTEMS

13-412.AB Mandatory requirements for Methods A and B.

13-412.AB.1 Water heater sizing and design. Service water heating system design loads for the purpose of sizing systems and equipment shall be determined in accordance with manufacturers' published sizing guidelines or generally accepted engineering standards and handbooks acceptable to the adopting authority(e.g., ASHRAE *Handbook—HVAC Applications*).

13-412.AB.2 Service water heating system controls.

13-412.AB.2.1 Temperature controls. Temperature controls shall be provided that allow for storage temperature adjustment from 120°F (49°C)or lower to a maximum temperature compatible with the intended use.

Exception: When the manufacturer's installation instructions specify a higher minimum thermostat setting to minimize condensation and resulting corrosion.

13-412.AB.2.2 Temperature maintenance controls. Systems designed to maintain usage temperatures in hot water pipes, such as recirculating hot water systems or heat trace, shall be equipped with automatic time switches or other controls that can be set to switch off the usage temperature maintenance system during extended periods when hot water is not required.

13-412.AB.2.3 Circulating pump controls. When used to maintain storage tank water temperature, recirculating pumps shall be equipped with controls limiting operation to a period from the start of the heating cycle to a maximum of 5 minutes after the end of the heating cycle.

13-412.AB.2.4 Heat traps. Vertical pipe risers serving storage water heaters and storage tanks not having integral heat traps and serving a nonrecirculating system shall have heat traps on both the inlet and outlet piping as close as practical to the storage tank. A heat trap is a means to counteract the natural convection of heated water in a vertical pipe run. The means is either a device specifically designed for the purpose or an arrangement of tubing that forms a loop of 360 degrees or piping that from the point of connection to the water heater (inlet or outlet) includes a length of piping directed downward before connection to the vertical piping of the supply water or hot water distribution system, as applicable.

13-412.AB.2.5 Water flow rate controls.

13-412.AB.2.5.1 Showers. Showers used for other than safety reasons shall be equipped with flow control devices to limit the water discharge to a maximum of 2.5 gpm (.16 L/S) per shower head at a distribution pressure of 80 psig (552 kPa) when tested in accordance with the procedures of ANSI A112.18.1M. Flow restricting inserts used as a component part of a showerhead shall be mechanically retained at the point of manufacture.

13-412.AB.2.5.2 Lavatories or restrooms of public facilities. Lavatories or restrooms of public facilities shall:

1. Be equipped with outlet devices which limit the flow of hot water to a maximum of 0.5 gpm (.03 L/s) or be equipped with self-closing valves that limit delivery to a per cycle maximum of 0.25 gallons (.95 L) of hot water for recirculating systems and to a maximum of 0.50 gallons (1.9 L) for nonrecirculating systems.
   Exception: Separate lavatories for physically handicapped persons shall not be equipped with self-closing valves.
2. Be equipped with devices which limit the outlet temperature to a maximum of 110°F (43°C).
3. Meet the provisions of 42 CFR 6295 (k), *Standards for Water Closets and Urinals.*

13-412.AB.2.6 Swimming pool and spa temperature controls.

13-412.AB.2.6.1 Time switches. Time switches shall be installed on swimming pool heaters and pumps.

Exceptions:

1. Where public health standards require 24-hour pump operation.
2. Where pumps are required to operate solar and waste heat recovery pool heating systems.

13-412.AB.2.6.2 Pool covers. Heated pools shall be equipped with a vapor retardant pool cover on or at the water surface. Pools heated to more than 90°F (32°C) shall have a pool cover with a minimum insulation value of *R*-12.

Exception: Pools deriving over 60 percent of the energy for heating from site-recovered energy or solar energy source.

13-412.AB.2.6.3 Pool heaters. Pool heaters shall be equipped with a readily accessible on-off switch to allow shutting off the heater without adjusting the thermostat setting. Pool heaters fired by natural gas shall not have continuously burning pilot lights.

13-412.AB.3 Equipment performance standards.

13-412.AB.3.1 Equipment efficiency. All water heating equipment, hot water supply boilers used solely for heating potable water, pool heaters, and hot water storage tanks shall meet the criteria listed in Table 13-412.AB.3. Where multiple criteria are listed, all criteria shall be met. Omission of minimum performance requirements for certain classes of equipment does not preclude use of such equipment where appropriate. Equipment not listed in Table 13-412.AB.3 has no minimum performance requirements.

Exception: All water heaters and hot water supply boilers having more than 140 gallons (530 L) of storage capacity are not required to meet the standby loss (SL) requirements of Table 13-412.AB.3 when:

1. The tank surface is thermally insulated to R-12.5,
2. A standing pilot light is not installed,
3. Gas- or oil-fired storage water heaters have a flue damper or fan-assisted combustion.

13-412.AB.3.2 Combination service water heating and space heating equipment.

13-412.AB.3.2.1 Space heating and water heating. The use of a gas-fired or oil-fired space heating boiler system otherwise complying with Section 13-408.AB.3 to provide the total space heating and water heating for a building is allowed when one of the following conditions is met.

1. The single space heating boiler, or the component of a modular or multiple boiler system that is heating the service water, has a standby loss in Btu/h not exceeding (13.3 x pmd + 400) / *n* where *pmd* is the probable maximum demand in gal/h, determined in accordance with the procedures described in generally accepted engineering standards and handbooks, and *n* is the fraction of the year when the outdoor daily mean temperature is greater than 64.9°F (18°C). The standby loss is to be determined for a test period of 24 hours duration while maintaining a boiler water temperature of at least 90°F (32°C) above ambient, with an ambient temperature between 60°F and 90°F (16°C and 32°C). For a boiler with a modulating burner, this test shall be conducted at the lowest input.
2. It is demonstrated to the satisfaction of the building official that the use of a single heat source will consume less energy than separate units.
3. The energy input of the combined boiler and water heater system is less than 150,000 Btu/h (720 m^2/kW).

13-412.AB.3.2.2 Service water heating equipment. Service water heating *equipment* used to provide the additional function of space heating as part of a combination (integrated) *system* shall satisfy all stated requirements for the service water heating *equipment*.

13-412.AB.3.2.3 Combination water and space heating systems. Combination water and space heating systems with input ratings of less than 105,000 Btu/h shall utilize a water heater listed by the Gas Appliance Manufacturer's Association (GAMA). Changeouts of burners to increase capacity shall not be made unless the unit has been listed at that capacity by GAMA.

13-412.AB.4 Service hot water piping insulation. The following piping shall be insulated to levels shown in Table 13-411.AB.2:

1. Recirculating system piping, including the supply and return piping of a circulating tank type water heater.

2. The first 8 feet (2438 mm) of outlet piping for a constant temperature nonrecirculating storage system.
3. The inlet pipe between the storage tank and a heat trap in a nonrecirculating storage system.
4. Pipes that are externally heated (such as heat trace or impedance heating).

13-412.A Requirements specific to Method A. Water heater efficiencies determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the minimum performance level installed in buildings.

SECTION 13-413
ELECTRIC POWER

13-413.0 Applicability. This section applies to all building power distribution systems. The provisions for electrical distribution for all sections of this Code are subject to the applicable Florida Public Service Commission rules regarding electric utilities set forth in Chapter 25-6, *Florida Administrative Code*, and the design conditions in ASHRAE 90.1.

13-413.AB Mandatory requirements for Methods A and B.

13-413.AB.1 Voltage drop.

TABLE 13-412.AB.3
PERFORMANCE REQUIREMENTS FOR WATER HEATING EQUIPMENT

Equipment Type	Size Category (input)	Subcategory or Rating Condition	Performance Required[1]	Test Procedure[2]
Electric Water Heaters	≤12kW	Resistance ≥20 gal	0.97-0.00132V EF	DOE 10 CFR Part 430[3]
	>12 kW	Resistance ≥ 20 gal	20+35√V SL, Btu/h	ANSI Z21.10.3
	≤24 Amps and ≤250 Volts	Heat Pump	0.93-0.00132V EF	DOE 10 CFR Part 430[3]
Gas Storage Water Heaters	≤75,000 Btu/h	≥20 gal	0.67-0.0019V EF	DOE 10 CFR Part 430[3]
	>75,000 Btu/h	<4,000 (Btu/h)/gal	80%E_t (Q/800+110√V) SL, Btu/h	ANSI Z21.10.3
Gas Instantaneous Water Heaters	>50,000 Btu/h and <200,000 Btu/h[4]	≥4,000 (Btu/h)/gal and < 2 gal	0.62-0.0019V EF	DOE 10 CFR Part 430
	≥200,000 Btu/h	≥4,000 (Btu/h)/gal and <10 gal	80% E_t	ANSI Z21.10.3
	≥200,000 Btu/h	≥4000 (Btu/h)/gal and ≥10 gal	80% E_t (Q/800+110√V) SL, Btu/h	
Heat Pump Pool Heaters	All	–	4.0 COP At low air temperature	ARI 1160[5]
Oil Storage Water Heaters	≤105,000 Btu/h	≥20 gal	0.59-0.0019V EF	DOE 10 CFR Part 430[3]
	>105,000 Btu/h	<4,000 (Btu/h)/gal	78% E_t (Q/800+100√V) SL, Btu/h	ANSI Z21.10.3
Oil Instantaneous Water Heaters	≤210,000 Btu/h	≥4,000 (Btu/h)/gal and <2 gal	0.59-0.0019V EF	DOE 10 CFR Part 430
	>210,000 Btu/h	≥4,000 (Btu/h)/gal and <10 gal	80% E_t	ANSI Z21.10.3
	>210,000 Btu/h	≥4,000 (Btu/h)/gal and ≥10 gal	78% E_t (Q/800+110√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	ANSI Z21.10.3
Hot Water Supply Boilers, Gas		≥4000 (Btu/h)/gal and ≥10 Gal	80% E_t (Q/800+110√V) SL, Btu/h	
Hot Water Supply Boilers, Oil		≥4000 (Btu/h)/gal and ≥10 Gal	78% E_t (Q/800+110√V) SL, Btu/h	
Pool Heaters, Oil and Gas	All		78% E_t	ASHRAE 146
Unfired Storage Tanks	All		R-12.5	(none)

For SI: 1Btu/h = .2931W, °C = [(°F) - 32]/1.8

1. Energy factor (ER) and thermal efficiency (Et) 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.
2. Subchapter 13-3 contains a complete specification, including year version, of the referenced test procedure.
3. Electric, gas and oil water heaters' EF ratings in the residential size range are the same as those found in Table 13-612.AB.3.2 of this code.
4. 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 180°F or higher.
5. Test reports from independent laboratories are required to verify procedure compliance.

13-413.AB.1.1 Feeders and customer-owned service conductors. Feeder and customer-owned service conductors shall be sized for a maximum voltage drop of 2 percent at design load.

13-413.AB.1.2 Branch circuits. Branch circuit conductors shall be sized for a maximum voltage drop of 3 percent at design load.

13-413.AB.2 Completion requirements.

13-413.AB.2.1 Drawings. Construction documents shall require that within 30 days after the date of system acceptance, record drawings of the actual installation shall be provided to the building owner, including:

1. A single-line diagram of the building electrical distribution system and
2. Floor plans indicating location and area served for all distribution.

13-413.AB.2.2 Manuals. Construction documents shall require that an operating manual and maintenance manual be provided to the building owner. The manuals shall include, at a minimum, the following:

1. Submittal data stating *equipment* rating and selected options for each piece of *equipment* requiring maintenance.
2. Operation manuals and maintenance manuals for each piece of *equipment* requiring maintenance. Required routine maintenance actions shall be clearly identified.
3. Names and addresses of at least one qualified service agency.

NOTE: Enforcement agencies should only check to be sure that the construction documents require this information to be transmitted to the owner and should not expect copies of any of the materials.

SECTION 13-414
MOTORS

13-414.0 Applicability. All permanently wired electric motors shall meet the requirements of Section 13-414.AB.1.

13-414.AB Mandatory requirements for Methods A and B.

13-414.AB.1 Electric motors. Electric motors shall comply with the requirements of the Energy Policy Act of 1992 where applicable, as shown in Table 13-414.AB.1. Motors that are not included in the scope of the Energy Policy Act have no performance requirements in this section.

SECTION 13-415
LIGHTING

13-415.0 Applicability. Lighting systems and equipment shall comply with the requirements of 13-415.AB and applicable re-

TABLE 13-414.AB.1
MINIMUM NOMINAL EFFICIENCY FOR GENERAL PURPOSE Design A and Design B Motors[1]

	Minimal Nominal Full-Load Efficiency (%)					
	Open Motors			Enclosed Motors		
Number of Poles	2	4	6	2	4	6
Synchronous speed (RPM)	3600	1800	1200	3600	1800	1200
Motor Horsepower						
1.0	——	82.5	80.0	75.5	82.5	80.0
1.5	82.5	84.0	84.0	82.5	84.0	85.5
2.0	84.0	84.0	85.5	84.0	84.0	86.5
3.0	84.0	86.5	86.5	85.5	87.5	87.5
5.0	85.5	87.5	87.5	87.5	87.5	87.5
7.5	87.5	88.5	88.5	88.5	89.5	89.5
10.0	88.5	89.5	90.2	89.5	89.5	89.5
15.0	89.5	91.0	90.2	90.2	91.0	90.2
20.0	90.2	91.0	91.0	90.2	91.0	90.2
25.0	91.0	91.7	91.7	91.0	92.4	91.7
30.0	91.0	92.4	92.4	91.0	92.4	91.7
40.0	91.7	93.0	93.0	91.7	93.0	93.0
50.0	92.4	93.0	93.0	92.4	93.0	93.0
60.0	93.0	93.6	93.6	93.0	93.6	93.6
75.0	93.0	94.1	93.6	93.0	94.1	93.6
100.0	93.0	94.1	94.1	93.6	94.5	94.1
125.0	93.6	94.5	94.1	94.5	94.5	94.1
150.0	93.6	95.0	94.5	94.5	95.0	95.0
200.0	94.5	95.0	94.5	95.0	95.0	95.0

1. Nominal efficiencies shall be established in accordance with NEMA Standard MG1. Design A and Design B are National Electric Manufacturers Association (NEMA) design class designations for fixed frequency small and medium AC squirrel-cage induction motors.

quirements of Appendix 13-B. This section shall apply to the following:

1. Interior spaces of buildings;
2. Exterior building features, including facades, illuminated roofs, architectural features, entrances, exits, loading docks, and illuminated canopies; and
3. Exterior building grounds lighting provided through the building's electrical service.

Exceptions:

1. Emergency lighting that is automatically off during normal building operation,
2. Lighting within living units,
3. Lighting that is specifically designated as required by a health or life safety statute, ordinance, or regulation,
4. Decorative gas lighting systems.

13-415.AB Mandatory requirements for Methods A and B.

13-415.AB.1 Controls.

13-415.AB.1.1 Automatic lighting controls. Interior lighting in buildings larger than 5,000 square feet (465 m^2) shall be controlled with an automatic control device to shut off building lighting in all spaces. This automatic control device shall function on either:

1. A scheduled basis using a time-of-day operated control device that turns lighting off at specific programmed times—an independent program schedule shall be provided for areas of no more than 25,000 square feet (2323 m^2) but not more than one floor.
2. An occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space.
3. A signal from another control or alarm system that indicates the area is unoccupied.

Exceptions: The following shall not require an automatic control device.

a. Lighting intended for 24-hour operation.
b. Lighting in spaces where patient care is rendered.
c. Spaces where an automatic shutoff would endanger the safety or security of the room's or building's occupant(s).

13-415.AB.1.2 Space control. Each space enclosed by ceiling-height partitions shall have at least one control device to independently control the general lighting within the space. Each manual device shall be readily accessible and located so the occupants can see the controlled lighting.

a. A control device shall be installed that automatically turns lighting off within 30 minutes of all occupants leaving a space, except spaces with multiscene control, in the following:
    1. Classrooms (not including shop classrooms, laboratory classrooms, and preschool through 12th grade classrooms).
    2. Conference/meeting rooms.
    3. Employee lunch and break rooms.

    These spaces are not required to be connected to other automatic lighting shutoff controls.
b. For all other spaces, each control device shall be activated either manually by an occupant or automatically by sensing an occupant. Each control device shall control a maximum of 2,500 square feet (232 m^2) area for a space 10,000 square feet (929 m^2) or less; and a maximum of 10,000 square feet (929 m^2) area for a space greater than 10,000 square feet (929 m^2); and be capable of overriding any time-of-day scheduled shut-off control for no more than 4 hours.

Exception: Remote location shall be permitted for reasons of safety or security when the remote control device has an indicator pilot light as part of or next to the control device, and the light is clearly labeled to identify the controlled lighting.

13-415.AB.1.3 Additional controls. Controls are required in the following cases:

1. Display or accent lighting. Display or accent lighting shall have a separate control.
2. Case lighting. Lighting in cases used for display purposes shall have a separate control device.
3. Hotel and motel guest room lighting. Hotel and motel guest rooms and guest suites shall have a master control device at the main room entry that controls all permanently installed luminaires and switched receptacles.
4. Task lighting. Supplemental task lighting, including permanently installed under-shelf or under-cabinet lighting, shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided the control device is readily accessible and located so that the occupant can see the controlled lighting.
5. Nonvisual lighting. Lighting for nonvisual applications, such as plant growth and food warming, shall have a separate control device.
6. Demonstration lighting. Lighting equipment that is for sale or for demonstrations in lighting education shall have a separate control device.

13-415.AB.1.4 Exterior lighting control. Lighting for all exterior applications not exempted in Section 13-415.0 shall have automatic controls capable of turning off exterior lighting when sufficient daylight is available, or when the lighting is not required during nighttime hours. Lighting not designated for

dusk-to-dawn operation shall be controlled by an astronomical time switch. Lighting designated for dusk-to-dawn operation shall be controlled by an astronomical time switch or photosensor. Astronomical time switches shall be capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.

Exception: Lighting for covered vehicle entrances or exits from buildings or parking structures where required for safety, security, or eye adaptation.

13-415.AB.2 Exterior lighting.

13-415.AB.2.1 Exterior building grounds lighting. All exterior building grounds luminaires that operate at greater than 100 watts shall contain lamps having a minimum efficacy of 60 lm/W unless the luminaire is controlled by a motion sensor or qualifies for one of the exceptions under Sections 13-415.0 and 13-415.AB.2.2.

13-415.AB.2.2 Exterior building lighting power. The total exterior lighting power allowance for all exterior building applications is the sum of the individual lighting power densities permitted in Table 13-415.AB.2.2 for these applications, plus an additional unrestricted allowance of 5% of that sum. Trade-offs are allowed only among exterior lighting applications listed in the Table 13-415.AB.2.2 "Tradable Surfaces" section. Exterior lighting for all applications (except those included in the exceptions to Sections 13-415.0 and this section) shall comply with the requirements of Section 13-415.AB.2.1.

Exceptions: Lighting used for the following exterior applications is exempt when equipped with a control device independent of the control of the nonexempt lighting:

(a) specialized signal, directional, and marker lighting associated with transportation;

(b) advertising signage or directional signage;

(c) Lighting that is integral to equipment or instrumentation and is installed by its manufacturer;

(d) Lighting for theatrical purposes, including performance, stage, film and video production;

(e) Lighting for athletic playing areas;

(f) Temporary lighting;

(g) Lighting for industrial production, material handling, transportation sites and associated storage areas;

(h) Theme elements in theme/amusement parks; and

(i) Lighting used to highlight features of public monuments and registered historic landmark structures or buildings.

TABLE 13-415.AB.2.2
LIGHTING POWER DENSITIES FOR BUILDING EXTERIORS

APPLICATIONS	LIGHTING POWER DENSITIES
Tradable Surfaces (Lighting Power Densities for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs, and outdoor sales areas may be traded.)	
Uncovered Parking Areas	
Parking lots and drives	0.15 W/ft^2
Building Grounds	
Walkways less than 10 feet wide	1.0 watts per linear foot
Walkways 10 feet wide or greater, plaza areas, and special feature areas	0.2 W/ft^2
Stairways	1.0 W/ft^2
Building Entrances and Exits	
Main entries	30 watts per linear foot of door width
Other doors	20 watts per linear foot of door width
Canopies and Overhangs	
Canopies (free-standing and attached) and overhangs	1.25 W/ft^2
Outdoor Sales	
Open areas (including vehicle sales lots)	0.5 W/ft^2
Street frontage for vehicle sales lots in addition to "open area" allowance	20 watts per linear foot
Nontradable Surfaces (Lighting Power Density calculations for the following applications can be used only for the specific application and cannot be traded between surfaces or with other exterior lighting. The following allowances are in addition to any allowance otherwise permitted in the "Tradable Surfaces" section of this table.)	
Building facades	0.2 W/ft^2 for each illuminated wall or surface or 5.0 watts per linear foot for each illuminated wall or surface length
Automated teller machines and night depositories	270 watts per location plus 90 watts per additional ATM per location
Entrances and gatehouse inspection stations at guarded facilities	1.25 W/ft^2 of uncovered area (covered areas are included in the "Canopies and Overhangs" section of "Tradable Surfaces")
Loading areas for law enforcement, fire, ambulance and other emergency service vehicles	0.5 W/ft^2 of uncovered area (covered areas are included in the Canopies and Overhangs" section of "Tradable Surfaces")
Drive-up windows at fast food restaurants	400 watts per drive-through
Parking near 24-hour retail entrances	800 watts per main entry

13-415.AB.3 Tandem wiring. Luminaires designed for use with one or three linear fluorescent lamps >30W each shall use two-lamp tandem-wired ballasts in place of single lamp ballasts when two or more luminaires are in the same space and on the same control device.

Exceptions:

1. Recessed luminaires more than 10 feet (3048 mm) apart measured center to center.

2. Surface-mounted or pendant luminaires that are not continuous.
3. Luminaires using single-lamp high-frequency electronic ballasts.
4. Luminaires using three-lamp high-frequency electronic or three-lamp electromagnetic ballasts.
5. Luminaires on emergency circuits.
6. Luminaires with no available pair.

13-415.AB.4 Exit signs. Internally illuminated exit signs shall not exceed 5 watts per face.

13-415.AB.5 Interior lighting power, scope. The *interior lighting power allowance* for a building or a separately metered or permitted portion of a *building* shall be determined by the space-by-space method described in Section 13-415.B.1. Trade-offs of *interior lighting power allowance* among portions of the *building* for which a different method of calculation has been used are not permitted. The *installed interior lighting power* identified in accordance with Section 13-415.AB.5.1 shall not exceed the *interior lighting power allowance* developed in accordance with Section 13-415.B.1.

Exceptions: The following *lighting equipment* and applications shall not be considered when determining the interior lighting power allowance developed in accordance with Section 13-415.B.1, nor shall the wattage for such lighting be included in the installed interior lighting power identified in accordance with Section 13-415.AB.5.1. However, any such lighting shall not be exempt unless it is an addition to general lighting and is controlled by an independent control device.

1. Display or accent lighting that is an essential element for the function performed in galleries, museums, and monuments.
2. Lighting that is integral to equipment or instrumentation and is installed by its manufacturer.
3. Lighting specifically designed for use only during medical or dental procedures and lighting integral to medical equipment.
4. Lighting integral to both open and glass enclosed refrigerator and freezer cases.
5. Lighting integral to food warming and food preparation equipment.
6. Lighting for plant growth or maintenance.
7. Lighting in spaces specifically designed for use by the visually impaired.
8. Lighting in retail display windows, provided the display area is enclosed by ceiling-height partitions.
9. Lighting in interior spaces that have been specifically designated as a registered interior historic landmark.
10. Lighting that is an integral part of advertising or directional signage.
11. Exit signs.
12. Lighting that is for sale or lighting educational demonstration systems.
13. Lighting for theatrical purposes, including performance,stage, and film and video production.
14. Lighting for television broadcasting in sporting activity areas.
15. Casino gaming areas.

13-415.AB.5.1 Installed interior lighting power. The installed interior lighting power shall include all power used by the luminaires, including lamps, ballasts, current regulators, and control devices except as specifically exempted in Section 13-415.AB.5.

Exception: If two or more independently operating lighting systems in a space are capable of being controlled to prevent simultaneous user operation, the installed interior lighting power shall be based solely on the lighting system with the highest wattage

13-415.A Requirements specific to Method A. Lighting levels and types determined by the EnergyGauge Summit Fla/Com Method A performance calculation to demonstrate compliance with this code shall be the maximum performance levels installed for lighting.

13-415.B Requirements specific to method B. Lighting levels and types specified on Form 400B or on the EnergyGauge Summit Fla/Com Method B printout shall be the maximum levels installed for lighting. Lighting for shell buildings shall be sufficiently efficient to meet Method A criteria for the entire space at time of build-out.

13-415.B.1 Form 400B and the EnergyGauge Summit Fla/Com printout utilize the lighting power densities for the appropriate building type(s) from Table 13-415.B.1 to determine code compliance.

TABLE 13-415.B.1
LIGHTING POWER DENSITIES (LPD) USING THE SPACE-BY-SPACE METHOD

Common Space Types[1]	LPD (W/ft²)	Building Specific Space Types (Continued)	LPD (W/ft²)
Office—enclosed	1.1	Fire stations	
Office—open plan	1.1	Fire station engine room	0.8
Conference/Meeting/Multipurpose	1.3	Sleeping quarters	0.3
Classroom/Lecture/Training	1.4	Post Office—sorting area	1.2
for Penitentiary	1.3	Convention center—exhibit space	1.3
Lobby	1.3	Library	
for Hotel	1.1	Card file & cataloging	1.1
for Performing arts theater	3.3	Stacks	1.7
for Motion picture theater	1.1	Reading area	1.2
Audience/seating area	0.9	Hospital	
for Gymnasium	0.4	Emergency	2.7
for Exercise center	0.3	Recovery	0.8
for Convention center	0.7	Nurse station	1.0
for Penitentiary	0.7	Exam/Treatment	1.5
for Religious buildings	1.7	Pharmacy	1.2
for Sports arena	0.4	Patient room	0.7
for Performing arts theater	2.6	Operating room	2.2
for Motion picture theater	1.2	Nursery	0.6
for Transportation	0.5	Medical supply	1.4
Atrium—first three floors	0.6	Physical therapy	0.9
Atrium—each additional floor	0.2	Radiology	0.4
Lounge/Recreation	1.2	Laundry/Washing	0.6
for Hospital	0.8	Automotive—Service/Repair	0.7
Dining area	0.9	Manufacturing	
for Penitentiary	1.3	Low bay (<25 ft floor to ceiling height)	1.2
for Hotel	1.3	High bay (>25 ft floor to ceiling height)	1.7
for Motel	1.2	Detailed manufacturing	2.1
for Bar lounge/Leisure dining	1.4	Equipment room	1.2
for Family dining	2.1	Control room	0.5
Food preparation	1.2	Hotel/Motel guest rooms	1.1
Laboratory	1.4	Dormitory—Living quarters	1.1
Restrooms	0.9	Museum	
Dressing/Locker/Fitting room	0.6	General exhibition	1.0
Corridor/Transition	0.5	Restoration	1.7
for Hospital	1.0	Bank/Office—banking activity area	1.5
for Manufacturing facility	0.5	Religious buildings	
Stairs—active	0.6	Worship—pulpit, choir	2.4
Active storage	0.8	Fellowship hall	0.9
for Hospital	0.9	Retail (for accent lighting see Sec. 415.2.B.2)	
Inactive storage	0.3	Sales area	1.7
for Museum	0.8	Mall concourse	1.7
Electrical/mechanical	1.5	Sports arena	
Workshop	1.9	Ring sports area	2.7
		Court sports area	2.3
Building Specific Space Types		Indoor playing field area	1.4
Gymnasium/Exercise center		Warehouse	
Playing area	1.4	Fine material storage	1.4
Exercise area	0.9	Medium/bulky material storage	0.9
Courthouse/Police station/Penitentiary		Parking garage—garage area	0.2
Courtroom	1.9	Transportation	
Confinement cells	0.9	Airport—concourse	0.6
Judges chambers	1.3	Air/Train/Bus—Baggage area	1.0
		Terminal—Ticket counter	1.5

For SI: 1 foot = 304.8 mm.

a. In cases where both a common space type and a building specific space type are listed, the building specific space type shall apply.

SUBCHAPTER 13-6
RESIDENTIAL BUILDING COMPLIANCE METHODS

SECTION 13-600
ADMINISTRATION

13-600.1 Methods of compliance. Scope. This chapter provides two Methods by which residential buildings may be brought into compliance with this code.

13-600.1.1 Method A, the Whole Building Performance Method. This is a performance based code compliance method which considers energy use for the whole building, both for the envelope and its major energy-consuming systems. Under this method, energy loads are calculated for the energy-consuming elements of an as-built house and simultaneously for a baseline house of the same configuration. The as-built normalized modified energy loads shall be less than the baseline energy loads to comply with this code. Applicable performance criteria in Appendix 13-C shall be followed. Applicable requirements described in Sections 13-601 through 13-613 shall also be met.

Method A may be applied to demonstrate code compliance for new residential construction, both single-family detached and multiple-family attached structures, and to additions to existing residential buildings. Existing buildings not exempt from this code may be brought into compliance by this method.

13-600.1.1.1 As an alternative to the computerized Compliance Method A, the Alternate Residential Point System Method hand calculation, Alternate Form 600A, may be used. All requirements specific to this calculation are located in Appendix 13-2C. Buildings complying by this alternative shall meet all mandatory requirements of this chapter. Computerized versions of the Alternate Residential Point System Method shall not be acceptable for code compliance.

13-600.1.2 Method B, the Component Prescriptive Method. This is a prescriptive code compliance method for residences of three stories or less, additions, renovations to existing residential buildings; new heating, cooling, and water heating systems in existing buildings; and site-added components of manufactured homes and manufactured buildings. Using this method, a residence would meet or exceed all applicable requirements for the list of minimum component requirements.

Exceptions: Method B shall not be applied in new construction, including additions, that incorporates the following:

1. Skylights.
2. Windows with greater than 16 percent glass to floor area.
3. Electric resistance heat.

13-600.1.2.1 Renovations. To comply by this method, all energy-related components or systems being installed or changed in the renovation shall meet the minimum prescriptive levels listed for that component.

13-600.2 Forms. Code compliance by this subchapter shall be demonstrated by completing and submitting to the building official the appropriate forms described below. An original form or EnergyGauge USA–Fla/Res computerized printout, accompanied by a copy of the front page of the form as provided in Section 13-105.0, shall be submitted to the building department to demonstrate compliance with this code before a building permit is issued.

Method A compliance		Form1100A-08 (EnergyGauge USA Fla/Res computerized printout)
	or	Form 600A-08 (hand calculation)
Method B compliance		Form 1100B-08

13-600.2.1 Form 1100D-07 (desuperheater, heat recovery unit water heater efficiency certification). This form shall be submitted when credit is being taken for water heating with a heat recovery unit. The form is used to demonstrate that the net superheat recovery is equal to or greater than the 30 percent minimum required to obtain credit. The form shall be affixed to the heat recovery unit by the manufacturer.

Exception: If the heat recovery unit is listed in the current ARDM Directory of Certified Refrigerant Desuperheater Heat Recovery Unit Water Heaters as meeting the net heat recovery minimum and the unit bears the ARDM label signifying compliance with this code, the label shall serve as a certification in place of Form 1100D-07.

13-600.2.2 EPL display card. The building official shall require that an energy performance level (EPL) display card be completed and certified by the builder to be accurate and correct before final approval of a residential building for occupancy. The EPL display card contains information indicating the energy performance level and efficiencies of components installed in a dwelling unit. The EPL display card shall be included as an addendum to the sales contract for both presold and nonpresold residential buildings in accordance with Section 553.9085, *Florida Statutes*.

13-600.2.3 Availability. Forms may be found in Appendix 13-D or online at www.floridabuilding.org. The EnergyGauge USA–Fla/Res computer program may be found online at www.energygauge.com.

13-600.3 Types of requirements. Mandatory requirements shall be met for all buildings. The section number followed by the combined number and letters ".AB" indicates these mandatory requirements (i.e., requirements that shall be met by buildings complying by either Method A or B) in Sections 13-601 through 13-613. Requirements specific to Method A or B (i.e., ".B" is specific to Method B) shall be met when complying with the code by that method. Prescriptive requirements for Method B may be more stringent than the basic prescriptive requirements and shall supersede them. General requirements

contained in Appendix 13-C for building material properties, testing and installation shall be followed.

13-600.A Requirements specific to Method A.

13-600.A.1 General. Requirements specific to Method A are included in the text under the applicable building component section. Compliance is by Form 1100A-08 produced by the EnergyGauge USA–Fla/Res computer program. The Method A calculation shall result in either a PASS or FAIL status. For a building to pass, the total energy score calculated for the as-built house shall be less than or equal to the total energy score calculated for the baseline house. The baseline features and calculation procedures contained in Section 13-613 and in Appendix 13-C shall be used to demonstrate code compliance of the building design for residential buildings complying by Method A. Except where prescribed elsewhere, efficiencies described in the Method A calculation submittal to demonstrate compliance with this code shall be the minimum level installed for each component.

13-600.A.1.1 Insulation *R*-values. *R*-values used for the insulation level installed shall be the *R*-value of the added insulation only. Appendix 13-C, Section C1.2, contains general rules for insulation that shall be followed.

13-600.A.1.2 Areas. Areas used in the calculation shall be the actual net areas for each component determined from the plans and specifications of the building to be constructed.

13-600.A.2 Energy loads. Energy loads for Method A compliance are as provided in the EnergyGauge USA–Fla/Res computer program.

13-600.A.3 Residences not heated or not cooled. Residences which are heated or cooled, but not both, shall complete both summer and winter calculations. If an addition or part of an addition is claimed to be exempt from the code because it will be neither heated nor cooled, the exempt area shall be fully separated from the conditioned area by walls or doors.

13-600.A.4 Worst-case calculations. Residential occupancies which are identical in configuration, square footage, and building materials may comply with the code by performing a worst-case calculation using compliance Method A. A worst case calculation generates the highest as-built energy score in a Method A calculation. When submitting worst-case calculations, copies of the Form 1100A shall be submitted or referenced with each set of plans, dependent on the requirements of the building department.

13-600.A.5 Additions.

13-600.A.5.1 Additions complying alone. Additions to existing buildings shall follow the same Method A calculation procedure as new construction with the following qualifications.

1. Calculations shall be conducted using only the components of the addition itself, including those preexisting components which separate the addition from unconditioned spaces.
2. Heating and cooling system loads shall be equal to the baseline system loads unless new equipment is installed to replace existing equipment or to service the addition specifically.
3. Water heating is not included in the calculation unless a supplemental water heater is installed, an existing water heater is replaced, or an alternative water heater (gas, solar, HRU, dedicated heat pump) is installed.

13-600.A.5.2 Additions unable to comply alone. Additions may comply with the code requirements for the addition alone or by demonstrating that the entire building, including the addition, complies with the code requirements for new buildings using compliance Method A. Section 13-600.A.5.2.1 contains restrictions which shall apply if the entire building is used to demonstrate compliance.

13-600.A.5.2.1 Assumptions for existing building efficiencies. The following restrictions apply if the entire building is used to demonstrate code compliance:

1. The owner shall demonstrate to the building department's satisfaction that all *R*-values and equipment efficiencies claimed are present. If the building was built after 1980, the original energy code submittal may be used to demonstrate efficiencies.
2. If it is apparent from inspection that no insulation is present in the existing walls, floors or ceilings, or if inspection is not possible, an *R*-value of zero (0) shall be used for that component in the calculation. If, as part of the addition and renovation project, insulation or equipment in the existing structure is upgraded, the new values may be used in the calculation.
3. If, upon inspection, insulation is found but the *R*-value is unknown, then an *R*-value shall be determined by an energy audit utilizing current acceptable practice based on insulation thickness, density and type.
4. Equipment efficiencies shall be demonstrated, either from manufacturer's literature or certified equipment directories, or by the procedure provided in Section 13-607.AB.3 based on system capacity and total on-site energy input. Equipment to be added shall meet the applicable minimum equipment efficiency from Tables 13-607.AB.3.2A, 13-607.AB.3.2B, 13-607.AB.3.2D, 13-608.AB.3.2E and 13-608.AB.3.2F. Existing residential equipment not meeting the efficiencies in Tables 13-607.AB.3.2A, 13-607.AB.3.2B, 13-607.AB.3.2D, 13-608.AB.3.2E, and 13-608.AB.3.2F shall utilize the cooling or heating system efficiencies provided in Tables 13-C4.1.1A to 13-C4.1.1B of Appendix 13-C.
5. Any nonvertical roof glass shall be calculated as horizontal glazing.

13-600.A.6 Multiple-family occupancies.

13-600.A.6.1 Common conditioned spaces. Common conditioned spaces occurring in multiple-family buildings that are not part of specific tenancy units, such as corridors, lobbies, recreation rooms, offices, etc., shall be calculated using one of the following procedures:

1. No energy use calculation is required for common areas if less than 5 percent of the building area is used for such common areas.
2. Corridors, lobbies and similar areas shall be calculated using Subchapter 13-4.
3. Nonresidential occupancies within a multiple-family structure such as cafeterias, offices, and gyms shall be calculated in accordance with Subchapter 13-4.

13-600.B Requirements specific to Method B. Requirements specific to Method B are included in the text under the applicable building component section. Compliance is by Form 1100B-08. This compliance method provides a list of requirements that must be met or exceeded. Any practice, system, or rating for which the energy performance determined from compliance Method A meets or exceeds the energy performance of the prescribed practice or system in the same climate zone may be used to comply with the Method B requirements. No substitutions or variations less energy efficient than the established levels and standards listed for each component type shall be permitted. No components or systems shall be installed with efficiencies less than the mandatory requirements for that component or system.

13-600.B.1 Additions. Requirements shall apply only to building components and equipment being added to an addition or replaced in an existing building to service an addition. Existing components or systems in a residence need not meet the requirements. Substitutions or variations that are less energy efficient than the prescribed efficiency levels and standards listed shall not be permitted.

13-600.B.2 Renovations. Requirements shall apply only to those components or systems being repaired or replaced.

13-600.B.3 Manufactured homes and manufactured buildings. Requirements specified for manufactured homes and manufactured buildings shall be met for all site-installed components and features of such buildings at the time of first setup. Complete code compliance shall be demonstrated for manufactured buildings.

SECTION 13-601
FENESTRATIONS (GLAZING)

13-601.AB Mandatory requirements for Methods A or B.

13-601.AB.1 Window efficiencies. Windows shall have no higher *U*-factor or solar heat gain coefficient (SHGC) than that certified to be in compliance with the code. Unlabeled windows shall use the default *U*-factor and SHGC criteria of Section C2.1.1 in Appendix 13-C of this chapter.

Glazing in doors shall be considered fenestrations. See Section 13-104.4.5.

13-601.AB.2 Window infiltration. Windows shall meet the minimum air infiltration requirements of Section 13-606.1.

13-601.AB.3 Overhangs. Nonpermanent shading devices such as canvas awnings shall not be considered overhangs. Permanently attached wood and metal awnings may be considered overhangs.

13-601.A Requirements specific to Method A. The type of window to be installed shall have properties at least as efficient as the window(s) used to calculate Form 1100A. Window performance criteria are as contained in the EnergyGauge USA Fla/Res computer program.

13-601.A.1 Glass orientation. Glazing shall be considered in the Method A calculation by orientation of all windows and skylights.

13-601.A.2 Glass types. Glazing shall be considered by its *U*-factor and its solar heat gain coefficient (SHGC), or, if unlabeled, default values shall be assumed as per Section 13-C2.1.1 of Appendix 13-C of this chapter.

13-601.A.3 Glass overhangs. Overhang effect is measured in EnergyGauge USA Fla/Res by overhang separation, which is the vertical measure of the distance from the top of a window to the bottom of the overhang. The overhang for adjustable exterior shading devices shall be determined at its most extended position.

13-601.A.4 Glass areas. All glazing areas of a residence, including windows, sliding glass doors, glass in doors, skylights, etc., shall include the manufacturer's frame area in the total window area. Window measurements shall be as specified on the plans and specifications for the residence.

Exception: When a window in existing exterior walls is enclosed by an addition, an amount equal to the area of this window may be subtracted from the glazing area for the addition for that overhang and orientation.

13-601.B Requirements specific to Method B. All new glass in residential buildings complying by Method B, including sliding glass doors and glass in exterior doors that has an area one-third or more of the total door area, shall meet the criteria in Sections 13-601.B.1 through 13-601.B.3.

13-601.B.1 General.

13-601.B.1.1 Percentage of glass. The percentage of glass area to conditioned floor area shall not exceed 16 percent.

Exceptions:

1. When glass in existing exterior walls is being removed or enclosed by an addition, an amount equal to the total area of this glass may be subtracted from the total glass area prior to determining the installed glass percentage.
2. Additions of 600 square feet (56 m^2) or less.

13-601.B.1.2 Glass type. All glass shall have *U*-factors and solar heat gain coefficients no higher than those listed from Table 11B-1 on Form 1100B.

13-601.B.2 Additions of 600 square feet (56 m^2) or less. All glazing in residential additions of 600 square feet (56

m^2) or less complying by Method B shall meet the minimum criteria given on Form 1100B for new glazing installed in the addition. All new glazing shall meet the *U*-factor and the solar heat gain coefficient (SHGC) criteria on Form 1100B for the type of glass and the percentage of glass to floor area categories on the form for glass installed in the addition. Glass windows and doors that were previously located in an existing exterior wall that is being removed or enclosed by an addition do not have to comply with the overhang and solar heat gain coefficient requirements listed on Form 1100B when reinstalled as part of the addition.

13-601.B.2.1 Glazing area. The maximum percentage of glass-to-floor area allowed for additions of 600 square feet (56 m^2) or less shall be 50 percent. The total glazing area calculated shall include the areas of windows, sliding glass doors, all areas which exceed one-third the area of the door in which they are located, and double the area of all skylights or other nonvertical roof glass. When glass in existing exterior walls is being removed or enclosed by an addition, an amount equal to the total area of this glass may be subtracted from the total glass area prior to determining the installed glass percentage.

13-601.B.3 Renovations. New windows installed in renovations may be of any glass type and solar heat gain coefficients where glass areas are under an overhang of at least 2 feet (610 mm) whose lower edge does not extend further than 8 feet (2438 mm) from the overhang. Glass areas that do not meet this criteria shall be either single-pane tinted, double-pane clear, or double-pane tinted in accordance with Table 13-C.2.1.1 in Appendix 13-C of this chapter. All skylights or nonvertical glass shall be double paned or single paned with a diffuser.

Exception: These requirements apply only to glass that is being replaced.

SECTION 13-602
WALLS

13-602.AB Mandatory requirements for Methods A or B.

13-602.AB.1 Wall insulation. Walls shall be insulated to at least the level certified to be in compliance with this code on the code compliance form.

Insulation *R*-values claimed shall be in accordance with the criteria described in Section 13-C1.2 of Appendix 13-C.

13-602.AB.1.1 Common walls. Walls common to two separate conditioned tenancies shall be insulated to a minimum of R-11 for frame walls, and to R-3 on both sides of common masonry walls.

13-602.AB.1.2 Walls considered ceiling area. Wall areas that separate conditioned living space from unconditioned attic space (such as attic knee walls, walls on cathedral ceilings, skylight chimney shafts, gambrel roofs, etc.) shall be considered ceiling area and have a minimum insulation value of R-19.

13-602.AB.2 Wall infiltration. Walls shall meet the minimum air infiltration requirements of Section 13-606.AB.

13-602.A Requirements specific to Method A.

13-602.A.1 Wall types. Walls entered into the EnergyGauge USA Fla/Res program shall be identified in sufficient detail for the building official to determine whether their characteristics are adequately represented on the form submitted for code compliance.

13-602.B Requirements specific to Method B. Walls shall be either frame or masonry construction, including face brick, to comply with this Method. All exterior and adjacent walls shall be insulated to the minimum *R*-value given on Table 11B-1 of Form 1100B in accordance with the criteria in Section 13-C1.2 of Appendix 13-C.

13-602.B.1 Additions. All walls shall be insulated to the minimum *R*-value given on Form 1100B for the type of construction used in the addition.

13-602.B.2 Renovations. Minimum insulation levels installed in renovated walls shall be not less than those specified in Section 13-602.B.1. These requirements apply only to those walls being renovated.

13-602.B.3 Manufactured homes and manufactured buildings. Marriage walls between sections of double wide or multiple units shall be sealed with long-life caulk or gasketing and shall be mechanically fastened in accordance with the manufacturer's instructions. See also the Section 13-610.B.4 requirements for ducts located in marriage walls of multiple unit manufactured homes and buildings.

SECTION 13-603
DOORS

13-603.AB Mandatory requirements for Methods A or B.

13-603.AB.1 Door types allowed. All exterior and adjacent doors other than glass doors shall be solid core wood, wood panel, or insulated doors. Hollow core doors shall not be used in either exterior or adjacent walls. Doors may have glass sections.

13-603.AB.2 Door infiltration. Doors shall meet the minimum air infiltration requirements for doors contained in Section 13-606.AB.1.1.

13-603.A Requirements specific to Method A.

13-603.A.1 Door types. Doors shall be identified as either exterior or adjacent, based on the type of wall in which they are located, and in sufficient detail for the building official to determine whether their characteristics are adequately represented on the form submitted for code compliance.

13-603.A.2 Door area determination. Door areas shall be determined from the measurements specified on the plans for each exterior and adjacent door.

All sliding glass doors and glass areas in doors shall be included in the glazing calculation and meet the requirements of Section 13-601 unless the glass is less than one-third of the area of the door. Door area entry into the EnergyGauge USA Fla/Res computer program shall meet the requirements of Appendix 13-C, Section C2.3.

SECTION 13-604
CEILINGS

13-604.AB Mandatory requirements for Methods A or B.

13-604.AB.1 Ceiling insulation. Ceilings shall have an insulation level of at least R-19, space permitting. For the purposes of this code, types of ceiling construction that are considered to have inadequate space to install R-19 include single assembly ceilings of the exposed deck and beam type and concrete deck roofs. Such ceiling assemblies shall be insulated to at least a level of R-10.

Ceiling insulation *R*-values claimed shall be in accordance with the criteria described in Section C1.2 of Appendix 13-C of this chapter.

13-604.AB.1.1 Ceilings with blown-in insulation. Ceilings with a rise greater than 5 and a run of 12 (5 over 12 pitch) shall not be insulated with blown-in insulation. Blown-in (loose fill) insulation shall not be used in sections of attics where the distance from the top of the bottom chord of the trusses, ceiling joists or obstructions (such as air conditioning ducts) to the underside of the top chord of the trusses at the ridge is less than 30 inches (762 mm) or where the distance from any point of 30 inches (762 mm) minimum clearance out to the ceiling surface in the roof eave area that is to be insulated is greater than 10 feet (3048 mm).

13-604.AB.1.1.1 Insulation dams. In every installation of blown-in (loose fill) insulation, insulation dams (for installations up to R-19 only); or insulation chutes, insulation baffles, or similar devices (for installations over R-19) shall be installed in such a manner so as to restrict insulation from blocking natural ventilation at the roof eave area to the attic space. Such devices shall be installed in spaces between all rafters of the roof structure and shall extend from the eave plate line to the attic area. In all cases, including the use of batt insulation, the insulation shall not be installed so as to block natural ventilation flow.

13-604.AB.1.1.2 Reference marks. In that portion of the attic floor to receive blown insulation, reference marks or rules shall be placed within every 6 feet to 10 feet (1829 mm to 3048 mm) throughout the attic space. The reference marks shall show the height to which the insulation must be placed in order to meet the planned insulation level. Such marks shall be used by the building official to verify the claimed insulation level. The reference marks or rules may be placed on truss webs or other appropriate roof framing members. Each reference mark or rule shall be visible from at least one attic access point.

13-604.AB.1.2 Common ceilings/floors. Wood, steel and concrete ceilings/floors common to separate conditioned tenancies shall be insulated to a minimum R-11, space permitting.

13-604.AB.1.3 Roof decks over dropped ceiling plenum. Roof decks shall be insulated to R-19 if the space beneath it will be used as a plenum of the air distribution system. Plenums shall meet all criteria of Section 13-610.AB.3.6.

13-604.AB.2 Ceiling infiltration. Ceilings shall meet the minimum air infiltration requirements of Section 13-606.1.

13-604.A Requirements specific to Method A.

13-604.A.1 Ceiling types. Ceilings entered into the EnergyGauge USA Fla/Res program shall be identified in sufficient detail for the building official to determine whether their characteristics are adequately represented on the form submitted for code compliance.

13-604.A.2 Walls considered ceiling area. Wall areas that separate conditioned living space from unconditioned attic space (such as attic knee walls, walls on cathedral ceilings, skylight chimney shafts, gambrel roofs, etc.) shall be considered ceiling area. Such areas shall be included in calculations of ceiling area and shall have a minimum insulation value of R-19.

13-604.A.3 Installation criteria for homes claiming the radiant barrier option. The radiant barrier or IRCC options may be claimed in the EnergyGauge USA Fla/Res computer program where the radiant barrier system is to be installed in one of the configurations depicted in Figure 13-604.A.3 and the following conditions are met:

1. It shall be fabricated over a ceiling insulated to a minimum of R-19 with conventional insulation and shall not be used as a means to achieve partial or whole compliance with the minimum attic insulation level of R-19 prescribed in Section 13-604.AB.1. Either a sheet type or spray applied interior radiation control coating (IRCC) may be used.
2. If the radiant barrier material has only one surface with high reflectivity or low imessivity it shall be facing downward toward the ceiling insulation.
3. The attic airspace shall be vented in accordance with Section 2309.7 of the *Florida Building Code, Building*.
4. The radiant barrier system shall conform to ASTM C 1313, *Standard Specification for Sheet Radiant Barriers for Building Construction Applications*, or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction*, as appropriate for the type of radiant barrier to be installed. The operative surface shall have an emissivity not greater than 0.06 for sheet radiant barriers or 0.25 for interior radiation control coatings as demonstrated by independent laboratory testing according to ASTM C 1371.
5. The radiant barrier system (RBS) shall conform with ASTM C 1158, *Use and Installation of Radiant Barrier Systems (RBS) in Building Constructions for Sheet Radiant Barriers*, or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction*, for IRCC systems.
6. The radiant barrier shall be installed so as to cover gable ends without closing off any soffit, gable or roof ventilation.

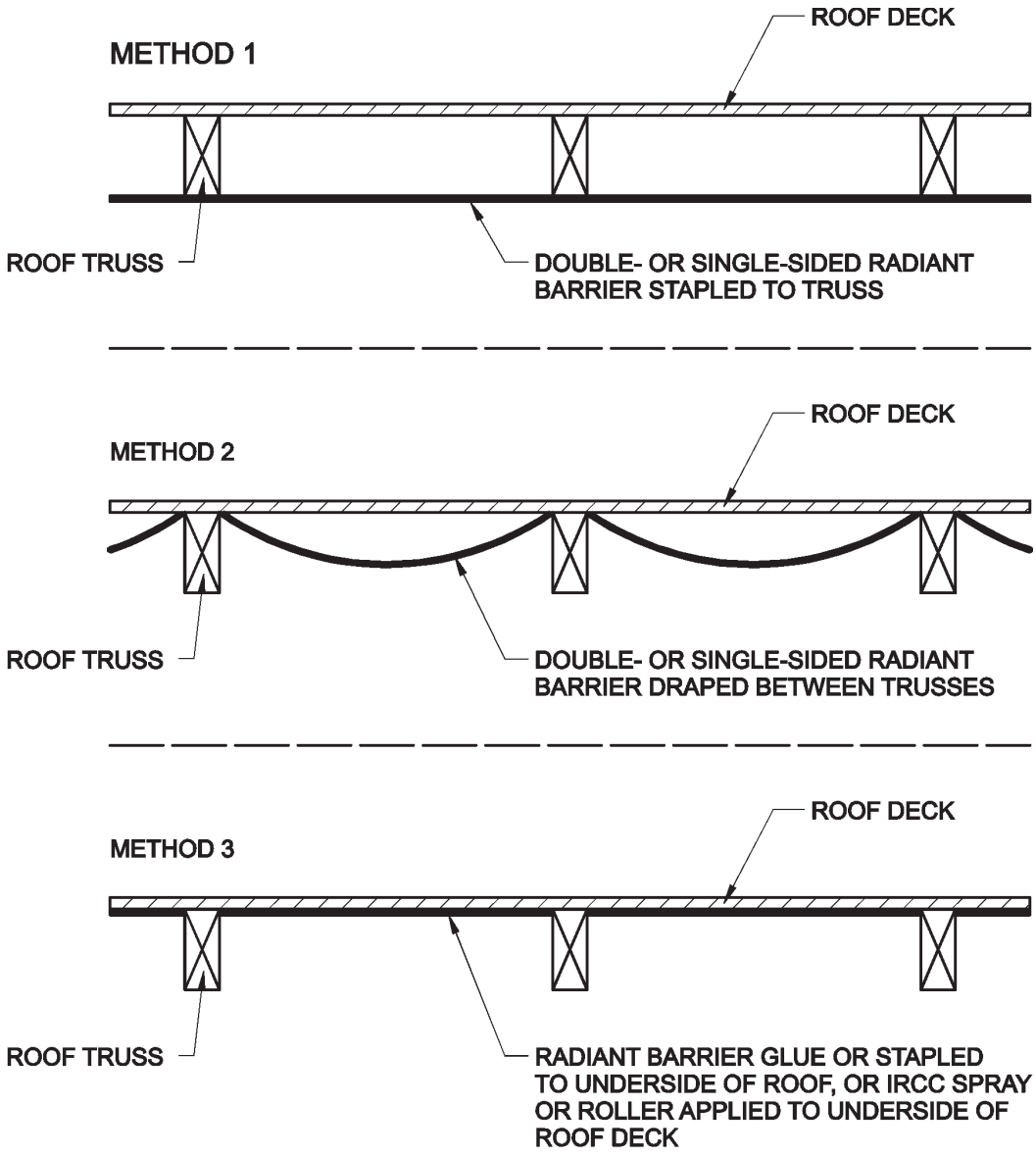


FIGURE 13-604.A.3
ACCEPTABLE ATTIC RADIANT BARRIER CONFIGURATIONS

13-604.A.4 Installation criteria for homes claiming the cool roof option. The cool roof option may be claimed in the EnergyGauge USA Fla/Res computer program where the roof to be installed has a tested solar reflectance of greater than 4 percent when evaluated in accordance with ASTM methods E-903, C-1549, E-1918 or CRRC Method #1. Emittance values provided by the roofing manufacturer in accordance with ASTM C 1371 shall be used when available. In cases where the appropriate data are not known, emittance shall be the same as the baseline home. Testing of a qualifying sample of the roofing material shall be performed by an approved independent laboratory with these results provided by the manufacturer.

13-604.A.5 Installation criteria for homes using the unvented attic assembly option. The unvented attic assembly option may be used in EnergyGauge USA Fla/Res if the criteria in Section R806.4 of the *Florida Building Code, Residential,* have been met.

13-604.B Requirements specific to Method B. All ceilings separating conditioned and unconditioned spaces shall be insulated to at least the minimum *R*-value given in Table 11B-1 of Form 1100B.

13-604.B.1 Additions. All roof/ceilings shall be insulated to the minimum *R*-value given on Form 1100B for the type of construction used in the addition.

13-604.B.2 Renovations. Minimum insulation levels installed in renovated roofs/ceilings shall be not less than those specified in Section 13-604.B.1. These requirements apply only to roofs/ceilings that are being renovated.

SECTION 13-605
FLOORS

13-605.AB Mandatory requirements for Methods A or B.

13-605.AB.1 Floor Insulation. Insulation *R*-values claimed shall be in accordance with the criteria described in Section C1.2 of Appendix 13-C of this chapter.

13-605.AB.1.1 Common floors. Wood, steel and concrete floors/ceilings common to two separate conditioned tenancies in multifamily applications shall be insulated to a minimum of R-11, space permitting.

13-605.AB.1.2 Slab-on-grade. For insulated slab-on-grade floors, the exposed vertical edge of the slab shall be covered with exterior slab insulation extending from the top of the slab down to at least the finished grade level. Extending the insulation to the bottom of the footing or foundation wall is recommended.

13-605.AB.2 Floor infiltration. Floors shall meet the minimum air infiltration requirements of Section 13-606.

13-605.A Requirements specific to Method A.

13-605.A.1 Floor types. Floors entered into the EnergyGauge USA Fla/Res program shall be identified in sufficient detail for the building official to determine whether their characteristics are adequately represented on the form submitted for code compliance.

13-605.B Requirements specific to Method B. All floors shall be insulated to the minimum R-value given on Table 11B-1 of Form 1100B.

13-605.B.1 Additions. All floors shall be insulated to the minimum *R*-value given on Form 1100B for the type of construction used.

13-605.B.2 Renovations. Minimum insulation levels installed in renovated floors shall be not less than those specified on Form 1100B for only the floors that are being renovated.

SECTION 13-606
AIR INFILTRATION

13-606.AB Mandatory requirements for Methods A or B. Buildings shall be constructed and sealed in such a way as to prevent excess air infiltration.

Caution: Caution should be taken to limit the use of materials and systems which produce unusual or excessive levels of indoor air contaminants.

13-606.AB.1 Infiltration levels allowed.

13-606.AB.1.1 Exterior doors and windows. Exterior doors and windows shall be designed to limit air leakage into or from the building envelope. Manufactured doors and windows shall have air infiltration rates not exceeding those shown in Table 13-606.AB.1.1. These rates shall be determined from tests conducted at a pressure differential of 1.567 pound per square foot (8 kg/m^2), which is equivalent to the impact pressure of a 25 mph wind. Compliance with the criteria of air leakage shall be determined by testing to AAMA/WDMA/101/I.S. 2 or ASTM E 283, as appropriate. Site-constructed doors and windows shall be sealed in accordance with Section 13-606.AB.1.2.

TABLE 13-606.AB.1.1
ALLOWABLE AIR INFILTRATION RATES

Frame Type	Windows (cfm per square foot of window area)	Doors (cfm per square foot of door area)	
		Sliding	Swinging
Wood	0.3	0.3	0.5
Aluminum	0.3	0.3	0.5
PVC	0.3	0.3	0.5

13-606.AB.1.2 Exterior joints or openings in the envelope. Exterior joints, cracks, or openings in the building envelope that are sources of air leakage shall be caulked gasketed, weatherstripped or otherwise sealed in accordance with the criteria in Sections 13-606.AB.1.2.1 through 13-606.AB.1.2.5.

13-606.AB.1.2.1 Exterior and adjacent walls. Exterior and adjacent walls shall be sealed at the following locations:

1. Between windows and doors and their frames;
2. Between windows and door frames and the surrounding wall;

3. Between the foundation and wall assembly sill-plates;
4. Joints between exterior wall panels at changes in plane, such as with exterior sheathing at corners and changes in orientation;
5. Openings and cracks around all penetrations through the wall envelope such as utility services and plumbing;
6. Between the wall panels and top and bottom plates in exterior and adjacent walls. In frame construction, the crack between exterior and adjacent wall bottom plates and floors shall be sealed with caulking or gasket material. Gypsum board or other wall paneling on the interior surface of exterior and adjacent walls shall be sealed to the floor; and
7. Between walls and floor where the floor penetrates the wall.
8. Log walls shall meet the criteria contained in Section 13-C3.4 of Appendix 13-C of this chapter.

Exception: As an alternative to Items 1 through 7 above for frame buildings, an infiltration barrier may be installed in the exterior and adjacent walls. The infiltration barrier shall provide a continuous air barrier from the foundation to the top plate of the ceiling of the house, and shall be sealed at the foundation, the top plate, at openings in the wall plane (windows, doors, etc.), and at the seams between sections of infiltration barrier material. When installed on the interior side of the walls, such as with insulated face panels with an infiltration barrier, the infiltration barrier shall be sealed at the foundation or subfloor.

13-606.AB.1.2.2 Floors. Penetrations and openings in raised floors, greater than or equal to $^1/_8$ inch (3 mm) in the narrowest dimension, shall be sealed unless backed by truss or joist members against which there is a tight fit or a continuous air barrier.

Exception: Where an infiltration barrier is installed in the floor plane of a house with raised floors. The infiltration barrier shall create a continuous air barrier across the entire floor area, and shall be sealed at the perimeter, at openings in the floor plane (grilles, registers, crawl space accesses, plumbing penetrations, etc.), and at seams between sections of infiltration barrier material.

13-606.AB.1.2.3 Ceilings. Ceilings shall be sealed at the following locations:

1. Between walls and ceilings.
2. At penetrations of the ceiling plane of the top floor of the building (such as chimneys, vent pipes, ceiling fixtures, registers, open shafts, or chases) so that air flow between the attic or unconditioned space and conditioned space is stopped.
3. Large openings, such as shafts, chases soffits, opening around chimneys, and dropped ceiling spaces (such as above kitchen cabinets, bathroom vanities, shower stalls, and closets), shall be sealed with an airtight panel or sheeting material and sealed to adjacent top plates (or other framing members) so that a continuous air barrier separates the spaces below and above the ceiling plane.
4. Gaps between ceiling gypsum board and the top plate shall be sealed with a sealant to stop air flow between the attic and the interior of wall cavities.
5. The attic access hatch, if located in the conditioned space shall have an airtight seal.

Exception: Where an infiltration barrier is installed in the ceiling plane of the top floor of the house. The infiltration barrier shall: create a continuous air barrier across the entire ceiling plane, be continuous across the tops of interior and exterior walls, and be sealed at the perimeter, at openings in the ceiling plane (grilles, registers, attic accesses, plumbing penetrations, vent pipes, chimneys, etc.), and at seams between sections of infiltration barrier material.

13-606.AB.1.2.4 Recessed lighting fixtures. Recessed lighting fixtures installed in ceilings that abut an attic space shall meet one of the following requirements:

1. Type IC rated, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity and sealed or gasketed to prevent air leakage into the unconditioned space.
2. Type IC or non-IC rated, installed inside a sealed box [minimum of $^1/_2$-inch-thick (12.7 mm)] gypsum wall board, preformed polymeric vapor barrier, or other air tight assembly manufactured for this purpose) and maintaining required clearances of not less than $^1/_2$-inch-thick (12.7 mm) from combustible material and not less than 3 inches (76 mm) from insulation material.
3. Type IC rated, with no more than 2.0 cfm (.00094 m^3/s) air movement from the conditioned space to the ceiling cavity when measured in accordance with ASTM E 283. The fixture shall be tested at 75 Pa and shall be labeled.

13-606.AB.1.2.5 Multiple-story houses. In multiple-story houses, the perimeter of the floor cavity (created by joists or trusses between floors) shall have an air barrier to prevent air flow between this floor cavity and outdoors or buffer zones of the house (such as a space over the garage).

1. Air-tight panels, sheathing, or sheeting shall be installed at the perimeter of the floor cavity. The panels, sheathing, or sheeting material shall be sealed to the top plate of the lower wall and the

bottom plate of the upper wall by mastic or other adhesive caulk, or otherwise bridge from the air barrier of the upper floor to the air barrier of the lower floor.

2. Joints between sections of panels, sheathing, or sheeting shall be sealed.
3. All fireplaces and wood stoves shall have flue dampers.

13-606.AB.1.3 Additional infiltration requirements. The following additional requirements shall be met:

1. All exhaust fans vented to the outdoors shall have dampers. This does not apply to combustion devices with integral exhaust ductwork, which shall comply with the *Florida Building Code, Fuel Gas*.
2. All combustion space heaters, furnaces, and water heaters shall be provided with adequate combustion air. Such devices shall comply with NFPA or the locally adopted code.

   Caution: Caution should be taken to limit the use of materials and systems which produce unusual or excessive levels of indoor air contaminants.

13-606.AB.1.4 Apertures or openings. Any apertures or openings in walls, ceilings or floors between conditioned and unconditioned space (such as exits in the case of hydrostatic openings in stairwells for coastal buildings) shall have dampers which limit air flow between the spaces.

13-606.A Requirements specific to Method A.

13-606.A.1 Infiltration loads. Infiltration loads shall be determined from the EnergyGauge USA Fla/Res computer program. Infiltration performance criteria shall be found in Section C3 in Appendix 13-C of this code.

13-606.A.2 Infiltration area. The area to be considered in the Infiltration calculation of Method A shall be the total conditioned floor area of the building.

SECTION 13-607
SPACE COOLING SYSTEMS

13-607.AB Mandatory requirements For Methods A or B.

13-607.AB.1 Equipment sizing. A cooling and heating load calculation shall be performed on the building and shall be attached to the Form 1100 submitted when application is made for a building permit, or in the event the mechanical permit is obtained at a later time, the calculation shall be submitted with the application for the mechanical permit. HVAC sizing calculations shall account for the directional orientation of the building for which the load is calculated; worst-case sizing calculations shall not be permitted. Cooling and heating design loads, for the purpose of sizing HVAC equipment and designing HVAC systems, shall be determined for the dwelling spaces (typically rooms or zones) served by each piece of equipment in accordance with ACCA Manual J, ACCA Manual N, or the ASHRAE *Cooling and Heating Load Calculation Manual*. This code does not allow designer safety factors, provisions for future expansion or other factors which affect equipment sizing in excess of the capacity limitations in Section 13-607.AB.1.1. System sizing calculations shall not include loads created by local intermittent mechanical ventilation such as standard kitchen and bathroom exhaust systems. The engineered ventilation requirement of the various procedures shall not be used as an infiltration rate when estimating infiltration loads.

Exceptions:

1. Where mechanical systems are designed by an engineer registered in the state of Florida, the engineer has the option of submitting a signed and sealed summary sheet in lieu of the complete sizing calculation(s). Such summary sheet shall include the following (by zone):
   Project name/owner
   Project Address
   Sizing Method Used
   Area in square feet
   Outdoor dry bulb used
   Total heating required with outside air
   Outdoor wet bulb used
   Total sensible gain
   Relative humidity
   Total latent gain
   Indoor dry bulb
   Total cooling required with outside air
   Grains water (difference)
2. Systems installed in existing buildings not meeting the definition of renovation in Section 13-202.

13-607.AB.1.1 Cooling equipment capacity. Cooling only equipment shall be selected so that its total capacity is not less than the calculated total load but not more than 1.15 times greater than the total load calculated according to the procedure selected in Section 13-607.AB.1, or the closest available size provided by the manufacturer's product lines. The corresponding latent capacity of the equipment shall not be less than the calculated latent load.

The published value for ARI total capacity is a nominal, rating-test value and shall not be used for equipment sizing. Manufacturer's expanded performance data shall be used to select cooling-only equipment. This selection shall be based on the outdoor design dry bulb temperature for the load calculation (or entering water temperature for water-source equipment), the blower CFM provided by the expanded performance data, the design value for entering wet bulb temperature and the design value for entering dry bulb temperature.

Design values for entering wet bulb and dry bulb temperature shall be for the indoor dry bulb and relative humidity used for the load calculation and shall be adjusted for return side gains if the return duct(s) is installed in an unconditioned space.

The manufacturer and model number of the outdoor and indoor units (if split system) shall be submitted along

with the sensible and total cooling capacities at the design conditions described herein.

Exceptions:

1. Attached single- and multiple-family residential equipment sizing may be selected so that its cooling capacity is less than the calculated total load but not less than 80 percent of that load.
2. When signed and sealed by a Florida-registered engineer, in attached single- and multiple-family units, the capacity of equipment may be sized in accordance with good design practice.

13-607.AB.1.2 Extra capacity required for special occasions. Residences requiring excess cooling or heating equipment capacity on an intermittent basis, such as anticipated additional loads caused by major entertainment events, shall have equipment sized or controlled to prevent continuous space cooling or heating within that space by one or more of the following options:

1. A separate cooling or heating system is utilized to provide cooling or heating to the major entertainment areas.
2. A variable capacity system sized for optimum performance during base load periods is utilized.

13-607.AB.2 Controls. Each mechanical supply and exhaust ventilation system shall be equipped with a readily accessible switch or other means for shut off or volume reduction and shut off when ventilation is not required. Automatic or manual dampers installed for the purpose of shutting off ventilation systems shall be designed with tight shutoff characteristics to minimize air leakage.

Exception: Manual dampers for outdoor air intakes may be used for single-and multiple-family residential buildings or for fan system capacities of less than 5,000 cfm (2.4 m^3/s).

13-607.AB.2.1 Zoning for temperature control. In one- and two-family dwellings, at least one thermostat for regulation of space temperature shall be provided for each separate HVAC system or zone.

13-607.AB.2.2 Control setback and shutoff. The thermostat required in Section 13-607.AB.2.1, or an alternate means including, but not limited to, a switch or clock, shall provide a readily accessible manual or automatic means for reducing the energy required for heating and cooling during periods of nonuse or reduced need including, but not limited to, unoccupied periods or sleeping hours.

13-607.AB.2.3 Humidity control. Where a humidistat is used for comfort dehumidification, it shall be capable of being set to prevent the use of fossil fuel or electricity to reduce humidities below 60 percent.

13-607.AB.3 Equipment performance standards.

13-607.AB.3.1 Equipment ratings. Equipment efficiency ratings shall be obtained from a nationally recognized certification program directory, or from a manufacturer's rating certified to be in compliance with an approved Department of Energy (DOE) or Air-conditioning and Refrigeration Institute (ARI) rating procedure. Equipment efficiencies shall be based on the standard rating conditions contained in the test standard referenced in Subchapter 13-3 that is appropriate for that equipment. The procedure for determining the integrated part-load value (IPLV) for a piece of equipment shall be the one provided in the appropriate ARI test standard for the type of equipment referenced. Minimum ratings for products covered under the National Appliance Energy Conservation Act of 1987 shall be those determined for Region IV and used for the Federal Trade Commission's required appliance labeling.

Cooling system efficiencies shall be rated as follows:

1. Central air conditioning equipment under 65,000 Btu/h (312 m^3/kw) capacity, both split-system and single-package equipment, single or three phase, shall be rated with a seasonal energy efficiency ratio (SEER).
2. Packaged terminal air conditioners and heat pumps shall be rated with an energy efficiency ratio (EER).
3. Room air conditioners shall be rated by an energy efficiency ratio (EER).
4. Central air conditioning equipment over 65,000 Btu/h (312 m^3/kw) shall be rated with an energy efficiency ratio (EER).
5. Water-cooled and evaporatively cooled central systems under 135,000 Btu/h (648m^3/kw) shall be rated with an energy efficiency ratio (EER).
6. Large capacity air-cooled, evaporatively- cooled and water source unitary air-conditioning systems may also be rated with an IPLV.
7. Heat-operated cooling equipment and gas-driven heat pumps shall be rated with a COP-cooling.

13-607.AB.3.1.1 Equipment efficiency verification. Equipment covered under the Federal Energy Policy Act of 1992 (EPACT) shall comply with U.S. Department of Energy certification requirements. For other equipment, if a certification program exists for a product covered in Tables 13-607.AB.3.2A through 13-607.AB.3.2D, and it includes provisions for verification and challenge of equipment efficiency ratings, then the product shall be either listed in the certification program or, alternatively, the ratings shall be verified by an independent laboratory test report. If no certification program exists for a product covered in Tables 13-607.AB.3.2A through 13-607.AB.3.2D, the equipment efficiency ratings shall be supported by data furnished by the manufacturer. Where components, such as indoor or outdoor coils, from different manufacturers are used, a Florida-registered engineer shall specify component efficiencies whose combined efficiency meets the minimum equipment efficiency requirements in Section 13-607.AB.3.2.

13-607.AB.3.2 Minimum efficiencies for cooling equipment. Equipment shown in Tables 13-607.AB.3.2A, 13-607.AB.3.2B and 13-607.AB.3.2D shall meet the mini-

mum performance for that equipment at the specified rating conditions when tested in accordance with the specified test procedure. Omission of minimum performance requirements for equipment not listed in Tables 13-607.AB.3.2A, 13-607.AB.3.2B and 13-607.AB.3.2.D does not preclude use of such equipment. Equipment not listed in Tables 13-607.AB.3.2A, 13-607.AB.3.2B and 13-607.AB.3.2D has no minimum performance requirements. Where multiple rating conditions or performance requirements are provided, the equipment shall satisfy all stated requirements, unless otherwise exempted by footnotes in the table. However, equipment covered under the Federal Energy Policy Act of 1992 (EPACT) shall have no minimum efficiency requirements for operation at minimum capacity or other than standard rating conditions. Equipment used to provide water heating functions as part of a combination system shall satisfy all stated requirements for the appropriate space heating or cooling category.

Tables 13-607.AB.3.2A, 13-607.AB.3.2B and 13-607.AB.3.2D contain the minimum efficiency requirements for equipment covered by this section of the code. The tables are organized to cover the following types of equipment:

Table 13-607.AB.3.2A, Air Conditioners and Condensing Units.

Table 13-607.AB.3.2B, Heat Pumps.

Table 13-607.AB.3.2D, Packaged Terminal and Room Air Conditioners and Heat Pumps.

Exception: Existing mechanical systems undergoing alteration need not meet the minimum equipment efficiencies of this section except to preserve the original approval or listing of the equipment.

Where water chillers and cooling towers are installed in residential buildings complying by this subchater, minimum efficiency ratings shall be as found in Table 13-407.AB.3.2.1C, Tables 13-407.AB.3.2.1G and 13-407.AB.3.2.2H through 13-407.AB.3.2.2J.

13-607.A Prescriptive requirements specific to Method A.

13-607.A.1 Cooling systems. The impact of cooling system efficiency in the energy performance calculation shall be determined for air conditioners based on the appropriate efficiency rating for the system to be installed from the EnergyGauge USA Fla/Res computer program.

13-607.A.2 Additions. Space cooling may be provided by existing or newly installed equipment. Systems in operation before the construction of the addition shall be considered existing systems and shall comply with criteria in Section 13-600.A.5. New systems may be replacements of existing equipment or equipment installed to condition only the addition.

13-607.A.3 Existing equipment. Minimum efficiencies for existing equipment shall be assumed from Tables 13-C4.1.1A and 13-C4.1.1B in Appendix 13-C by the age of the unit unless documentation is available to demonstrate a higher efficiency.

13-607.A.4 Multiple systems. Where two or more systems of the same type are installed with different levels of efficiency serving different parts of the dwelling, a capacity-weighted performance rating shall be used to determine compliance.

13-607.A.5 Installation criteria for homes using the cross ventilation option. The cross ventilation option may be used in the EnergyGauge USA Fla/Res computer program if the criteria in Section 13-C4.1.3 of Appendix 13-C have been met.

13-607.A.6 Installation criteria for homes using the whole house fan option. The whole house fan option may be used in the EnergyGauge USA Fla/Res computer program if the criteria in Section 13-C4.1.4 of Appendix 13-C have been met.

13-607.B Requirements specific to Method B. Houses complying by Method B shall meet the cooling equipment efficiencies in Section 13-607.AB.3.2.

13-607.B.1 Additions. Where cooling equipment is to be installed in an addition, the requirements of Section 13-607.B shall be met only when equipment is installed to specifically serve the addition or is being installed in conjunction with the construction of the addition.

13-607.B.2 Renovations. Minimum efficiencies for cooling equipment to be added or replaced in renovations shall not be less than those specified in Section 13-607.AB.3.2.

13-607.B.3 Manufactured homes and manufactured buildings. Minimum efficiencies for site-installed cooling equipment in manufactured homes shall not be less than those specified in Section 13-607.AB.3.2.

13-607.B.4 Building systems. Newly manufactured cooling systems installed in existing buildings shall meet minimum requirements for that system in Section 13-607.AB (see also Section 13-101.6).

TABLE 13-607.AB.3.2A
ELECTRICALLY OPERATED UNITARY AIR CONDITIONERS AND CONDENSING UNITS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[2]	Test Procedure[1]
Air Conditioners, Air Cooled	<65,000 Btu/h[3]	All	Split System	13.0 SEER	ARI 210/240
			Single Package	13.0 SEER	
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.3 EER	
		All other	Split System and Single Package	10.1 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.7 EER	ARI 340/360
		All other	Split System and Single Package	9.5 EER	
	≥240,000 Btu/h and <760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.5 EER ,9.7 IPLV	
		All other	Split System and Single Package	9.3 EER,9.5 IPLV	
	≥760,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.2 EER, 9.4 IPLV	
		All other	Split System and Single Package	9.0 EER, 9.2 IPLV	
Through-the-Wall, Air Cooled	≤30,000 Btu/h[3]	All	Split System	10.9 SEER	ARI 210/240
			Single Package	10.6 SEER	
Small-Duct High-Velocity, Air Cooled	<65,000 Btu/h[3]	All	Split System or Single Package	11.0 SEER[4]	ARI 210/240
Space Constrained Products, Air Conditioners	<65,000 Btu/h[3]	All	Split System or Single Package	12.0 SEER	ARI 210/240
Air Conditioners, Water and Evaporatively Cooled	<65,000 Btu/h	All	Split System and Single Package	12.1 EER	ARI 210/240
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.5 EER	
		All other	Split System and Single Package	11.3 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER	ARI 340/360
		All other	Split System and Single Package	10.8 EER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	11.0 EER, 10.3 IPLV	
		All other	Split System and Single Package	10.8 EER, 10.1 IPLV	
Condensing Units, Air Cooled	≥135,000 Btu/h			10.1 EER, 11.2 IPLV	ARI 365
Condensing Units, Water or Evaporatively Cooled	≥135,000 Btu/h			13.1 EER,13.1 IPLV	

For SI: 1 Btu/h = .2931 W.

1. Subchapter 13-3 contains a complete specification of the reference test procedure, including the referenced year version of the test procedure.
2. IPLVs are only applicable to equipment with capacity modulation.
3. Single-phase, air-cooled air-conditioners less than 65,000 Btu/h are regulated by NAECA. SEER values are those set by NAECA.
4. As granted by U.S. Department of Energy letter of exception, specific to individual companies. SDHV products without a letter of exception shall have the same efficiency as air-cooled air conditioners.

TABLE 13-607.AB.3.2B
ELECTRICALLY OPERATED UNITARY AND APPLIED HEAT PUMPS – MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum Efficiency[2]	Test Procedure[1]
Air Cooled (Cooling Mode)	<65,000 Btu/h[3]	All	Split System	13.0 SEER	ARI 210/240
			Single Package	13.0 SEER	
	≥65,000 Btu/h and <135,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	10.1 EER	
		All other	Split System and Single Package	9.9 EER	
	≥135,000 Btu/h and <240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.3 EER	ARI 340/360
		All other	Split System and Single Package	9.1 EER	
	≥240,000 Btu/h	Electric Resistance (or None)	Split System and Single Package	9.0 EER 9.2 IPLV	
		All other	Split System and Single Package	8.8 EER 9.0 IPLV	
Through-the-Wall, Air Cooled (Cooling Mode)	≤30,000 Btu/h[3]	All	Split System	10.9 SEER	ARI 210/240
			Single Package	10.6 SEER	
Small-Duct High-Velocity, Air Cooled, Cooling Mode	<65,000 Btu/h[3]	All	Split System	11.0 SEER[4]	ARI 210/240
Water Source (Cooling Mode)	<17,000 Btu/h	All	86ºF Entering Water	11.2 EER	ISO-13256-1
	≥17,000 Btu/h and <135,000 Btu/h	All	86ºF Entering Water	12.0 EER	
Groundwater Source (Cooling Mode)	<135,000 Btu/h	All	59ºF Entering Water	16.2 EER	
Ground Source (Cooling Mode)	<135,000 Btu/h	All	77ºF Entering Water	13.4 EER	
Air Cooled (Heating Mode)	<65,000 Btu/h[3] (Cooling Capacity)		Split System	7.7 HSPF	ARI 210/240
			Single Package	7.7 HSPF	
	≥65,000 Btu/h and <135,000 Btu/h (Cooling Capacity)		47ºF db/43ºF wb Outdoor Air 17ºF db/15ºF wb Outdoor Air	3.2 COP 2.2 COP	
	≥135,000 Btu/h (Cooling Capacity)		47ºF db/43ºF wb Outdoor Air 17ºF db/15ºF wb Outdoor Air	3.1 COP 2.0 COP	ARI 340/360
Through-the-Wall (Air Cooled, Heating Mode)	≤30,000 Btu/h[3] (Cooling Capacity)		Split System	7.1 HSPF	ARI 210/240
			Single Package	7.0 HSPF	
Small-Duct High-Velocity (Air Cooled, Heating Mode)	<65,000 Btu/h[3] (Cooling Capacity)		Split System or Single Package	6.8 HSPF[4]	ARI 210/240
Space Constrained Products, Heat Pumps	<65,000Btu/h[3]		Split System or Single Package	7.4 HSPF	ARI 210/240
Water-Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		68ºF Entering Water	4.2 COP	ISO-13256-1
Groundwater Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		50ºF Entering Water	3.6 COP	
Ground Source (Heating Mode)	<135,000 Btu/h (Cooling Capacity)		32ºF Entering Water	3.1 COP	

For SI: 1 Btu/h = .2931W, °C = [(°F) - 32]/1.8

1. Subchapter 13-3 contains a complete specification of the reference test procedure, including the referenced year version of the test procedure.
2. IPLVs and Part Load rating conditions are only applicable to equipment with capacity modulation.
3. Single-phase, air-cooled heat pumps <65,000 Btu/h are regulated by NAECA. SEER and HSPF values are those set by NAECA.
4. As granted by U.S. Department of Energy letter of exception, specific to individual companies. SDHV products without a letter of exception shall have the same efficiency as air-cooled air-conditioners.

TABLE 13-607.AB.3.2D
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE-PACKAGE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS, AND ROOM AIR CONDITIONERS HEAT PUMPS — MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
PTAC (Cooling Mode), New Construction	7,000 ≥Btu/h <8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 12.5 – (0.213 x Cap/1000)][3]	11.0 EER	ARI 310/380
	8,000 ≤Btu/h < 9,000		10.8 EER	
	9,000 ≤Btu/h < 10,000		10.6 EER	
	10,000 ≤Btu/h < 11,000		10.4 EER	
	11,000 ≤Btu/h < 12,000		10.2 EER	
	12,000 ≤Btu/h < 13,000		9.9 EER	
	13,000 ≤Btu/h < 14,000		9.7 EER	
	14,000 ≤Btu/h < 15,000		9.5 EER	
	>15,000 Btu/h		9.3 EER	
PTAC (Cooling Mode), Replacements[2]	7,000 ≥Btu/h <8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 10.9 – (0.213 x Cap/1000)][3]	9.4 EER	
	8,000 ≤Btu/h < 9,000		9.2 EER	
	9,000 ≤Btu/h < 10,000		9.0 EER	
	10,000 ≤Btu/h < 11,000		8.8 EER	
	11,000 ≤Btu/h < 12,000		8.6 EER	
	12,000 ≤Btu/h < 13,000		8.3 EER	
	13,000 ≤Btu/h < 14,000		8.1 EER	
	14,000 ≤Btu/h < 15,000		7.9 EER	
	>15,000 Btu/h		7.7 EER	
PTHP (Cooling Mode), New Construction	7,000 ≥Btu/h <8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 12.3 – (0.213 x Cap/1000)][3]	10.8 EER	
	8,000 ≤Btu/h < 9,000		10.6 EER	
	9,000 ≤Btu/h < 10,000		10.4 EER	
	10,000 ≤Btu/h < 11,000		10.2 EER	
	11,000 ≤Btu/h < 12,000		10.0 EER	
	12,000 ≤Btu/h < 13,000		9.7 EER	
	13,000 ≤Btu/h < 14,000		9.5 EER	
	14,000 ≤Btu/h < 15,000		9.3 EER	
	>15,000 Btu/h		9.1 EER	
PTHP (Cooling Mode), Replacements[2]	7,000 ≥Btu/h <8,000	95°F db Outdoor Air [Based on capacity at lower range using EER= 10.8 – (0.213 x Cap/1000)][3]	9.3 EER	
	8,000 ≤Btu/h < 9,000		9.1 EER	
	9,000 ≤Btu/h < 10,000		8.9 EER	
	10,000 ≤Btu/h < 11,000		8.7 EER	
	11,000 ≤Btu/h < 12,000		8.5 EER	
	12,000 ≤Btu/h < 13,000		8.2 EER	
	13,000 ≤Btu/h < 14,000		8.0 EER	
	14,000 ≤Btu/h < 15,000		7.8 EER	
	>15,000 Btu/h		7.6 EER	
PTHP (Heating Mode), New Construction	7,000 ≥Btu/h <8,000	47°F db Outdoor Air [Based on capacity at lower range using COP= 3.2 – (0.026 x Cap/1000)][3]	3.02 COP	
	8,000 ≤Btu/h < 9,000		2.99 COP	
	9,000 ≤Btu/h < 10,000		2.97 COP	
	10,000 ≤Btu/h < 11,000		2.94 COP	
	11,000 ≤Btu/h < 12,000		2.91 COP	
	12,000 ≤Btu/h < 13,000		2.89 COP	
	13,000 ≤Btu/h < 14,000		2.86 COP	
	14,000 ≤Btu/h < 15,000		2.84 COP	
	>15,000 Btu/h		2.81 COP	
PTHP (Heating Mode), Replacements[2]	7,000 ≥Btu/h <8,000	47°F db Outdoor Air [Based on capacity at lower range using COP= 2.9 – (0.026 x Cap/1000)][3]	2.72 COP	
	8,000 ≤Btu/h < 9,000		2.69 COP	
	9,000 ≤Btu/h < 10,000		2.67 COP	
	10,000 ≤Btu/h < 11,000		2.64 COP	
	11,000 ≤Btu/h < 12,000		2.61 COP	
	12,000 ≤Btu/h < 13,000		2.59 COP	
	13,000 ≤Btu/h < 14,000		2.56 COP	
	14,000 ≤Btu/h < 15,000		2.54 COP	
	>15,000 Btu/h		2.51 COP	

(continued)

TABLE 13-607.AB.3.2D - continued
ELECTRICALLY OPERATED PACKAGED TERMINAL AIR CONDITIONERS, PACKAGED TERMINAL HEAT PUMPS, SINGLE-PACKAGE VERTICAL AIR CONDITIONERS, SINGLE-PACKAGE VERTICAL HEAT PUMPS, ROOM AIR CONDITIONERS, AND ROOM AIR CONDITIONERS HEAT PUMPS — MINIMUM EFFICIENCY REQUIREMENTS

SPVAC (Cooling Mode)	All Capacities	95°F db/75°F wb Outdoor Air	8.6 EER	ARI 390
SPVHP (Cooling Mode)	All Capacities	95°F db/75°F wb Outdoor Air	8.6 EER	
SPVHP (Heating Mode)	All Capacities	47°F db/43°F wb Outdoor Air	2.7 COP	
Room Air Conditioners with Louvered Sides	8,000 <Btu/h		9.7 EER	ANSI/AH AM RAC-1
	>8,000 <14,000 Btu/h		9.8 EER	
	>14,000 <20,000 Btu/h		9.7 EER	
	>20,000 Btu/h		8.5 EER	
Room Air Conditioners, without Louvered Sides	<8,000 Btu/h		9.0 EER	
	>8,000 Btu/h and <20,000 Btu/h		8.5 EER	
	≥20,,000 Btu/h		8.5 EER	
Room Air Conditioner Heat Pumps with Louvered Sides	<20,000 Btu/h		9.0 EER	
	≥20,000 Btu/h		8.5 EER	
Room Air Conditioner Heat Pumps without Louvered Sides	<14,000 Btu/h		8.5 EER	
	≥14,000 Btu/h		8.0 EER	
Room Air Conditioner, Casement only	All Capacities		8.7 EER	
Room Air Conditioner, Casement-Slider	All Capacities		9.5 EER	

For SI: 1Btu/h = .2931W, °C = [(°F) - 32]/1.8

1. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
2. Replacement units must be factory labeled as follows: "MANUFACTURED FOR REPLACEMENT APPLICATIONS ONLY; NOT TO BE INSTALLED IN NEW CONSTRUCTION PROJECTS." Replacement efficiencies apply only to units with existing sleeves less than 16 inches (406 mm) high and less than 42 inches (1067 mm) wide.
3. Cap means the rated cooling capacity of the product in Btu/h. If the unit's capacity is less than 7,000 Btu/h, use 7,000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation.

SECTION 13-608
SPACE HEATING SYSTEMS

13-608.AB Mandatory requirements for Methods A or B.

13-608.AB.1 Equipment sizing. An HVAC equipment sizing calculation shall be performed on the building in accordance with the criteria in Section 13-607.AB.1 and shall be attached to the Form 1100 submitted when application is made for a building permit. This code does not allow designer safety factors, provisions for future expansion or other factors which affect equipment sizing in excess of the capacity limitations in Sections 13-608.AB.1.1 through 13-608.AB.1.4. System sizing calculations shall not include loads due to intermittent local mechanical ventilation such as standard kitchen and bathroom exhaust systems. The engineered ventilation requirement of this code shall not be used as an infiltration rate when estimating infiltration load.

13-608.AB.1.1 Heat pumps. Heat pump sizing shall be based on the cooling requirements as calculated according to Section 13-607.AB.1 and the heat pump total cooling capacity shall not be more than 1.15 times greater than the design cooling load even if the design heating load is 1.15 times greater than the design cooling load. The published value for ARI total capacity is a nominal, rating-test value and shall not be used for equipment sizing. Manufacturer's expanded performance data shall not be used to determine heat pump cooling capacity. This selection shall be based on the outdoor design dry bulb temperature for the load calculation (or entering water temperature for water-source equipment), the blower CFM provided by the expanded performance data, the design value for entering wet bulb temperature and the design value for entering dry bulb temperature.

The design values for entering wet bulb temperature shall be for the indoor dry bulb and relative humidity used for the load calculation and shall be adjusted for return side gains if the return duct(s) is installed in an unconditioned space.

Capacity at the design heating temperature may be determined by interpolation or extrapolation of manufacturers' performance data, as allowed by the manufacturer, if these data are not available for the design temperature. The auxiliary capacity plus refrigeration cycle heating capacity shall not exceed 120 percent of the calculated heating requirements at the 99-percent design dry bulb temperature.

The manufacturer and model number of the outdoor and indoor units (if split system) shall be submitted along with the sensible and total cooling capacities at the design conditions described herein.

13-608.AB.1.2 Electric resistance furnaces. Electric resistance furnaces shall be sized within 4 kW of the design requirements calculated according to the procedure selected in Section 13-607.AB.1.

13-608.AB.1.3 Fossil fuel heating equipment. The capacity of fossil fuel heating equipment with natural draft atmospheric burners shall not be less than the design load calculated in accordance with Section 13-608.AB.1.

13-608.AB.1.4 Extra capacity required for special occasions. Residences requiring excess heating capacity

on an intermittent basis shall comply with Section 13-607.AB.1.2.

13-608.AB.2 Controls. Requirements specified for controls in Section 13-607.AB.2 shall apply for space heating systems. Lowering thermostat set points to reduce energy consumption of heating systems shall not cause energy to be expended to reach the reduced setting.

13-608.AB.2.1 Heat pump auxiliary heat control. Heat pumps equipped with internal electric-resistance heaters shall have controls that prevent supplemental heater operation when the heating load can be met by the heat pump alone during both steady-state operation and setback recovery. Supplemental heater operation is permitted during outdoor coil defrost cycles. Two means of meeting this requirement are (1) a digital or electronic thermostat designed for heat pump use that energizes auxiliary heat only when the heat pump has insufficient capacity to maintain setpoint or to warm up the space at a sufficient rate, or (2) a multistage space thermostat and an outdoor air thermostat wired to energize auxiliary heat only on the last stage of the space thermostat and when outside air temperature is less than 40°F (4°C).

Exception: Heat pumps whose minimum efficiency is regulated by NAECA and whose HSPF rating both meets the requirements shown in Table 13-607.AB.3.2B and includes all usage of internal electric resistance heating.

13-608.AB.3 Equipment performance standards.

13-608.AB.3.1 Equipment ratings. Equipment efficiency ratings shall be obtained from a nationally recognized certification program directory, from a manufacturer's rating certified to be in compliance with an approved Department of Energy (DOE) or Air-conditioning and Refrigeration Institute (ARI) rating procedure. Equipment efficiencies shall be based on the standard rating conditions contained in the test standard referenced in Subchapter 13-3 that is appropriate for that equipment. Minimum ratings for products covered under the National Appliance Energy Conservation Act of 1987 shall be those determined for Region IV and used for the Federal Trade Commission's required appliance labeling.

13-608.AB.3.1.1 Mix-matched equipment. Ratings for unitary central heat pump systems less than 65,000 Btu/h, using evaporator/(condenser) coils manufactured by independent companies, shall meet all requirements of Section 13-607.AB.3.1.1.

13-608.AB.3.2 Minimum efficiencies for heating equipment. Tables 13-607.AB.3.2B, 13-607.AB.3.2D, and 13-608.AB.3.2E through 13-608.AB.3.2F contain the minimum efficiency requirements for equipment covered by this section of the code. The tables are organized to cover the following types of equipment:

Table 13-607.AB.3.2B, Heat Pumps.

Table 13-607.AB.3.2D, Packaged Terminal Air Conditioners and Heat Pumps.

Table 13-608.AB.3.2E, Furnaces, Duct Furnaces and Unit Heaters.

Table 13-608.AB.3.2F, Gas- and Oil-Fired Boilers.

13-608.AB.3.2.1 Gas- and oil-fired furnaces. Gas-fired and oil-fired forced air furnaces with input ratings >225,000 Btu/h shall also have an intermittent ignition or interrupted device (IID) and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for furnaces where combustion air is drawn from the conditioned space. All furnaces with input ratings >225,000 Btu/h, including electric furnaces, that are not located within the conditioned space shall have jacket losses not exceeding 0.75 percent of the input.

13-608.AB.3.2.2 Central electric furnaces. Central electric furnaces greater than 10 kW shall be divided into at least two stages and controlled by an outdoor thermostat, multistage indoor thermostat, or combinations thereof.

13-608.A Requirements specific to Method A.

13-608.A.1 Heating systems. The impact of heating system efficiency in the energy performance calculation shall be determined for the type of heating system to be installed based on its efficiency rating from the EnergyGauge USA Fla/Res computer program.

13-608.A.2 Additions. Space heating may be provided by existing or newly installed equipment. Systems in operation before the construction of the addition shall be considered existing systems. New systems may be replacements of existing equipment or equipment installed to condition only the addition.

13-608.A.3 Multiple systems. Where two or more systems of the same type are installed with different levels of efficiency serving different parts of the dwelling, a capacity-weighted performance rating shall be used to determine compliance.

13-608.B Requirements specific to Method B. Space heating systems are categorized as electric or gas and oil. Heating equipment shall meet the applicable minimum efficiencies listed on Table 11B-1 of Form 1100B.

13-608.B.1 Electric space heating. Electric resistance heating systems shall not be used when complying by Method B.

13-608.B.2 Gas, oil and instantaneous (tankless) water heaters used for space heating. Gas and oil heating systems may be installed. Gas instantaneous (tankless) water heaters that meet the requirements established for such equipment by this code may be installed.

13-608.B.3 Additions. New heating equipment to be added or replaced in additions complying by Method B shall meet the minimum efficiencies in Section 13-608.AB.3.2. Minimum equipment efficiencies shall be met only when equipment is installed to specifically serve the addition or is being installed in conjunction with the construction of the addition.

TABLE 13-608.AB.3.2E
WARM AIR FURNACES AND COMBINATION WARM AIR FURNACES/AIR-CONDITIONING UNITS, WARM AIR DUCT FURNACES AND UNIT HEATERS. MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type	Size Category	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Warm Air Furnace, Gas-Fired	<225,000 Btu/h		78% AFUE or ;80% E_t[4]	DOE 10 CFR, Part 430 or ANSI Z 21.47
	≥225,000 Btu/h	Maximum Capacity[4]	80% E_c[3]	ANSI Z21.47
Warm Air Furnace, Oil-Fired	<225,000 Btu/h		78% AFUE or ;80% E_t[4]	DOE 10 CFR, Part 430 or UL 727
	≥225,000 Btu/h	Maximum Capacity[5]	81% E_t[6]	UL 727
Warm Air Duct Furnaces, Gas-Fired	All Capacities	Maximum Capacity[5]	80% E_c[7]	ANSI Z83.8
Warm Air Unit Heaters, Gas-Fired	All Capacities	Maximum Capacity[5]	80% E_c[7]	ANSI Z83.8
Warm Air Unit Heaters, Oil-Fired	All Capacities	Maximum Capacity[5]	80% E_c[7]	UL 731

For SI: 1 Btu/h = .2931 W.
1. E_t = thermal efficiency. See test procedure for detailed discussion.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. E_c = combustion efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
4. Combination units not covered by NAECA (three-phase power or cooling capacity greater than or equal to 65,000 Btu/h) may comply with either rating.
5. Minimum and maximum ratings as provided for and allowed by the unit's controls.
6. E_t = thermal efficiency. Units must also include an IID, have jacket losses not exceeding 0.75% of the input rating, and have either power venting or a flue damper. A vent damper is an acceptable alternative to a flue damper for those furnaces where combustion air is drawn from the conditioned space.
7. E_c = combustion efficiency (100% less flue losses). See test procedure for detailed discussion.

TABLE 13-608.AB.3.2F
GAS- AND OIL-FIRED BOILERS MINIMUM EFFICIENCY REQUIREMENTS

Equipment Type[4]	Size Category (Input)	Subcategory or Rating Condition	Minimum Efficiency[1]	Test Procedure[2]
Boilers, Gas-Fired	<300,000 Btu/h	Hot water	80% AFUE	DOE 10 CFR Part 430
		Steam	75% AFUE	
	≥300,000 Btu/h and <2,500,000	Maximum Capacity[3]	75% E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	80% E_c	
	>2,500,000 Btu/h[4]	Steam	80% E_c	
Boilers, Oil-Fired	<300,000 Btu/h		80% AFUE	DOE 10 CFR Part 430
	≥300,000 Btu/h and ≤250,000,000 Btu/h	Maximum Capacity[3]	78% E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	83% E_c	
	>2,500,000 Btu/h[4]	Steam	83% E_c	
Oil-Fired (Residual)	≥300,000 Btu/h and ≤250,000,000 Btu/h	Maximum Capacity[3]	78% E_t[1]	H.I. Htg Boiler Std.
	>2,500,000 Btu/h[4]	Hot Water	83% E_c	
	>2,500,000 Btu/h[4]	Steam	83% E_c	

For SI: 1 Btu/h = .2931 W.
1. E_t = thermal efficiency. See reference documents for detailed information.
2. Subchapter 13-3 contains a complete specification of the referenced test procedure, including the referenced year version of the test procedure.
3. Minimum and maximum ratings as provided for and allowed by the unit's controls.
4. These requirements apply to boilers with rated input of 8,000,000 Btu/h or less that are not packaged boilers, and to all package boilers. Minimum efficiency requirements for boilers cover all capacities of packaged boilers.

13-608.B.4 Renovations. Minimum efficiencies for heating equipment to be added or replaced in renovations shall not be less than those specified in Section 13-608.AB.3.2.

13-608.B.5 Manufactured homes and manufactured buildings. Minimum efficiencies for site-installed heating equipment in manufactured homes shall not be less than those specified in Section 13-608.AB.3.2.

13-608.B.6 Building systems. Newly manufactured heating systems installed in existing buildings shall meet the minimum requirements for that system in Section 13-608.AB (see Section 13-101.6 for exceptions).

SECTION 13-609
VENTILATION SYSTEMS

13-609.AB Mandatory requirements for Methods A or B.

13-609.AB.1 Buildings operated at positive indoor pressure. Residential buildings designed to be operated at a positive indoor pressure or for mechanical ventilation shall meet the following criteria:

1. The design air change per hour minimums for residential buildings in ASHRAE 62, *Ventilation for Acceptable Indoor Air Quality*, shall be the maximum rates allowed for residential applications.
2. No ventilation or air-conditioning system make-up air shall be provided to conditioned space from attics, crawl spaces, attached enclosed garages or outdoor spaces adjacent to swimming pools or spas.
3. If ventilation air is drawn from enclosed space(s), then the walls of the space(s) from which air is drawn shall be insulated to a minimum of R-11 and the ceiling shall be insulated to a minimum of R-19, space permitting, or R-10 otherwise.

SECTION 13-610
AIR DISTRIBUTION SYSTEMS

13-610.AB Mandatory requirements for Methods A or B.

13-610.AB.1 Air distribution system sizing and design. All air distribution systems shall be sized and designed in accordance with recognized engineering standards such as ACCA Manual D or other standards based on the following:

1. Calculation of the supply air for each room shall be based on the greater of the heating load or sensible cooling load for that room.
2. Duct size shall be determined by the supply air requirements of each room, the available static pressure and the total equivalent length of the various duct runs.
3. Friction loss data shall correspond to the type of material used in duct construction.

13-610.AB.2 Air distribution system insulation requirements. All air distribution system components which move or contain conditioned air, including but not limited to, air filter enclosures, air ducts and plenums located in or on buildings shall be thermally insulated in accordance with the requirements of Sections 13-610.AB.2.1 through 13-610.AB.2.3.

13-610.AB.2.1 Insulation required. The minimum installed thermal resistance (*R*-value) for air distribution system components shall be as specified in Table 13-610.AB.2.1.

Exception: Air distribution system component insulation (except where required to prevent condensation) is not required in the following cases:

1. Within conditioned space.
2. Exhaust air ducts.
3. Factory-installed plenums, casings, or ductwork furnished as a part of HVAC equipment tested and rated in accordance with Section 13-607.AB.3 or 13-608.AB.3.

TABLE 13-610.AB.2.1
MINIMUM INSULATION LEVELS
AIR DISTRIBUTION SYSTEM COMPONENTS[1]

Location	*R*-Value
On roof	R-6
Exterior of building	R-6
Attic with ceiling insulation	R-6
Between conditioned floors[2]	R-4.2
Enclosed attached garages	R-4.2
Unconditioned basement	R-4.2
Vented crawlspace	R-4.2

1. See Section 13-610.AB.3.5, Air-handling units.
2. Except where perimeter walls to the between floor space are insulated.

13-610.AB.2.2 *R*-value determination. All duct insulation and factory-made ducts shall be labeled with *R*-values based on flat sections of insulation only at installed thickness and excluding any air film resistance. The thermal resistance (R) shall be determined using the relationship $R = t/k$ where t (inches) is the installed thickness and k (Btu-in/hr·ft²°F) is the measured apparent thermal conductivity at 75°F (24°C) mean temperature and at installed thickness tested in accordance with ASTM C 518 or ASTM C 177.

The installed thickness of duct insulation used to calculate *R*-values shall be determined as follows:

1. Duct board, duct liner and factory-made rigid ducts not normally subjected to compression shall use the nominal insulation thickness.
2. Duct wrap shall have an assumed installed thickness of 75 percent of nominal thickness (25-percent compression).
3. Factory-made flexible air ducts shall have the installed thickness and calculated *R*-values determined in accordance with Paragraph 3.4 of the ADC Standard, *Flexible Duct Performance & Installation Standards.*

13-610.AB.2.3 Condensation control. Additional insulation with vapor barrier shall be provided where the minimum duct insulation requirements of Section

13-610.AB.2 are determined to be insufficient to prevent condensation.

13-610.AB.2.4 Fibrous glass duct liner. Fibrous glass duct liner shall be fabricated and installed in accordance with the provisions of the NAIMA *Fibrous Glass Duct Liner Standard.*

13-610.AB.3 Air distribution system construction and installation. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability. All transverse joints, longitudinal seams and fitting connections shall be securely fastened and sealed in accordance with the applicable standards of this section.

13-610.AB.3.0 General. All enclosures which form the primary air containment passageways for air distribution systems shall be considered ducts or plenum chambers and shall be constructed and sealed in accordance with the applicable criteria of this section.

13-610.AB.3.0.1 Mechanical fastening. All joints between sections of air ducts and plenums, between intermediate and terminal fittings and other components of air distribution systems, and between subsections of these components shall be mechanically fastened to secure the sections independently of the closure system(s).

13-610.AB.3.0.2 Sealing. Air distribution system components shall be sealed with approved closure systems.

13-610.AB.3.0.3 Space provided. Sufficient space shall be provided adjacent to all mechanical components located in or forming a part of the air distribution system to assure adequate access for: (1) construction and sealing in accordance with the requirements of Section 13-610.AB.3 of this code; (2) inspection; and (3) cleaning and maintenance. A minimum of 4 inches (102 mm) is considered sufficient space around air-handling units.

Exception: Retrofit or replacement units not part of a renovation are exempt from the minimum clearance requirement.

13-610.AB.3.0.4 Product application. Closure products shall be applied to the air barriers of air distribution system components being joined in order to form a continuous barrier or they may be applied in accordance with the manufacturer's instructions or appropriate industry installation standard where more restrictive.

13-610.AB.3.0.5 Surface preparation. The surfaces upon which closure products are to be applied shall be clean and dry in accordance with the manufacturer's installation instructions.

13-610.AB.3.0.6 Approved mechanical attachments. Approved mechanical attachments for air distribution system components include screws, rivets, welds, interlocking joints crimped and rolled, staples, twist in (screw attachment), and compression systems created by bend tabs or screw tabs and flanges or by clinching straps. Mechanical attachments shall be selected to be appropriate to the duct system type.

13-610.AB.3.0.7 Approved closure systems. The following closure systems and materials are approved for air distribution construction and sealing for the applications and pressure classes prescribed in Sections 13-610.AB.3.1 through 13-610.AB.3.8:

1. Metal closures.
   a. Welds applied continuously along metal seams or joints through which air could leak.
   b. Snaplock seams, and grooved, standing, double-corner, single-corner and Pittsburgh-lock seams, as defined by SMACNA, as well as all other rolled mechanical seams. All seams shall be rolled or crimped
2. Gasketing, which achieves a 25/50 flame spread/smoke- density-development rating under ASTM E 84 or UL 723, provided that it is used only between mated surfaces which are mechanically fastened with sufficient force to compress the gasket and to fill all voids and cracks through which air leakage would otherwise occur.
3. Mastic closures. Mastics shall be placed over the entire joint between mated surfaces. Mastics shall not be diluted. Approved mastics include the following:
   a. Mastic or mastic-plus-embedded fabric systems applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part III.
   b. Mastic or mastic-plus-embedded fabric systems applied to nonmetal flexible duct that are listed and labeled in accordance with UL 181B, Part II.
   c. Mastic ribbons, which achieve a 25/50 flame spread/smoke density development rating under ASTM E 84 or UL 723, provided that they may be used only in flange-joints and lap-joints, such that the mastic resides between two parallel surfaces of the air barrier and that those surfaces are mechanically fastened.
4. Tapes. Tapes shall be applied such that they extend not less than 1 inch onto each of the mated surfaces and shall totally cover the joint. When used on rectangular ducts, tapes shall be used only on joints between parallel rigid surfaces and on right angle joints. Approved tapes include the following:
   a. Pressure-sensitive tapes.
      1) Pressure-sensitive tapes applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part I.
      2) Pressure-sensitive tapes applied to nonmetal flexible duct that are listed and la-

beled in accordance with UL 181B, Part I.

b. Heat-activated tapes applied to fibrous glass ductboard that are listed and labeled in accordance with UL 181A, Part II.

5. Aerosol sealant. Such sealants shall be installed by manufacturer-certified installers following manufacturer instructions and shall achieve 25/50 flame spread/smoke-density-development ratings under ASTM E 84 or UL 723.

13-610.AB.3.1 Metal duct, rigid and flexible. All transverse joints, longitudinal seams and duct wall penetration of ducts and joints with other air distribution system components shall be mechanically attached and sealed using approved closure systems for that pressure class specified in Section 13-610.AB.3.1.1 or Section 13-610.AB.3.1.2.

13-610.AB.3.1.1 Pressures less than 1-inch water gauge, approved closure systems. The following closure systems are approved for rigid metal duct designed to be operated at pressures less than 1-inch w.g. when they conform to the approved closure and mechanical attachment requirements of Section 13-610.AB.3.0:

1. Continuous welds.
2. Snaplock seams, and grooved, standing, double-corner, single-corner and Pittsburgh-lock seams and all other rolled mechanical seams.
3. Mastic, mastic-plus-embedded fabric, or mastic ribbons.
4. Gaskets.
5. Pressure-sensitive tape.

13-610.AB.3.1.2 Pressures 1-inch water gauge or greater, approved closure systems. The following closure systems are approved for rigid metal duct designed to be operated at pressures 1-inch w.g. or greater and flexible duct when they conform to the approved closure and mechanical attachment requirements of Section 13-610.AB.3.0:

1. Continuous welds.
2. Mastic or mastic-plus-embedded fabric systems.
3. Gaskets.

13-610.AB.3.1.3 High pressure duct systems. High pressure duct systems designed to operate at pressures greater than 3-inch water gauge (4-inch water gauge pressure class), shall be tested in accordance with the SMACNA *HVAC Air Duct Leakage Test Manual*. The tested duct leakage class, at a test pressure equal to the design duct pressure class rating, shall be equal to or less than Leakage Class 6. Leakage testing may be limited to representative sections of the duct system but in no case shall such tested sections include less than 25 percent of the total installed duct area for the designated pressure class.

13-610.AB.3.2 Fibrous glass duct, rigid. All rigid fibrous glass ducts and plenums shall be constructed and erected in accordance with the provisions of the NAIMA *Fibrous Glass Duct Construction Standards*.

All joints, seams and duct wall penetrations including, but not limited to, the joints between sections of duct and between duct and other distribution system components shall be mechanically attached and sealed using approved closure systems as specified in Section 13-610.AB.3.2.1.

13-610.AB.3.2.1 Approved closure systems. The following closure systems are approved for rigid fibrous glass ducts when they conform to the approved closure and mechanical attachment requirements of Section 13-610.AB.3.0:

1. Heat-activated tapes.
2. Pressure-sensitive tapes.
3. Mastics or mastic-plus-embedded fabric systems.

13-610.AB.3.2.2 Mechanical fastening. Attachments of ductwork to air-handling equipment shall be by mechanical fasteners. Where access is limited, two fasteners on one side shall be acceptable when installed in accordance with Section 13-610.AB.3.0.6.

13-610.AB.3.3 Flexible duct systems, nonmetal. Flexible nonmetal ducts shall be joined to all other air distribution system components by either terminal or intermediate fittings. All duct collar fittings shall have a minimum $^{5}/_{8}$ inch (16 mm) integral flange for sealing to other components and a minimum 3-inch (76 mm) shaft for insertion into the inner duct core.

Flexible ducts having porous inner cores shall not be used.

Exception: Ducts having a nonporous liner between the porous inner core and the outer jacket. Fastening and sealing requirements shall be applied to such intermediate liners.

All joints of flexible ducts to fittings and fittings to other air distribution system components shall be mechanically attached and sealed as specified in Sections 13-610.AB.3.3.1 through 13-610.AB.3.3.6.

13-610.AB.3.3.1 Duct core to duct fitting, mechanical attachment. The reinforced core shall be mechanically attached to the duct fitting by a drawband installed directly over the wire-reinforced core and the duct fitting. The duct fitting shall extend a minimum of 2 inches (51 mm) into each section of duct core. When the flexible duct is larger than 12 inches (303 mm) in diameter or the design pressure exceeds 1-inch water gauge, the drawband shall be secured by a raised bead or indented groove on the fitting.

13-610.AB.3.3.2 Duct core to duct fitting, approved closure systems. The reinforced lining shall be sealed to the duct fitting using one of the following sealing materials which conforms to the approved

closure and mechanical attachment requirements of Section 13-610.AB.3.0:

1. Gasketing.
2. Mastic, mastic-plus-embedded fabric, or mastic ribbons.
3. Pressure-sensitive tape.
4. Aerosol sealants, provided that their use is consistent with UL 181.

13-610.AB.3.3.3 Duct outer jacket to duct collar fitting. The outer jacket of a flexible duct section shall be secured at the juncture of the air distribution system component and intermediate or terminal fitting in such a way as to prevent excess condensation. The outer jacket of a flexible duct section shall not be interposed between the flange of the duct fitting and the flexible duct, rigid fibrous glass duct board, or sheet metal to which it is mated.

13-610.AB.3.3.4 Duct collar fitting to rigid duct, mechanical attachment. The duct collar fitting shall be mechanically attached to the rigid duct board or sheet metal by appropriate mechanical fasteners, either screws, spin-in flanges, or dovetail flanges.

13-610.AB.3.3.5 Duct collar fitting to rigid duct, approved closure systems. The duct collar fitting's integral flange shall be sealed to the rigid duct board or sheet metal using one of the following closure systems/materials which conforms to the approved closure and mechanical attachment standards of Section 13-610.AB.3.0:

1. Gasketing.
2. Mastic or mastic-plus-embedded fabric systems.
3. Mastic ribbons when used to attach a duct collar to sheet metal.
4. Pressure-sensitive tape.
5. Aerosol sealants, provided that their use is consistent with UL 181.

13-610.AB.3.3.6 Flexible duct installation and support. Flexible ducts shall be configured and supported so as to prevent the use of excess duct material, prevent duct dislocation or damage, and prevent constriction of the duct below the rated duct diameter in accordance with the following requirements:

1. Ducts shall be installed fully extended. The total extended length of duct material shall not exceed 5 percent of the minimum required length for that run.
2. Bends shall maintain a center line radius of not less than one duct diameter.
3. Terminal devices shall be supported independently of the flexible duct.
4. Horizontal duct shall be supported at intervals not greater than 5 feet (1524 mm). Duct sag between supports shall not exceed $^1/_2$ inch (12.7 mm) per foot of length. Supports shall be provided within $1^1/_2$ feet (38 mm) of intermediate fittings and between intermediate fittings and bends. Ceiling joists and rigid duct or equipment may be considered to be supports.
5. Vertical duct shall be stabilized with support straps at intervals not greater than 6 feet (1829 mm).
6. Hangers, saddles and other supports shall meet the duct manufacturer's recommendations and shall be of sufficient width to prevent restriction of the internal duct diameter. In no case shall the material supporting flexible duct that is in direct contact with it be less than $1^1/_2$ inches (38 mm) wide.

13-610.AB.3.4 Terminal and intermediate fittings. All seams and joints in terminal and intermediate fittings, between fitting subsections and between fittings and other air distribution system components or building components shall be mechanically attached and sealed as specified in Section 13-610.AB.3.4.1 or 13-610.AB.3.4.2.

13-610.AB.3.4.1 Fittings and joints between dissimilar duct types, approved closure systems. Approved closure systems shall be as designated by air distribution system component material type in Section 13-610.AB.3.

Exception: When the components of a joint are fibrous glass duct board and metal duct, including collar fittings and metal equipment housings, the closure systems approved for fibrous glass duct shall be used.

13-610.AB.3.4.2 Terminal fittings and air ducts to building envelope components, approved closure systems. Terminal fittings and air ducts which penetrate the building envelope shall be mechanically attached to the structure and sealed to the envelope component penetrated and shall use one of the following closure systems/materials which conform to the approved closure and mechanical application requirements of Section 13-610.AB.3.0:

1. Mastics or mastic-plus-embedded fabrics.
2. Gaskets used in terminal fitting/grille assemblies which compress the gasket material between the fitting and the wall, ceiling or floor sheathing.

13-610.AB.3.5 Air-handling units. All air-handling units shall be mechanically attached to other air distribution system components. Air-handling units located outside the conditioned space shall be sealed using approved closure systems conforming to the approved closure and mechanical application requirements of Section 13-610.AB.3.1.

13-610.AB.3.5.1 Approved closure systems. Systems conforming to the product and application standards of Section 13-610.AB.3.0 may be used when sealing air-handling units.

13-610.AB.3.5.2 Air-handling units. Air-handling units shall be allowed in attics if the following conditions are met:

1. The service panel of the equipment is located within 6 feet (1829 mm) of an attic access.
2. A device is installed to alert the owner or shut the unit down when the condensation drain is not working properly.
3. The attic access opening is of sufficient size to replace the air handler.
4. A notice is posted on the electric service panel indicating to the homeowner that the air handler is located in the attic. Said notice shall be in all capitals, in 16 point type, with the title and first paragraph in bold:

NOTICE TO HOMEOWNER

A PART OF YOUR AIR-CONDITIONING SYSTEM, THE AIR HANDLER, IS LOCATED IN THE ATTIC. FOR PROPER, EFFICIENT, AND ECONOMIC OPERATION OF THE AIR-CONDITIONING SYSTEM, YOU MUST ENSURE THAT REGULAR MAINTENANCE IS PERFORMED.

YOUR AIR-CONDITIONING SYSTEM IS EQUIPPED WITH ONE OR BOTH OF THE FOLLOWING: (1) A DEVICE THAT WILL ALERT YOU WHEN THE CONDENSATION DRAIN IS NOT WORKING PROPERLY OR (2) A DEVICE THAT WILL SHUT THE SYSTEM DOWN WHEN THE CONDENSATION DRAIN IS NOT WORKING. TO LIMIT POTENTIAL DAMAGE TO YOUR HOME, AND TO AVOID DISRUPTION OF SERVICE, IT IS RECOMMENDED THAT YOU ENSURE PROPER WORKING ORDER OF THESE DEVICES BEFORE EACH SEASON OF PEAK OPERATION.

13-610.AB.3.6 Cavities of the building structure. Cavities in framed spaces, such as dropped soffits and walls, shall not be used to deliver air from or return air to the conditioning system unless they contain an air duct insert which is insulated in accordance with Section 13-610.AB.2 and constructed and sealed in accordance with the requirements of Section 13-610.AB.3 appropriate for the duct materials used.

Exception: Return air plenums.

13-610.AB.3.6.1 Cavities designed for air transport such as mechanical closets, chases, air shafts, etc. shall be lined with an air barrier and sealed in accordance with Section 13-610.AB.3.7 and shall be insulated in accordance with Section 13-610.AB.2.

13-610.AB.3.6.2 Building cavities which will be used as return air plenums shall be lined with a continuous air barrier made of durable nonporous materials. All penetrations to the air barrier shall be sealed with a suitable long-life mastic material.

Exception: Surfaces between the plenum and conditioned spaces from which the return/mixed air is drawn.

13-610.AB.3.6.3 Building cavities beneath a roof deck that will be used as return air plenums shall have an insulated roof with the insulation having an *R*-value of at least *R*-19.

13-610.AB.3.7 Mechanical closets. The interior surfaces of mechanical closets shall be sheathed with a continuous air barrier as specified in Section 13-610.AB.3.7.1 and shall be sealed with approved closure systems as specified in Section 13-610.AB.3.7.2. All joints shall be sealed between air barrier segments and between the air barriers of walls and those of the ceiling, floor and door framing. All penetrations of the air barrier including, but not limited to, those by air ducts, plenums, pipes, service lines, refrigerant lines, electrical wiring, and condensate drain lines shall be sealed to the air barrier with approved closure systems.

Exception: Air passageways into the closet from conditioned space that are specifically designed for return air flow.

Through-wall, through-floor and through-ceiling air passageways into the closet shall be framed and sealed to form an air-tight passageway using approved air duct materials and approved closure systems.

Duct penetrations through any part of the ceiling, walls or floor of a mechanical closet shall have sufficient space between surrounding ceiling, walls or floor and any duct or plenum penetration to allow for sealing of the penetration and inspection of the seal.

Clothes washers, clothes dryers, combustion water heaters and atmospheric combustion furnaces shall not be located in mechanical closets used as return air plenums.

13-610.AB.3.7.1 Approved air barriers. The following air barriers are approved for use in mechanical closets:

1. One-half-inch-thick (12.7 mm) or greater gypsum wallboard, taped and sealed.
2. Other panelized materials having inward facing surfaces with an air porosity no greater than that of a duct product meeting Section 22 of UL 181 which are sealed on all interior surfaces to create a continuous air barrier.

13-610.AB.3.7.2 Approved closure systems. The following closure systems are approved for use in mechanical closets:

1. Gypsum wallboard joint compound over taped joints between gypsum wallboard panels.
2. Sealants complying with the product and application standards of Section 13-610.AB.3.2.1 for fibrous glass ductboard.
3. A suitable long-life caulk or mastic compliant with the locally adopted mechanical code for all applications.

13-610.AB.3.8 Enclosed support platforms. Enclosed support platforms located between the return air inlet(s) from conditioned space and the inlet of the air-handling

unit or furnace, shall contain a duct section constructed entirely of rigid metal, rigid fibrous glass duct board, or flexible duct which is constructed and sealed according to the respective requirements of Section 13-610.AB.3. and insulated according to the requirements of Section 13-610.AB.2.

The duct section shall be designed and constructed so that no portion of the building structure, including adjoining walls, floors and ceilings, shall be in contact with the return air stream or function as a component of this duct section.

The duct section shall not be penetrated by a refrigerant line chase, refrigerant line, wiring, pipe or any object other than a component of the air distribution system.

Through-wall, through-floor and through-ceiling penetrations into the duct section shall contain a branch duct which is fabricated of rigid fibrous glass duct board or rigid metal and which extends to and is sealed to both the duct section and the grille side wall surface. The branch duct shall be fabricated and attached to the duct insert in accordance with Section 13-610.AB.3.2 or Section 13-610.AB.3.1, respective to the duct type used.

13-610.A Requirements specific to Method A.

13-610.A.1 Duct types. Duct systems shall include both supply and return air sections and shall be described in sufficient detail to allow the building official to determine code compliance. The impact of air distribution system efficiency in the energy performance calculation shall be determined from the EnergyGauge USA Fla/Res computer program in accordance with Section 13-613 of this code.

13-610.A.2 Installation criteria for homes claiming the tested duct option. The tested duct option may be claimed in the EnergyGauge USA Fla/Res computer program where the air distribution system is tested in accordance with ASHRAE 152, in which case measured duct air leakage values shall be used. Tested duct leakage shall be determined and documented by a Certified Class 1 Florida Rater.

13-610.A.3 Installation criteria for homes claiming the factory-sealed air-handling unit option. The factory-sealed air-handling unit option may be claimed in the EnergyGauge USA Fla/Res computer program if the unit has been tested and certified by the manufacturer to have achieved a 2 percent or less leakage rate at 1-inch water gauge when all air inlets, air outlets and condensate drain port(s), when present, are sealed at an air pressure of 1-inch water gauge with no greater than 2 percent design cubic foot per minute discharge.

13-610.B Requirements specific to Method B.

13-610.B.1 Ducts installed. All ducts shall be insulated to at least the level required by Table 11B-1 on Form 1100B. All ducts and air handlers shall be either located in conditioned space or tested by a Class 1 BERS rater to be leak free according to the criteria in Section 13-610.A.2 of the *Florida Building Code, Building*.

13-610.B.2 Additions. New ducts that are installed to serve an addition shall either be insulated to *R*-6 or be installed in conditioned space as designated on Form 1100B.

Exception: Only new or replacement ducts installed as part of the addition shall meet this requirement.

13-610.B.3 Renovations. Replacement duct systems that are not in conditioned space shall be insulated to levels specified in Section 13-610.B.2.

Exception: Only new or replacement ducts installed as part of the renovation shall meet this requirement.

13-610.B.4 Manufactured homes and manufactured buildings. Site-installed components and features of the air distribution system(s) of manufactured homes shall be insulated, constructed, sealed and supported in accordance with the requirements of Sections 13-610.AB.2 and 13-610.AB.3. The duct connection between the air distribution systems of separate units of multiple unit manufactured homes and buildings shall be installed, sealed and inspected according to the provisions of this code.

Manufactured homes and buildings having interior furnaces and site-installed single package air conditioners which share the same supply registers shall have an automatic backflow damper installed between the air conditioning unit and the factory-installed duct to prevent the functioning of return grilles as supply registers and to prevent the forced passage of conditioned air through inactive air handlers when another system is in operation.

13-610.B.5 Building systems. Newly manufactured air distribution system components installed in existing buildings shall meet the minimum requirements for air distribution systems contained in Sections 13-610.AB.2 through 13-610.AB.3.8, as appropriate. See Section 13-101.6 for exceptions.

SECTION 13-611
PIPING

13-611.AB Mandatory requirements for Methods A or B.

13-611.AB.1 Piping insulation. All piping installed to service buildings and within buildings, including the vapor line of HVAC refrigerant piping, shall be thermally insulated in accordance with Table 13-611.AB.1, except as stated herein (for service water heating systems, see Section 13-612.AB.5).

Exceptions: Piping insulation is not required in the following cases:

1. Piping installed within HVAC equipment.
2. Piping containing fluid at temperatures between 55°F and 120°F (13°C to 49°C).
3. Piping within the conditioned space.
4. Piping within basements or unvented crawl spaces (plenums) having insulated walls.

13-611.AB.1.1 Other insulation thicknesses. Insulation thickness in Table 13-611.AB.1 are based on insulation having thermal resistance in the range of 4.0 to

TABLE 13-611.AB.1
MINIMUM PIPE INSULATION

Piping System Types	Fluid Temperature Range°F	Runouts[2] (inches)	Insulation for Pipe < 1"	Thickness Sizes[1] 1.25 - 2"
HEATING SYSTEMS				
Steam and hot water				
Low pressure/temp.	201 - 250	1.0	1.5	1.5
Low temperature	120 - 200	0.5	1.0	1.0
Steam condensate (for feed water)	Any	1.0	1.0	1.5
COOLING SYSTEMS	40 - 55	0.5	0.5	0.75
Chilled water, refrigerant or brine	Below 40	1.0	1.0	1.50

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8

1. For piping larger than 1 inch diameter and exposed to outdoor ambient temperatures, increase thickness by 0.5 inch.
2. Runouts to individual thermal units (not exceeding 12 feet in length).
3. The required minimum thicknesses do not consider water vapor transmission and condensation. Additional insulation, vapor retarders, or both, may be required to limit water vapor transmission and condensation.

4.6°F·ft²·h/Btu· per inch of thickness on a flat surface at a mean temperature of 75°F (24°C).

Minimum insulation thickness shall be increased for materials having *R*-values less than 4.0°F·ft²·h/Btu·in. or may be reduced for materials having *R*-values greater than 4.6°F·ft²·h/Btu·in. as follows:

1. For materials with thermal resistivity greater than *R*-4.6, the minimum insulation thickness may be reduced as follows:

   New minimum thickness =

$$\frac{4.6 \times \text{Table } 13-611.AB.1 \text{ Thickness}}{\text{Actual Resistivity}}$$

2. For material with thermal resistivity less than R-4.0, the minimum insulation thickness shall be increased as follows:

   New minimum thickness =

$$\frac{4.0 \times \text{Table } 13-611.AB.1 \text{ Thickness}}{\text{Actual Resistivity}}$$

SECTION 13-612
WATER HEATING SYSTEMS

13-612.AB Mandatory requirements for Methods A or B.

13-612.AB.1 Sizing. Reserved.

13-612.AB.2 Controls.

13-612.AB.2.1 Storage water heater temperature controls.

13-612.AB.2.1.1 Automatic controls. Service water heating systems shall be equipped with automatic temperature controls capable of adjustment from the lowest to the highest acceptable temperature settings for the intended use. The minimum temperature setting range shall be from 100°F to 140°F (38°C to 60°C).

13-612.AB.2.1.2 Shut down. A separate switch or a clearly marked circuit breaker shall be provided to permit the power supplied to electric service systems to be turned off. a separate valve shall be provided to permit the energy supplied to the main burner(s) of combustion types of service water heating systems to be turned off.

13-612.AB.2.2 Heat traps. Storage water heaters not equipped with integral heat traps and having vertical pipe risers shall have heat traps installed on both the inlets and outlets. External heat traps shall consist of either a commercially available heat trap or a downward and upward bend of at least 3 $^1/_2$ inches (89 mm) in the hot water distribution line and cold water line located as close as possible to the storage tank.

13-612.AB.2.3 Swimming pool and spa temperature controls.

13-612.AB.2.3.1 On-off switch required. All pool and spa heaters shall be equipped with an on-off switch mounted for easy access to allow the heater to be shut off without adjusting the thermostat setting and to allow restarting without relighting the pilot light.

13-612.AB.2.3.2 Covers required. Spas and heated swimming pools shall be equipped with a cover designed to minimize heat loss.

Exception: Outdoor pools deriving over 70 percent of the energy for heating from nondepletable on site-recovered sources computed over an operating season are exempt from this requirement.

13-612.AB.2.3.3 Time clocks on private pools. Time clocks shall be installed on private pools so that the pump can be set to run during off-peak electric demand periods and can be set for the minimum time necessary to maintain the water in a clear and sanitary condition in keeping with applicable health standards.

Exceptions: Pumps connected to swimming pool solar water heating systems or any pool legally considered a public pool.

13-612.AB.2.3.4 Pool heater efficiency. All gas- and oil-fired pool heaters when tested in accordance with ANSI Z 21.56 shall have a minimum thermal efficiency of 78 percent.

Heat pump pool heaters shall be tested in accordance with ARI 1160, Table 2. Standard Rating Conditions-Low Air Temperature, and shall have a minimum COP of 4.0. Test reports from independent laboratories are required to verify procedure compliance.

13-612.AB.2.4 Showers. Showers used for other than safety reasons shall be equipped with flow control devices to limit the water discharge to a maximum of 2.50 gpm (.16 L/S) per shower head at a distribution pressure of 80 psig (552 kPa) when tested in accordance with the procedures of ANSI A112.18.1M. Flow-restricting inserts used as a component part of a showerhead shall be mechanically retained at the point of manufacture.

13-612.AB.3 Equipment performance standards.

13-612.AB.3.1 Electric water heater efficiencies.

13-612.AB.3.1.1 Storage capacities of 120 gallons or less. All automatic electric storage water heaters having a storage capacity of 120 gallons (454 L) or less and an input rating of 12 kw or less shall, when tested in accordance with the DOE Uniform Test Method for Measuring the Energy Consumption of Water Heaters, Appendix E to Subpart B, 10 CFR Part 430, meet the performance minimums listed in Table 13-612.AB.3.

13-612.AB.3.1.2 Storage capacities greater than 120 gallons. Performance minimums for electric storage water heaters with capacities greater than 120 gallons (454 L) or an input rate greater than 12 kw shall have a standby loss of $.30+27/V_T$ percent/hour or less, where V_T is the tested storage volume in gallons and tested in accordance with ANSI test method Z21.10.3.

13-612.AB.3.2 Gas- and oil-fired water heater efficiencies.

13-612.AB.3.2.1 Tanks with input ratings of 75,000 Btu/h or less (Gas) or 105,000 Btu/h or less (oil). All gas- and oil-fired automatic storage water heaters with capacities of 100 gallons or less and an input rating of 75,000 Btu/h or less (gas) or 105,000 Btu/h or less (oil) shall, when tested in accordance with the DOE Uniform Test Method for Measuring the Energy Consumption of Water Heaters, Appendix E to Subpart B, 10 CFR Part 430, meet the performance minimums listed in Table 13-612.AB.3.

13-612.AB.3.2.2 Tanks with input ratings greater than 75,000 Btu/h (gas) or greater than 105,000 Btu/h (oil). All gas-fired storage water heaters with input ratings greater than 75,000 Btu/h but less than or equal to 155,000 Btu/h, and all oil-fired storage water heaters with input ratings greater than 105,000 Btu/h but less than or equal to 155,000 Btu/h, shall have a steady-state combustion efficiency E_t of .78 or less and a standby loss of $1.30+114/V_T$ (in percent/hour) or less, where V_T is the tested storage volume in gallons. All gas- and oil-fired storage water heaters with input ratings greater than 155,000 Btu/h shall have a steady-state combustion efficiency E_t of .78 or more and a standby loss of $1.30+95/V_T$, where V_T is the tested storage volume in gallons.

13-612.AB.3.2.3 Gas instantaneous or tankless water heaters. All gas-fired instantaneous (tankless) water heaters that a) initiate heating based on sensing water flow; b) are designed to deliver water at a controlled temperature of less than 180 °F (82 °C); c) have an input less than 200,000 Btu/h (210 MJ/h); d) have a manufacturer's specified storage capacity of less than 2 gallons (7.6 L), and, e) have either a fixed or variable burner input shall, when tested in accordance with the DOE Uniform Test Method for Measuring the Energy Consumption of Water Heaters, Appendix E to Subpart B, Title 10 CFR 430, meet the performance minimums established in Title 10 CFR 430.32, Energy and Water Conservation Standards and Effective Dates.

13-612.AB.3.3 Unfired storage tanks. All unfired storage tanks shall have a standby loss of 6.5 Btu/h/ft^2 or less, based on an 80°F (27°C) water-air temperature difference.

13-612.AB.3.4 Solar water heating systems. Solar systems for domestic hot water production are rated by the annual solar energy factor of the system. The solar energy factor of a system shall be determined from the Florida Solar Energy Center *Directory of Certified Solar Systems*. Solar collectors shall be tested in accordance with ISO Standard 9806, *Test Methods for Solar Collectors*, and SRCC Standard TM-1, *Solar Domestic Hot Water System and Component Test Protocol*. Collectors

TABLE 13-612.AB.3
MINIMUM PERFORMANCE STANDARDS
WATER HEATING EQUIPMENT: FIRED STORAGE WATER HEATER MINIMUM ENERGY FACTORS (EF)

TYPE / VOLUME	TANK VOLUME (GALLONS)								
	20	30	40	50	65	75	80	100	120
ELECTRIC: Up to 120 gallon or 12kW input	.94	.93	.92	.90	.88	—	.86	.84	.81
GAS: Up to 100 gallon or 75,000 Btu/h input	.63	.61	.59	.58	.55	.53	—	.48	—
OIL: Up to 50 gallon or 75,000 Btu/h input	—	.53	.51	.50	—	—	—	—	—

in installed solar water heating systems should meet the following criteria:

1. Be installed with a tilt angle between 10 degrees and 40 degrees of the horizontal; and
2. Be installed at an orientation within 45 degrees of true south.

13-612.AB.3.5 Combination service water heating and space heating equipment. Service water heating equipment used to provide additional functions (e.g. space heating) as part of a combination (integrated) system shall comply with minimum performance requirements for water heating equipment. For combined gas storage tank water heating and space heating systems tested to ANSI/ASHRAE 124, the EF used shall be the effective water heating efficiency (CA_{ef}) listed for the appliance by the Gas Appliance Manufacturer's Association (GAMA). For combined gas instantaneous (tankless) water heating and space heating systems, the EF used shall be determined in accordance with the DOE Uniform Test Method for Measuring the Energy Consumption of Water Heaters, Appendix E to Subpart B, Title 10 CFR 430.

Combination systems utilizing a storage tank water heater as the heat source for space heating purposes with input ratings of 105,000 Btu/h (360 m^3/kW) or less shall utilize a water heater listed by the Gas Appliance Manufacturer's Association (GAMA). Changeouts of burners or heating elements to increase capacity shall not be made unless the unit has been listed at that capacity by GAMA.

Combination systems utilizing a storage tank water heater as the heat source for space heating purposes with input ratings greater than 105,000 Btu/h (360 m^3/kW) shall comply with the criteria of Section 13-412.AB.3.4, Subchapter13-4.

13-612.AB.4 Pumps. Circulating hot water systems shall be arranged so that the circulating pump(s) can be conveniently turned off (automatically or manually) when the hot water system is not in operation.

13-612.AB.5 Piping insulation. Circulating hot water systems (including piping for waste heat recovery systems (HRUs)) shall be insulated with insulation of at least $^1/_2$ inch (12.7 mm) minimum thickness with a thermal conductivity no greater than 0.28 Btu/in./h·ft^2°F.

Pipe insulation buried underground shall be as specified by the manufacturer for underground use.

13-612.A Requirements specific to Method A.

13-612.A.1 Water heating system energy loads. Energy loads for service water heating systems shall be based on the appropriate efficiency rating for the system to be installed from the EnergyGauge USA Fla/Res computer program.

13-612.A.2 Additions. Water heating shall be considered in Method A calculations if any of the following conditions are met:

1. Existing systems are replaced during construction;
2. Additional water heaters are installed; or
3. A gas, solar, HRU or dedicated heat pump is installed to gain calculation credits.

13-612.A.3 Installation criteria for homes claiming the heat recovery unit (HRU) option. The heat recovery unit option may be claimed in the EnergyGauge USA Fla/Res computer program for installation of a waste heat recovery unit (HRU) on either an air conditioner or a heat pump where the heat recovery unit has a minimum net useful heat exchange effect of 30 percent and meets the following criteria:

1. The net useful heat exchange effect shall be demonstrated by either a Form 1100D prominently displayed on the unit with test results clearly visible for inspection or by an ARDM certified refrigerant desuperheater seal affixed to the unit. See Section 13-600.2.1 for a description of Form 1100D and Appendix 13-D for a copy of the form.
2. The net useful heat exchange effect shall have been determined by an independent laboratory testing to the standard rating conditions specified in Florida Standard FL-1 (see Appendix 13-E).
3. If more than one air conditioning system is installed in a residence and only one HRU is installed, energy load shall be based on the gallon capacity of the water heater to which it is coupled and the total capacity of the water heaters in the residence. In such case, the HRU shall be attached to the system serving the daytime primary living areas (family room, living room, kitchen, dining room and adjacent bedrooms and bathrooms).

13-612.A.4 Installation criteria for homes claiming the dedicated heat pump option. The dedicated heat pump option may be claimed in the EnergyGauge USA Fla/Res computer program for a dedicated heat pump (also known as a heat pump water heater) installed either with a tank (an integral unit) or without a tank (add on to another water heater) based on the COP of the system on which it is installed. No minimum rating is required for this equipment.

13-612.B Requirements specific to Method B. New water heating equipment installed in buildings complying by Method B shall meet the minimum efficiencies given in Section 13-612.AB.3, Table 13-612.AB.3.

Exception: Existing water heating systems in an addition or renovation that will not be replaced.

SECTION 13-613
CALCULATIONAL PARAMETERS SPECIFIC TO COMPLIANCE METHOD A

13-613.A Method A compliance simulation and end-use load determination. Except as specified by this section, the baseline home and as-built home shall be configured and analyzed using identical methods and techniques. The Baseline totals for Method A code compliance developed in accordance with the criteria in Sections 13-613.A.1 and 13-613.A.2 shall be adjusted by a factor of 0.85 to make the code 15 percent more stringent than the "2007" code Baseline features.

13-613.A.1 Home Specification. The Baseline home and As-Built home shall be configured and analyzed as specified by Table 13-613.A.1-1.

TABLE 13-613.A.1-1
SPECIFICATIONS FOR BASELINE AND AS-BUILT HOMES

Building Component	Baseline Home	As-Built Home
Above-grade walls:	Type: wood frame Gross area: same as As-Built home *U*-Factor: 0.082 Solar absorptance = 0.75 Emittance = 0.90	Same as As-Built home Same as As-Built home Same as As-Built home Same as As-Built home Same as As-Built home
Conditioned basement walls:	Type: same as As-Built home Gross area: same as As-Built home *U*-Factor: 0.36 with the insulation layer on the interior side of walls	Same as As-Built home Same as As-Built home Same as As-Built home
Floors over unconditioned spaces:	Type: wood frame Gross area: same as As-Built home *U*-Factor: 0.064	Same as As-Built home Same as As-Built home Same as As-Built home
Ceilings:	Type: wood frame Gross area: same as As-Built home *U*-Factor: 0.035	Same as As-Built home Same as As-Built home Same as As-Built home
Roofs:	Type: composition shingle on wood sheathing Gross area: same as As-Built home Solar absorptance = 0.75 Emittance = 0.90	Same as As-Built home Same as As-Built home Same as As-Built home Same as As-Built home
Attics:	Type: vented with aperture = 1 ft^2 per 300 ft^2 ceiling area	Same as As-Built home
Foundations:	Type: same as As-Built home Gross Area: same as As-Built home *R*-value: 0	Same as As-Built home Same as As-Built home Same as As-Built home
Crawl spaces:	Type: vented with net free vent aperture = 1 ft^2 per 150 ft^2 of crawl space floor area.	Same as As-Built home, but not less net free ventilation area than the baseline home unless an approved ground cover in accordance with Section 408.1 of the *Florida Building Code, Residential,* is used, in which case, the same net free ventilation area as the As-Built home down to a minimum net free vent area of 1 ft^2 per 1,500 ft^2 of crawl space floor area.
Doors:	Area: 40 ft^2 Orientation: North *U*-factor: 0.75	Same as As-Built home Same as As-Built home Same as As-Built home

(continued)

TABLE 13-613.A.1-1 - continued
SPECIFICATIONS FOR BASELINE AND AS-BUILT HOMES

Glazing:[a]	Total area[b] = 18% of conditioned floor area Orientation: equally distributed to four (4) cardinal compass orientations (N,E,S,&W) *U*-factor: 0.75 SHGC: 0.40 Interior shade coefficient: Summer = 0.70 Winter = 0.85 External shading: none	Same as As-Built home Same as As-Built home Same as As-Built home Same as As-Built home Same as As-Built home [c] Same as As-Built home Same as As-Built home
Skylights:	None	Same as As-Built home
Thermally isolated sunrooms:	None	Same as As-Built home
Air exchange rate:	Specific Leakage Area (SLA)[d] = 0.00036 (assuming no energy recovery)	For residences that are not tested, the same as the Baseline home. For residences with mechanical ventilation systems and with envelope leakage tested in accordance with ASHRAE 119, Section 5.1, the measured air exchange rate (e) combined with the As-Built mechanical ventilation rate (f) where such mechanical ventilation rate shall not be less than 0.01 x CFA + 7.5 x (N_{br}+1)
Mechanical ventilation:	None, except where a mechanical ventilation system is specified by the As-Built home, in which case: Annual vent fan energy use: kWh/yr = 0.03942*CFA + 29.565*(N_{br}+1)(per dwelling unit) where: CFA = conditioned floor area N_{br} = number of bedrooms	Same as As-Built home Same as As-Built home
Internal gains:	IGain = 17,900 + 23.8*CFA + 4104*N_{br} (Btu/day per dwelling unit)	Same as Baseline Home
Internal mass:	An internal mass for furniture and contents of 8 pounds per square foot of floor area	Same as Baseline home, plus any additional mass specifically designed as a thermal storage element[g] but not integral to the building envelope or structure

(continued)

TABLE 13-613.A.1-1 - continued
SPECIFICATIONS FOR BASELINE AND AS-BUILT HOMES

Structural mass:	For masonry floor slabs, 80% of floor area covered by R-2 carpet and pad, and 20% of floor directly exposed to room air	Same as As-Built home
	For masonry basement walls, same as as-built home, but with insulation located on the interior side of the walls	Same as As-Built home
	For other walls, for ceilings, floors, and interior walls, wood frame construction	Same as As-Built home
Heating systems:[h],[i]	Fuel type: same as As-Built home	Same as As-Built home[i]
	Efficiencies:	Same as As-Built home
	Electric: air source heat pump with prevailing federal minimum efficiency	Same as As-Built home
	Nonelectric furnaces: natural gas furnace with prevailing federal minimum efficiency	Same as As-Built home
	Nonelectric boilers: natural gas boiler with prevailing federal minimum efficiency	Same as As-Built home
	Capacity: sized in accordance with Section 13-607.ABC.1 of this code.	
Cooling systems:[h],[k]	Fuel type: Electric	Same as As-Built home[k]
	Efficiency: in accordance with prevailing federal minimum standards	
	Capacity: sized in accordance with Section 13-607.ABC.1 of this code.	
Service water heating systems:[h],[m]	Fuel type: same as As-Built home	Same as As-Built home[m]
	Efficiency: in accordance with prevailing federal minimum standards	Same as As-Built home
	Use (gal/day): $30*N_{du}+10*N_{br}$ where N_{du} = number of dwelling units	Same as Baseline home
	Tank temperature: 120°F	Same as Baseline home
Thermal distribution systems:	A thermal distribution system efficiency (DSE) of 0.80 shall be applied to both the heating and cooling system efficiencies.	Using As-Built duct locations and a DSE of 0.88, except when tested in accordance with ASHRAE 152(n), in which case measured duct air leakage values shall be used

(continued)

TABLE 13-613.A.1-1 - continued
SPECIFICATIONS FOR BASELINE AND AS-BUILT HOMES

Thermostat:	Type: manual Temperature set points: Cooling temperature set point = 78°F; Heating temperature set point = 68°F	Type: Same as As-Built home Temperature set points: same as the Baseline home, except when programmable thermostats are installed.

NOTES:

(a) Glazing shall be defined as sunlight-transmitting fenestration, including the area of sash, curbing or other framing elements, that enclose conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements. For doors where the sunlight-transmitting opening is less than one-third of the door area, the glazing area of the sunlight transmitting opening shall be used. For all other doors, the glazing area shall be the rough frame opening area for the door including the door and the frame.

(b) For homes with conditioned basements and for multi-family attached homes the following formula shall be used to determine total window area:

$$A_F = 0.18 \times A_{FL} \times F_A \times F$$

where:

A_F = Total fenestration area.

A_{FL} = Total floor area of directly conditioned space.

F_A = (Above-grade thermal boundary gross wall area)/(above-grade boundary gross wall area + 0.5 x below-grade boundary gross wall area)

F = (Above-grade thermal boundary gross wall area)/(above-grade thermal boundary gross wall area + common gross wall area) or 0.75, whichever is greater.

and where:

Thermal boundary wall is any wall that separates conditioned space from unconditioned space or ambient conditions *Abovegrade thermal boundary wall* is any portion of a thermal boundary wall not in contact with soil *Below-grade boundary wall* is any portion of a thermal boundary wall in soil contact

Common wall is the total wall area of walls adjacent to another conditioned living unit, not including common foundation and attic walls.

(c) For fenestrations facing within 15 degrees of due south that are directly coupled to thermal storage mass, the winter interior shade coefficient shall be permitted to increase to 0.95 in the As-Built home.

(d) Where leakage area (L) is defined in accordance with Section 5.1 of ASHRAE 119 and where:

SLA = L/CFA (where L and CFA are in the same units).

Hourly calculations using the procedures given in the *ASHRAE Handbook of Fundamentals*, Chapter 27, page 27.21, Equation 40 (Sherman-Grimsrud model) using Shelter Class 4 shall be used to determine the air exchange rate resulting from infiltration.

(e) Tested envelope leakage shall be determined in accordance with Section 5.1 of ASHRAE 119 and documented by a Certified Class 1 Florida Rater. Either hourly calculations using the procedures given in the *ASHRAE Handbook of Fundamentals*, Chapter 27, page 27.21, Equation 40 (Sherman-Grimsrud model) using Shelter Class 4 shall be used to determine the air exchange rates resulting from infiltration.

(f) The combined air exchange rate for infiltration and mechanical ventilation shall be determined in accordance with Equation 43 of *ASHRAE Handbook of Fundamentals,* page 27.23.

(g) Thermal storage element shall mean a component not normally part of the floors, walls, or ceilings that is part of a passive solar system, and that provides thermal storage such as enclosed water columns, rock beds, or phase change containers. A thermal storage element must be in the same room as fenestration that faces within 15 degrees of due south, or must be connected to such a room with pipes or ducts that allow the element to be actively charged.

(h) For an as-built home with multiple heating, cooling, or water heating systems using different fuel types, the fuel type of the heating and cooling system serving the greatest floor area and the fuel type of the hot water system having the greatest capacity shall be used for the compliance calculation. For the Baseline home, the prevailing federal minimum efficiency shall be as-

sumed except that the efficiencies given in Table 13-613.A.1-1(a) below will be assumed when:

1) A type of device not covered by NAECA is found in the As-Built home;
2) The As-Built home is heated by electtricity using a device other than an air source heat pump; or
3) The As-Built home does not contain one or more of the required HVAC equipment systems.

TABLE 13-613.A.1-1(a)
DEFAULT BASELINE HOME HEATING AND COOLING EQUIPMENT EFFICIENCIES [(i) (k) (m) (n)]

As-Built Home Fuel	Function	Baseline Home Device
Electric	Heating	7.7 HSPF air source heat pump
Nonelectric warm air furnace or space heater	Heating	78% AFUE gas furnace
Nonelectric boiler	Heating	80% AFUE gas boiler
Any type	Cooling	13 SEER electric air conditioner

(i) For an As-Built home without a proposed heating system, a heating system with the prevailing federal minimum efficiency shall be assumed for both the baseline home and As-Built home. For electric heating systems, the prevailing federal minimum efficiency air-source heat pump shall be selected.

(k) For an As-Built home without a proposed cooling system, an electric air conditioner with the prevailing federal minimum efficiency shall be assumed for both the Baseline home and the As-Built home.

(m) For an as-built home with a nonstorage type water heater, a 40-gallon storage-type water heater with the prevailing federal minimum efficiency with the same fuel as the predominant heating fuel type shall be assumed for both the Rated and Baseline Homes.

(n) Tested duct leakage shall be determined and documented by a Certified Class 1 Florida Rater.

13-613.A.2 Calculation of end-use energy loads for code compliance determination.

13-613.A.2.1 The energy loads for heating, cooling and hot water in the As-Built home shall be normalized to account for the differences in improvement potential that exist across equipment types using the following formula in accordance with the paper "The HERS Rating Method and the Derivation of the Normalized Modified Loads Method," Research Report No. FSEC-RR-54-00, Florida Solar Energy Center.

$$nMEUL = REUL * (nEC\_x / EC\_r)$$

where:

nMEUL = Normalized modified end-use loads (for heating, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

REUL = Baseline home end-use loads (for heating, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

EC_r = Estimated energy consumption for Baseline home's end uses (for heating, including auxiliary electric consumption, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

and where:

$$nEC\_x = (a * EEC\_x - b) * (EC\_x * EC\_r * DSE\_r) / (EEC\_x * REUL)$$

where:

nEC_x = Normalized energy consumption for As-Built home's end uses (for heating, including auxiliary electric consumption, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

EC_r = Estimated energy consumption for Baseline home's end uses (for heating, including auxiliary electric consumption, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

EC_x = Estimated energy consumption for the As-Built home's end uses (for heating, including auxiliary electric consumption, cooling or hot water) as computed using EnergyGauge USA Fla/Res.

EEC_x = Equipment efficiency coefficient for the As-Built home's equipment, such that EEC_x equals the energy consumption per unit load in like units as the load, and as derived from the Manufacturer's Equipment Performance Rating (MEPR) such that EEC_x equals 1.0 / MEPR for AFUE, COP or EF ratings, or such that EEC_x equals 3.413 / MEPR for HSPF, EER or SEER ratings.

DSE_r = REUL/EC_r * EEC_r. For simplified system performance methods, DSE_r equals 0.80 for heating and cooling systems. However, for detailed modeling of heating and cooling systems, DSE_r may be less than 0.80 as a result of part load performance degradation, coil air flow degradation, improper system charge and auxiliary resistance heating for heat pumps. Except as otherwise provided by these standards, where detailed systems modeling is employed, it must be applied equally to both the Baseline and the As-Built homes.

EEC_r = Equipment efficiency coefficient for the Baseline home's equipment, such that EEC_r equals the energy consumption per unit load in like units as the load, and as derived from the manufacturer's equipment performance rating (MEPR) such that EEC_r equals 1.0 / MEPR for AFUE, COP or EF ratings, or such that EEC_r equals 3.413 / MEPR for HSPF, EER or SEER ratings.

REUL = Baseline home end use loads (for heating or cooling) as computed using EnergyGauge USA Fla/Res.

and where the coefficients *a* and *b* are as defined by Table 13-613.A.2-1 below:

TABLE 13-613.A.2-1
COEFFICIENTS *a* and *b*

Fuel Type and End Use	a	b
Electric space heating	2.2561	0
Fossil fuel* space heating	1.0943	0.4043
Biomass space heating	0.8850	0.4047
Electric air conditioning	3.8090	0
Electric water heating	0.9200	0
Fossil fuel* water heating	1.1877	1.0130

*Such as natural gas, LP, fuel oil

13-613.A.2.2 Following normalization of the heating, cooling and hot water energy consumptions for the As-Built home as specified in Section 13-613.A.2.1 above, the Baseline home's total reference end-use loads for heating, cooling and hot water (REULtot) shall be compared with the proposed As-Built home's total normalized modified end use loads for heating, cooling and hot water (nMEULtot). If the total normalized modified loads of the proposed As-Built home (nMEULtot) are equal to or less than the total reference loads of the Baseline home (REULtot), the proposed As-Built home complies with this code.

APPENDIX 13-A

JURISDICTIONAL DATA

PERMITTING OFFICE	JURISDICTION NUMBER	CLIMATE ZONE	REPORTING GROUP
ALACHUA COUNTY	111000	3	III
ALACHUA	111400	3	III
ALACHUA DISTRICT SCHOOLS	111100	3	III
UNIVERSITY OF FLORIDA	111200	3	III
GAINESVILLE	111300	3	III
HIGH SPRINGS	111500	3	III
NEWBERRY	111800	3	III
WALDO	111900	3	III
SANTA FE COMMUNITY COLLEGE	112000	3	III
BAKER COUNTY	121000	3	III
MACCLENNY	121100	3	III
BAKER DISTRICT SCHOOSL	121200	3	III
BAY COUNTY	131000	1	III
CALLAWAY	131100	1	III
LYNN HAVEN	131300	1	III
MEXICO BEACH	131400	1	III
PANAMA CITY	131500	1	III
PANAMA CITY BEACH	131600	1	III
BAY DISTRICT SCHOOLS	131700	1	III
SPRINGFIELD	131800	1	III
GULF COAST COMMUNITY COLLEGE	131900	1	III
BRADFORD COUNTY	141000	3	III
BRADFORD DISTRICT SCHOOLS	141100	3	III
BREVARD COUNTY	151000	6	II
CAPE CANAVERAL	151100	6	II
COCOA	151200	6	II
COCOA BEACH	151300	6	II
INDIATLANTIC	151400	6	II
INDIAN HARBOR BEACH	151500	6	II
MALABAR	151600	6	II
MELBOURNE	151700	6	II
MELBOURNE BEACH	151800	6	II
MELBOURNE VILLAGE	151900	6	II
PALM BAY	152000	6	II
PALM SHORES	152100	6	II
ROCKLEDGE	152200	6	II
SATELLITE BEACH	152300	6	II
TITUSVILLE	152400	6	II

WEST MELBOURNE	152500	6	II
BREVARD DISTRICT SCHOOLS	152600	6	II
BREVARD COMMUNITY COLLEGE	152700	6	II
BROWARD COUNTY	161000	8	II
COCONUT CREEK	161100	8	II
COOPER CITY	161200	8	II
CORAL SPRINGS	161300	8	II
DANIA	161400	8	II
DAVIE	161500	8	II
DEERFIELD BEACH	161600	8	II
FORT LAUDERDALE	161700	8	II
HALLANDALE	161900	8	II
HOLLYWOOD	162100	8	II
LAUDERDALE BY THE SEA	162200	8	II
LAUDERDALE LAKES	162300	8	II
LAUDERHILL	162400	8	II
LIGHTHOUSE POINT	162600	8	II
MARGATE	162700	8	II
MIRAMAR	162800	8	II
NORTH LAUDERDALE	162900	8	II
OAKLAND PARK	163000	8	II
PARKLAND	163100	8	II
PEMBROKE PARK	163200	8	II
PEMBROKE PINES	163300	8	II
PLANTATION	163400	8	II
POMPANO BEACH	163500	8	II
SEA RANCH LAKES	163600	8	II
SUNRISE	163700	8	II
TAMARAC	163800	8	II
WESTON	163850	8	II
WILTON MANORS	163900	8	II
BROWARD DISTRICT SCHOOLS	164000	8	II
BROWARD COMMUNITY COLLEGE	164100	8	II
CALHOUN COUNTY	171000	1	III
CALHOUN DISTRICT SCHOOLS	171100	1	III
BLOUNTSTOWN	171200	1	III
CHARLOTTE COUNTY	181000	7	III
PUNTA GORDA	181100	7	III
CHARLOTTE DISTRICT SCHOOLS	181200	7	III
CITRUS COUNTY	191000	4	III
CRYSTAL RIVER	191100	4	III
INVERNESS	191200	4	III
CITRUS DISTRICT SCHOOLS	91300	4	III
CLAY COUNTY	201000	3	III

GREEN COVE SPRINGS	201100	3	III
ORANGE PARK	201300	3	III
PENNEY FARMS	201400	3	III
CLAY DISTRICT SCHOOLS	201500	3	III
COLLIER COUNTY	211000	7	III
EVERGLADES CITY	211100	7	III
MARCO ISLAND	211300	7	III
NAPLES	211200	7	III
COLLIER DISTRICT SCHOOLS	211400	7	III
COLUMBIA COUNTY	221000	3	III
LAKE CITY	221200	3	III
COLUMBIA DISTRICT SCHOOLS	221300	3	III
LAKE CITY COMMUNITY COLLEGE	221400	3	III
DESOTO COUNTY	241000	5	III
DESOTO DISTRICT SCHOOLS	241100	5	III
DIXIE COUNTY	251000	2	III
DIXIE DISTRICT SCHOOLS	251100	2	III
DUVAL COUNTY	261000	3	III
ATLANTIC BEACH	261100	3	III
BALDWIN	261200	3	III
JACKSONVILLE	261300	3	III
JACKSONVILLE BEAC	261400	3	III
NEPTUNE BEACH	261500	3	III
DUVAL DISTRICT SCHOOLS	261600	3	III
FLORIDA COMMUNITY COLLEGE	261700	3	III
UNIVERSITY OF NORTH FLORIDA	261800	3	III
ESCAMBIA COUNTY	271000	1	III
PENSACOLA	271100	1	III
ESCAMBIA DISTRICT SCHOOLS	271200	1	III
PENSACOLA COMMUNITY COLLEGE	271300	1	III
UNIVERSITY OF WEST FLORIDA	271400	1	III
FLAGLER COUNTY	281000	3	III
BEVERLY BEACH	281100	3	III
BUNNELL	281200	3	III
FLAGLER BEACH	281300	3	III
FLAGLER DISTRICT SCHOOLS	281400	3	III
PALM COAST	281500	3	III
FRANKLIN COUNTY	291000	2	III
CARRABELLE	291200	2	III
FRANKLIN DISTRICT SCHOOLS	291300	2	III
GADSDEN COUNTY	301000	2	III
CHATTAHOOCHEE	301100	2	III
GRETNA	301300	2	III
HAVANA	301400	2	III

QUINCY	301500	2	III
GADSDEN DISTRICT SCHOOLS	301600	2	III
GILCHRIST COUNTY	311000	2	III
GILCHRIST DISTRICT SCHOOLS	311100	2	III
TRENTON	311300	2	III
GLADES COUNTY	321000	7	III
MOORE HAVEN	321100	7	III
GLADES DISTRICT SCHOOLS	321200	7	III
GULF COUNTY	331000	1	III
PORT ST. JOE	331100	1	III
GULF DISTRICT SCHOOLS	331200	1	III
HAMILTON COUNTY	341000	2	III
HAMILTON DISTRICT SCHOOLS	341100	2	III
HARDEE COUNTY	351000	5	III
BOWLING GREEN	351100	5	III
ZOLFO SPRINGS	351300	5	III
HARDEE DISTRICT SCHOOLS	351400	5	III
HENDRY COUNTY	361000	7	III
CLEWISTON	361100	7	III
HENDRY DISTRICT SCHOOLS	361200	7	III
HERNANDO COUNTY	371000	4	III
BROOKSVILLE	371100	4	III
HERNANCO DISTRICT SCHOOLS	371200	4	III
HIGHLANDS COUNTY	381000	5	III
AVON PARK	381100	5	III
LAKE PLACID	381200	5	III
SEBRING	381300	5	III
HIGHLANDS DISTRICT SCHOOLS	381400	5	III
SOUTH FLORIDA COMMUNITY COLLEGE	381500	5	III
HILLSBOROUGH COUNTY	391000	4	II
PLANT CITY	391100	4	II
TAMPA	391200	4	II
TEMPLE TERRACE	391300	4	II
HILLSBOROUGH DISTRICT SCHOOLS	391400	4	II
HILLSBOROUGH COMMUNITY COLLEGE	391500	4	II
UNIVERSITY OF SOUTH FLORIDA	391600	4	II
HOLMES COUNTY	401000	1	III
HOLMES DISTRICT SCHOOLS	401100	1	III
INDIAN RIVER COUNTY	411000	6	III
FELLSMERE	411100	6	III
ORCHID	411300	6	III
SEBASTIAN	411400	6	III
INDIAN RIVER DISTRICT SCHOOLS	411500	6	III
INDIAN RIVER COMMUNITY COLLEGE	411600	6	III

JACKSON COUNTY	421000	1	III
JACKSON DISTRICT SCHOOLS	421100	1	III
CHIPOLA JUNIOR COLLEGE	421200	1	III
GREENWOOD	421700	1	III
JEFFERSON COUNTY	431000	2	III
JEFFERSON DISTRICT SCHOOLS	431100	2	III
LAFAYETTE COUNTY	441000	2	III
MAYO	441100	2	III
LAFAYETTE DISTRICT SCHOOLS	441200	2	III
LAKE COUNTY	451000	5	III
EUSTIS	451300	5	III
FRUITLAND PARK	451400	5	III
GROVELAND	451500	5	III
HOWEY IN THE HILLS	451600	5	III
LADY LAKE	451700	5	III
LEESBURG	451800	5	III
MASCOTTE	451900	5	III
MOUNT DORA	452200	5	III
TAVARES	452300	5	III
UMATILLA	452400	5	III
LAKE DISTRICT SCHOOLS	452500	5	III
LAKE-SUMTER COMMUNITY COLLEGE	452600	5	III
LEE COUNTY	461000	7	III
CAPE CORAL	461100	7	III
FORT MYERS	461200	7	III
SANIBEL	461300	7	III
LEE DISTRICT SCHOOLS	461400	7	III
EDISON COMMUNITY COLLEGE	461500	7	III
GULF COAST UNIVERSITY	461600	7	III
LEON COUNTY	471000	2	III
TALLAHASSEE	471100	2	III
FLORIDA STATE UNIVERSITY	471200	2	III
TALLAHASSEE COMMUNITY COLLEGE	471300	2	III
LEON DISTRICT SCHOOLS	471300	2	III
FLORIDA A&M UNIVERSITY	471400	2	III
LEVY COUNTY	481000	4	III
CEDAR KEY	481200	4	III
CHIEFLAND	481300	4	III
INGLIS	481400	4	III
OTTER CREEK	481500	4	III
WILLISTON	481600	4	III
LEVY DISTRICT SCHOOLS	481700	4	III
LIBERTY COUNTY	491000	2	III
LIBERTY DISTRICT SCHOOLS	491100	2	III

MADISON COUNTY	501000	2	III
MADISON DISTRICT SCHOOLS	501100	2	III
LEE	501200	2	III
NORTH FLORIDA COMMUNITY COLLEGE	501300	2	III
MANATEE COUNTY	511000	4	II
ANNA MARIA	511100	4	II
BRADENTON	511200	4	II
BRADENTON BEACH	511300	4	II
HOLMES BEACH	511400	4	II
LONGBOAT KEY	511500	4	II
PALMETTO	511600	4	II
MANATEE DISTRICT SCHOOLS	511700	4	II
MANATEE COMMUNITY COLLEGE	511800	4	II
MARION COUNTY	521000	5	II
BELLEVIEW	521100	5	II
DUNNELLON	521200	5	II
MCINTOSH	521300	5	II
OCALA	521400	5	II
MARION DISTRICT SCHOOLS	521500	5	II
CENTRAL FLORIDA COMMUNITY COLLEGE	521600	5	II
MARTIN COUNTY	531000	8	II
JUPITER ISLAND	531100	8	II
OCEAN BREEZE PARK	531200	8	II
SEWALLS POINT	531300	8	II
STUART	531400	8	II
MARTIN DISTRICT SCHOOLS	531500	8	II
MIAMI-DADE COUNTY	231000	8	III
BAL HARBOUR VILLAGE	231100	8	III
BAY HARBOR ISLANDS	231200	8	III
BISCAYNE PARK	231300	8	III
CORAL GABLES	231400	8	III
DORAL	231410	8	III
EL PORTAL	231500	8	III
FLORIDA CITY	231600	8	III
GOLDEN BEACH	231700	8	III
HIALEAH	231800	8	III
HIALEAH GARDENS	231900	8	III
HOMESTEAD	232000	8	III
INDIAN CREEK VILLAGE	232100	8	III
ISLANDIA	232200	8	III
KEY BISCAYNE	233700	8	III
MEDLEY	232300	8	III
MIAMI	232400	8	III
MIAMI BEACH	232500	8	III

MIAMI GARDENS	232510	8	III
MIAMI SHORES VILLAGE	232600	8	III
MIAMI SPRINGS	232700	8	III
NORTH BAY VILLAGE	232800	8	III
NORTH MIAMI	233000	8	III
NORTH MIAMI BEACH	232900	8	III
OPA LOCKA	233100	8	III
PALMETTO BAY	233110	8	III
PENNSUCO	233200	8	III
PINECREST	233250	8	III
SOUTH MIAMI	233300	8	III
SUNNY ISLES BEACH	233700	8	III
SURFSIDE	233400	8	III
SWEETWATER	233500	8	III
VIRGINIA GARDENS	233600	8	III
MIAMI-DADE DISTRICT SCHOOLS	233800	8	III
MIAMI-DADE COMMUNITY COLLEGE	233900	8	III
FLORIDA INTERNATIONAL UNIVERSITY	234000	8	III
MONROE COUNTY	541000	7	III
KEY COLONY BEACH	541100	7	III
KEY WEST	541200	7	III
LAYTON	541300	7	III
MARATON	541400	7	III
MONROE DISTRICT SCHOOLS	541500	7	III
FLORIDA KEYS COMMUNITY COLLEGE	541600	7	III
NASSAU COUNTY	551000	3	III
CALLAHAN	551100	3	III
FERNANDINA BEACH	551200	3	III
HILLIARD	551300	3	III
NASSAU DISTRICT SCHOOLS	551400	3	III
OKALOOSA COUNTY	561000	1	II
CRESTVIEW	561400	1	II
DESTIN	561200	1	II
FORT WALTON BEACH	561300	1	II
MARY ESTHER	561500	1	II
NICEVILLE	561600	1	II
VALPARAISO	561800	1	II
OKALOOSA DISTRICT SCHOOLS	561900	1	II
OKALOOSA-WALTON COMMUNITY COLLEGE	562000`	1	II
OKEECHOOBEE COUNTY	571000	5	III
OKEECHOOBEE	571100	5	III
OKEECHOBEE DISTRICT SCHOOLS	571200	5	III
ORANGE COUNTY	581000	5	II
APOPKA	581100	5	II

BAY LAKE	581200	5	II
EATONVILLE	581400	5	II
EDGEWOOD	581500	5	II
LAKE BUENA VISTA	581600	5	II
MAITLAND	581800	5	II
OAKLAND	581900	5	II
OCOEE	582000	5	II
ORLANDO	582100	5	II
WINTER GARDEN	582300	5	II
WINTER PARK	582400	5	II
ORANGE DISTRICT SCHOOLS	582500	5	II
UNIVERSITY OF CENTRAL FLORIDA	582600	5	II
VALENCIA COMMUNITY COLLEGE	582700	5	II
OSCEOLA COUNTY	591000	5	II
KISSIMMEE	591100	5	II
ST CLOUD	591200	5	II
OSCEOLA DISTRICT SCHOOLS	591300	5	II
PALM BEACH COUNTY	601000	8	I
ATLANTIS	601100	8	I
BELLE GLADE	601200	8	I
BOCA RATON	601300	8	I
BOYNTON BEACH	601400	8	I
BRINY BREEZES	601500	8	I
CLOUD LAKE	601600	8	I
DELRAY BEACH	601700	8	I
GLEN RIDGE	601800	8	I
GOLF	601900	8	I
GOLFVIEW	602000	8	I
GREENACRES CITY	602100	8	I
HAVERHILL	602300	8	I
HIGHLAND BEACH	602400	8	I
HYPOLUXO	602500	8	I
JUPITER	602700	8	I
LAKE CLARKE SHORE	602900	8	I
LAKE PARK	603000	8	I
LAKE WORTH	603100	8	I
LANTANA	603200	8	I
MANALAPAN	603300	8	I
MANGONIA PARK	603400	8	I
NORTH PALM BEACH	603500	8	I
OCEAN RIDGE	603600	8	I
PAHOKEE	603700	8	I
PALM BEACH	603800	8	I
PALM BEACH GARDENS	603900	8	I

PALM BEACH SHORES	604000	8	I
PALM SPRINGS	604100	8	I
RIVIERA BEACH	604200	8	I
ROYAL PALM BEACH	604300	8	I
SOUTH PALM BEACH	604500	8	I
TEQUESTA	604600	8	I
WELLINGTON	604650	8	I
WEST PALM BEACH	604700	8	I
PALM BEACH DISTRICT SCHOOLS	604800	8	I
PALM BEACH COMMUNITY COLLEGE	604900	8	I
FLORIDA ATLANTIC UNIVERSITY	605100	8	I
PASCO COUNTY	611000	4	I
DADE CITY	611100	4	I
NEW PORT RICHEY	611200	4	I
PORT RICHEY	611300	4	I
ST. LEO	611400	4	I
ZEPHYRHILLS	611600	4	I
PASCO DISTRICT SCHOOLS	611700	4	I
PASCO-HERNANDO COMMUNITY COLLEGE	611800	4	I
PINELLAS COUNTY	621000	4	I
BELLEAIR	621100	4	I
BELLEAIR BEACH	621200	4	I
CLEARWATER	621500	4	I
DUNEDIN	621600	4	I
GULFPORT	621700	4	I
INDIAN ROCK BEACH	621800	4	I
INDIAN SHORES	621900	4	I
KENNETH CITY	622000	4	I
LARGO	622100	4	I
MADEIRA BEACH	622200	4	I
NORTH REDINGTON BEACH	622300	4	I
OLDSMAR	622400	4	I
PINELLAS PARK	622500	4	I
REDINGTON BEACH	622600	4	I
REDINGTON SHORES	622700	4	I
SAFETY HARBOR	622800	4	I
ST PETERSBURG	622900	4	I
ST PETERSBURG BEACH	623000	4	I
SEMINOLE	623100	4	I
SOUTH PASADENA	623200	4	I
TARPON SPRINGS	623300	4	I
TREASURE ISLAND	623400	4	I
PINELLAS DISTRICT SCHOOLS	623500	4	I
ST PETERSBURG JUNIOR COLLEGE	623600	4	I

POLK COUNTY	631000	5	I
AUBURNDALE	631100	5	I
BARTOW	631200	5	I
DAVENPORT	631300	5	I
DUNDEE	631400	5	I
EAGLE LAKE	631500	5	I
FORT MEADE	631600	5	I
FROSTPROOF	631700	5	I
HAINES CITY	631800	5	I
LAKE ALFRED	632100	5	I
LAKE HAMILTON	632200	5	I
LAKELAND	632300	5	I
LAKE WALES	632400	5	I
MULBERRY	632500	5	I
POLK CITY	632600	5	I
WINTER HAVEN	632700	5	I
POLK DISTRICT SCHOOLS	632800	5	I
POLK COMMUNITY COLLEGE	632900	5	I
PUTNAM COUNTY	641000	3	III
PALATKA	641300	3	III
PUTNAM DISTRICT SCHOOLS	641400	3	III
ST JOHNS COUNTY	651000	3	I
ST AUGUSTINE	651200	3	I
ST AUGUSTINE BEACH	651300	3	I
ST JOHNS DISTRICT SCHOOLS	651400	3	I
ST JOHNS RIVER COMMUNITY COLLEGE	651500	3	I
ST LUCIE COUNTY	661000	6	II
FORT PIERCE	661100	6	II
PORT ST LUCIE	661200	6	II
ST LUCIE VILLAGE	661300	6	II
ST LUCIE DISTRICT SCHOOLS	661400	6	II
SANTA ROSA COUNTY	671000	1	II
GULF BREEZE	671100	1	II
JAY	671200	1	II
MILTON	671300	1	II
SANTA ROSA DISTRICT SCHOOLS	671400	1	II
SARASOTA COUNTY	681000	4	II
NORTH PORT	681100	4	II
SARASOTA	681200	4	II
VENICE	681300	4	II
SARASOTA DISTRICT SCHOOLS	681400	4	II
SEMINOLE COUNTY	691000	5	I
ALTAMONTE SPRINGS	691100	5	I
CASSELBERRY	691200	5	I

LONGWOOD	691300	5	I
OVIEDO	691400	5	I
SANFORD	691500	5	I
WINTER SPRINGS	691600	5	I
LAKE MARY	691700	5	I
SEMINOLE DISTRICT SCHOOLS	691800	5	I
SEMINOLE COMMUNITY COLLEGE	691900	5	I
SEMINOLE INDIAN TRIBE	692000	5	III
SUMTER COUNTY	701000	5	II
BUSHNELL	701100	5	II
CENTER HILL	701200	5	II
COLEMAN	701300	5	II
WILDWOOD	701400	5	II
SUMTER DISTRICT SCHOOLS	701500	5	II
SUWANNEE COUNTY	711000	2	III
BRANFORD	711100	2	III
LIVE OAK	711200	2	III
SUWANNEE DISTRICT SCHOOLS	711300	2	III
TAYLOR COUNTY	721000	2	II
PERRY	721100	2	II
TAYLOR DISTRICT SCHOOLS	721200	2	II
UNION COUNTY	731000	3	II
UNION DISTRICT SCHOOLS	731100	3	II
VOLUSIA COUNTY	741000	6	I
DAYTONA BEACH	741100	6	I
DAYTONA BEACH SHORES	741200	6	I
DELAND	741300	6	I
EDGEWATER	741400	6	I
HOLLY HILL	741500	6	I
LAKE HELEN	741600	6	I
NEW SMYRNA BEACH	741700	6	I
OAK HILL	741800	6	I
ORANGE CITY	741900	6	I
ORMAND BEACH	742000	6	I
PIERSON	742100	6	I
PONCE INLET	742200	6	I
PORT ORANGE	742300	6	I
SOUTH DAYTONA	742400	6	I
VOLUSIA DISTRICT SCHOOLS	742500	6	I
DAYTONA BEACH COMMUNITY COLLEGE	742600	6	I
WAKULLA COUNTY	751000	2	II
WAKULLA DISTRICT SCHOOLS	751100	2	II
WALTON COUNTY	761000	1	II
DEFUNIAK SPRINGS	761100	1	II

WALTON DISTRICT SCHOOLS	761200	1	II
WASHINGTON COUNTY	771000	1	II
WASHINGTON DISTRICT SCHOOLS	771100	1	II

APPENDIX 13-B

SUPPLEMENTAL INFORMATION FOR SUBCHAPTER 13-4

B1.0 General requirements.

B1.1 Testing procedures.

B1.1.1 Building material thermal properties. If building material *R*-values or thermal conductivities are determined by testing, one of the following test procedures shall be used:

a. ASTM C 177,

b. ASTM C 236,

c. ASTM C 518, or

d. ASTM C 976.

For concrete, the oven-dried conductivity shall be multiplied by 1.2 to reflect the moisture content as typically installed.

B1.1.2 Assembly *U*-factors. If assembly *U*-factors are determined by testing, one of the following test procedures shall be used:

a. ASTM C 236 or

b. ASTM C 976.

Product samples tested shall be production line material or representative of material as purchased by the consumer or contractor. If the assembly is too large to be tested at one time in its entirety, then either a representative portion shall be tested or different portions shall be tested separately and a weighted average determined. To be representative, the portion tested shall include edges of panels, joints with other panels, typical framing percentages, and thermal bridges.

B1.1.3 Fenestrations and doors. Product samples used for determining fenestration performance shall be production line units or representative of units as purchased by the consumer or contractor.

B1.2 Calculation procedures and assumptions. The following procedures and assumptions shall be used for all calculations. *R*-values for air films, insulation, and building materials shall be taken from Sections B1.2.1 through B1.2.3, respectively. In addition, the appropriate assumptions listed in Sections B2.1 through B2.5, including framing factors, shall be used.

B1.2.1 Air films. Prescribed *R*-values for air films shall be as follows:

***R*-value**	**Condition**
0.17	All exterior surfaces
0.46	All semiexterior surfaces
0.61	Interior horizontal surfaces, heat flow up
0.92	Interior horizontal surfaces, heat flow down
0.68	Interior vertical surfaces

B1.2.1.1 Exterior surfaces are areas exposed to the wind.

B1.2.1.2 Semiexterior surfaces are protected surfaces that face attics, crawl spaces, and parking garages with natural or mechanical ventilation.

B1.2.1.3 Interior surfaces are surfaces within enclosed spaces.

B1.2.1.4 The *R*-value for cavity airspaces shall be taken from Table B-1 based on the emissivity of the cavity from Table B-2. No credit shall be given for airspaces in cavities that contain any insulation or less than $^1/_2$ inch (12.7 mm). The values for $3^1/_2$-inch (84 mm) cavities shall be used for cavities of that width and greater.

B1.2.2 Insulation *R*-values. Insulation *R*-values shall be determined as follows:

a. For insulation that is not compressed, the rated *R*-value of insulation shall be used.

b. For calculation purposes, the effective *R*-value for insulation that is uniformly compressed in confined cavities shall be taken from Table B-3.

c. For calculation purposes, the effective *R*-value for insulation installed in cavities in attic roofs with steel joists shall be taken from Table B-18.

d. For calculation purposes, the effective *R*-value for insulation installed in cavities in steel-framed walls shall be taken from Table B-17.

B1.2.3 Building material thermal properties. *R*-values for building materials shall be taken from Table B-4. Concrete block *R*-values shall be calculated using the isothermal planes method or a two-dimensional calculation program, thermal conductivities from Table B-5 and dimensions from ASTM C 90. The parallel path calculation method is not acceptable.

Exception: *R*-values for building materials or thermal conductivities determined from testing in accordance with Section B-1.1

B1.2.4 Building material heat capacities: The heat capacity of assemblies shall be calculated using published values for the unit weight and specific heat of all building material components that make up the assembly.

B1.2.5 Architectural drawings. All components of the building envelope in the proposed design shall be modeled as shown on architectural drawings or as installed for existing building envelopes.

Exceptions: The following building elements are permitted to differ from architectural drawings.

1. Any envelope assembly that covers less than 5 percent of the total area of that assembly type (e.g., exterior walls) need not be separately described. If not separately described, the area of an envelope assembly must be added to the area of the adjacent assembly of that same type.

2. Exterior surfaces whose azimuth orientation and tilt differ by no more than 45 degrees and are otherwise the ame may be described as either a single surface or by using multipliers.

B1.3 Insulation installation. Insulation materials shall be installed in accordance with the insulation installation standards listed in table 6C-2 of Appendix 13-C and in such a manner as to achieve *rated R-value of insulation*. Open-blown or poured loose-fill insulation shall not be used in attic roof spaces when the slope of the ceiling is more than 3:12. When eave vents are installed, baffling of the vent openings shall be provided to deflect the incoming air above the surface of the insulation.

Exception: Where *metal building roof* and *metal building wall* insulation is compressed between the roof or wall skin and the structure.

B1.3.1 Substantial contact. Insulation shall be installed in a permanent manner in *substantial contact* with the inside surface in accordance with manufacturer's recommendations for the framing system used. Flexible batt insulation installed in floor cavities shall be supported in a permanent manner by supports no greater than 24 inches (610 mm) on center (o.c.).

Exception: Insulation materials that rely on airspaces adjacent to reflective surfaces for their rated performance.

B1.3.2 Recessed equipment. Lighting fixtures; heating, ventilating, and air-conditioning equipment, including wall heaters, ducts, and plenums; and other equipment shall not be recessed in such a manner as to affect the insulation thickness unless:

1. The total combined area affected (including necessary clearances) is less than one percent of the opaque area of the assembly,
2. The entire *roof*, *wall*, or *floor* is covered with insulation to the full depth required,
3. The effects of reduced insulation are included in calculations using an area-weighted average method and compressed insulation values obtained from Table B-3.

In all cases, air leakage through or around the recessed equipment to the conditioned space shall be limited in accordance with Section 13-406.AB.1.2.

B1.3.3 Insulation protection. Exterior insulation shall be covered with a protective material to prevent damage from sunlight, moisture, landscaping operations, equipment maintenance, and wind. In *attics* and mechanical rooms, a way to access equipment that prevents damaging or compressing the insulation shall be provided. Foundation vents shall not interfere with the insulation. Insulation materials in ground contact shall have a water absorption rate no greater than 0.3 percent when tested in accordance with ASTM C 272.

B1.4 Assembly *U*-factor, C-factor and F-factor determination.

B1.4.1 Precalculated assembly *U*-factors, C-factors, F-factors, or Heat capacities. The *U-factors*, *C-factors, F-factors,* and *heat capacities* for typical construction assemblies are included in Sections B2.1 through B2.5. These values shall be used for all calculations unless otherwise allowed by applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities. Interpolation between values in a particular table in Appendix B is allowed for *rated R-values of insulation*, including insulated sheathing. Extrapolation beyond values in this appendix is not allowed.

B1.4.2 Applicant-determined assembly *U*-Factors, C-factors, F-factors, or heat capacities. If the *building official* determines that the proposed construction assembly is not adequately represented in Sections B2.1 through B2.5, the applicant shall determine appropriate values for the assembly using the assumptions in Section B1.5. An assembly is deemed to be adequately represented if:

a. The interior structure, hereafter referred to as the base assembly, for the *class of construction* is the same as described in Sections B2.1 through B2.5 and
b. Changes in exterior or interior surface *building materials* added to the base assembly do not increase or decrease the *R*-value by more than 2 from that indicated in the descriptions in Sections B2.1 through B2.5. Insulation, including insulated sheathing, is not considered a *building material*.

B1.5 Determination of alternate assembly *U*-factors, C-factors, F-factors, or heat capacities.

B1.5.1 General. Component *U*-factors for other opaque assemblies shall be determined in accordance with Section B1.5 only if approved by the *building official* in accordance with the applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities. The procedures required for each class of construction are specified in Section B1.5.2. Testing shall be performed in accordance with Section B1.1. Calculations shall be performed in accordance with Section B1.2.

B1.5.2 Required procedures. Two- or three-dimensional finite difference and finite volume computer models shall be an acceptable alternative method to calculating the thermal performance values for all assemblies and constructions listed below. The following procedures shall also be permitted to determine all alternative *U-factors*, *F-factors* and *C-factors*.

B1.5.2.1 Above-grade walls.

1. *Mass walls*: testing or the isothermal planes calculation method or two-dimensional calculation method. The parallel path calculation method is not acceptable.
2. *Metal building walls:* testing.
3. *Steel-framed walls*: testing or parallel path calculation method using the insulation/framing layer adjustment factors in Table B-17 or the modified zone method.
4. *Wood framed walls*: testing or parallel path calculation method.
5. Other *walls*: testing or two-dimensional calculation method.

B1.5.2.2 Below-grade walls.

(1) Mass walls: Testing or the isothermal planes calculation method or two-dimensional calculation method. The parallel path calculation method is not acceptable.

(2) Other walls: Testing or two-dimensional calculation method.

B1.5.2.3 Roofs.

1. Roofs with insulation entirely above deck: Testing or series calculation method.
2. Metal building roofs: Testing.
3. Attic roofs, wood joists: Testing or parallel path calculation method.
4. Attic roofs, steel joists: Testing or parallel path calculation method using the insulation/framing layer adjustment factors in Table B-18 or modified zone calculation method.
5. Attic roofs, concrete joists: Testing or parallel path calculation method if concrete is solid and uniform or isothermal planes calculation method if concrete has hollow sections.
6. Other attic roofs and other roofs: Testing or two dimensional calculation method.

B1.5.2.4 Floors.

1. Mass floors: Testing or parallel path calculation method if concrete is solid and uniform or isothermal planes calculation method if concrete has hollow sections.
2. Steel joist floors: Testing or modified zone calculation method.
3. Wood joist floors: Testing or parallel path calculation method or isothermal planes calculation method.
4. Other floors: Testing or two-dimensional calculation method.
5. Slab-on-grade floors: No testing or calculations allowed.

B2.0 Building envelope characteristics.

B2.1 Fenestration. All fenestration with *U*-factors, SHGC or visible light transmittance determined, certified, and labeled in accordance with NFRC 100, 200, and 300, respectively, as specified in Section B1.1.3 shall be assigned those values. *U*-factors (thermal transmittances) of fenestration products (windows, doors and skylights) shall be determined by an accredited, independent laboratory in accordance with National Fenestration Rating Council 100, *Procedure for Determining Fenestration Product U-Factors*. The solar heat gain coefficient (SHGC) for glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with National Fenestration Rating Council 200, *Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence*. Visible light transmittance shall be determined in accordance with NFRC 200 and shall be verified and certified by the manufacturer.

B2.1.1 Fenestration energy rating labels. Energy performance values (i.e. *U*-factor, solar heat gain coefficient) of fenestration products (i.e., windows, doors and skylights) shall be determined by an accredited, independent laboratory and labeled and certified by the manufacturer. Such certified and labeled fenestration energy ratings shall be accepted for the purposes of determining compliance with the building envelope requirements of this code.

B2.1.2 Unlabeled fenestrations. Where the specified energy performance (*U*-factor or solar heat gain coefficienet) of the fenestration product is not labeled nor readily apparent, the default procedures outlined in Tables B-6, B-7 and B-8 of this appendix for *U*-factor and SHGC shall be used to determine code compliance by Subchapter 4. Product features must be verifiable for the product to qualify for the default value associated with those features. Where the existence of a particular feature cannot be determined with reasonable certainty, the product shall not receive credit for that feature. Where a composite of materials from two different product types are used, the product shall be assigned the worst value.

B2.1.2.1 Unlabeled skylights. Unlabeled skylights shall be assigned the *U*-factors in Table B-6 and are allowed to use the SHGCs and visible light transmittances in Table B-7. The metal with thermal break frame category shall not be used unless all frame members have a thermal break equal to or greater than $^1/_4$ inch (6 mm).

B2.1.2.2 Unlabeled vertical fenestration. Unlabeled vertical fenestration, both operable and fixed, shall be assigned the *U*-factors, SHGCs, and visible light transmittances in Table B-8. No credit shall be given for any other features, including metal frames with thermal breaks, low-emissivity coatings, gas fillings, or insulating spacers, other than as determined in accordance with Section B1.1.3.

B2.1.3 Shading devices.

B2.1.3.1 Overhangs. Shading may be by recessing the glazing into the building structure by permanently mounted overhangs and projections or by permanently mounted sun shades with adequate air movement between the shading device and the fenestration. Complying overhangs shall be completely opaque and have the effect of being solid. Overhangs with slots, slats, grids and other openings are not considered if the sun can penetrate through at any occurring angle. Overhangs shall extend horizontally to points even with the left and right sides of the glazing.

B2.1.3.2 Shell buildings. Only those shading devices that are installed at the time of construction of the building shell shall be considered when determining compliance for shell buildings.

TABLE B-1
EMITTANCE VALUES OF VARIOUS SURFACES AND EFFECTIVE EMITTANCES OF AIR SPACES

Surface	Average Emittance *e*	Effective Emittance e eff of Air Space	
		One Surface *e*; Other, 0.9	Both Surfaces Emittance *e*
Aluminum foil,bright	0.05	0.05	0.03
Aluminum foil,with condensate just visible (> 0.7gr/ft^2)	0.3	0.29	—
Aluminum foil,with condensate clearly visible (> 2.9gr/ft^2)	0.7	0.65	—
Aluminum sheet	0.12	0.12	0.06
Aluminum coated paper, polished	0.2	0.2	0.11
Steel, galv., bright	0.25	0.24	0.15
Aluminum paint	0.5	0.47	0.35
Bldg materials: wood, paper, masonry, nonmetallic paints	0.9	0.82	0.82
Regular glass	0.84	0.77	0.72

TABLE B-2
R-VALUES FOR CAVITY AIR SPACES

Component	Airspace Thickness (in.)	*R*-Value, Effective Emissivity				
		0.03	0.05	0.20	0.50	0.82
Roof	0.5	2.13	2.04	1.54	1.04	0.77
	0.75	2.33	2.22	1.64	1.09	0.8
	1.5	2.53	2.41	1.75	1.13	0.82
	3.5	2.83	2.66	1.88	1.19	0.85
Wall	0.5	2.54	2.43	1.75	1.13	0.82
	0.75	3.58	3.32	2.18	1.3	0.9
	1.5	3.92	3.62	2.3	1.34	0.93
	3.5	3.67	3.4	2.21	1.31	0.91
Floor	0.5	2.55	1.28	1	0.69	0.53
	0.75	1.44	1.38	1.06	0.73	0.54
	1.5	2.49	2.38	1.76	1.15	0.85
	3.5	3.08	2.9	2.01	1.26	0.9

For SI: 1 inch = 25.4 mm.

TABLE B-3
EFFECTIVE *R*-VALUES FOR FIBERGLASS

INSULATION *R*-VALUE AT STANDARD THICKNESS									
Rated R-Value		38	30	22	21	19	15	13	11
Standard Thickness (in.)		12	9.5	6.5	5.5	6	3.5	3.5	3.5
Nominal Lumber Size (in.)	Actual Depth of Cavity (in.)	Effective insulation *r*-values when installed in a confined cavity							
2x12	11.25	37	—	—	—	—	—	—	—
2x10	9.25	32	30	—	—	—	—	—	—
2x8	7.25	27	26	22	21	19	—	—	—
2x6	5.5	—	21	20	21	18	—	—	—
2x4	3.5	—	—	14	—	13	15	13	11
	2.5	—	—	—	—	—	—	9.8	—
	1.5	—	—	—	—	—	—	6.3	6

For SI: 1 inch = 25.4 mm.

TABLE B-4
***R*-VALUES FOR BUILDING MATERIALS**

Material	Nominal Size (in.)	Actual Size (in.)	R-Value
Concrete and rubber pad	—	—	1.23
Concrete at R-0.0625/in.	—	2	0.13
	—	4	0.25
	—	6	0.38
	—	8	0.5
	—	10	0.63
	—	12	0.75
Flooring, wood subfloor	—	0.75	0.94
Gypsum board	—	0.5	0.45
	—	0.625	0.56
Metal deck	—	—	0
Roofing, built-up	—	0.375	0.33
Sheathing, vegetable fiber board, 0.78 in.	—	0.78	2.06
Soil at R-0.104/in.	—	12	1.25
Steel, mild	—	1	0.0031807
Stucco	—	0.75	0.08
Wood, 2 × 4 at R-1.25/in.	4	3.5	4.38
Wood, 2 × 6 at R-1.25/in.	6	5.5	6.88
Wood, 2 × 8 at R-1.25/in.	8	7.25	9.06
Wood, 2 × 10 at R-1.25/in.	10	9.25	11.56
Wood, 2 × 12 at R-1.25/in.	12	11.25	14.06
Wood, 2 × 14 at R-1.25/in.	14	13.25	16.56

For SI: 1 inch = 25.4 mm.

TABLE B-5
THERMAL CONDUCTIVITY OF CONCRETE BLOCK MATERIAL

Concrete Block Density in lb/ft^3	Thermal Conductivity in Btu·in./h·ft^2·°F
80	3.7
85	4.2
90	4.7
95	5.1
100	5.5
105	6.1
110	6.7
115	7.2
120	7.8
125	8.9
130	10
135	11.8
140	13.5

TABLE B-6
ASSEMBLY *U*-FACTORS FOR UNLABELED SKYLIGHTS

Product Type		Sloped Installation						
		Unlabeled Skylight with Curb (Includes glass/plastic, flat/domed, fixed/operable)				Unlabeled Skylight without Curb (Includes glass/plastic, flat/domed, fixed/operable)		
Frame Type		Aluminum without Thermal Break	Aluminum with Thermal Break	Reinforced Vinyl/ Aluminum Clad Wood	Wood/ Vinyl	Aluminum without Thermal Break	Aluminum with Thermal Break	Structural Glazing
ID	Glazing Type							
	SIngle Glazing							
1	1/8" glass	1.98	1.89	1.75	1.47	1.36	1.25	1.25
2	1/4" acrylic/polycarb	1.82	1.73	1.60	1.31	1.21	1.10	1.10
3	1/8" acrylic/polycarb	1.90	1.81	1.68	1.39	1.29	1.18	1.18
	Double Glazing							
4	1/4" airspace	1.31	1.11	1.05	0.84	0.82	0.70	0.66
5	1/2" airspace	1.30	1.10	1.04	0.84	0.81	0.69	0.65
6	1/4" argon space	1.27	1.07	1.00	0.80	0.77	0.66	0.62
7	1/2" argon space	1.27	1.07	1.00	0.80	0.77	0.66	0.62
	Double Glazing, *e* = 0.60 on surface 2 or 3							
8	1/4" airspace	1.27	1.08	1.01	0.81	0.78	0.67	0.63
9	1/2" airspace	1.27	1.07	1.00	0.80	0.77	0.66	0.62
10	1/4" argon space	1.23	1.03	0.97	0.76	0.74	0.63	0.58
11	1/2" argon space	1.23	1.03	0.97	0.76	0.74	0.63	0.58
	Double Glazing, *e* =0.40 on surface 2 or 3							
12	1/4" airspace	1.25	1.05	0.99	0.78	0.76	0.64	0.6
13	1/2" airspace	1.24	1.04	0.98	0.77	0.75	0.64	0.59
14	1/4" argon space	1.18	0.99	0.92	0.72	0.70	0.58	0.54
15	1/2" argon space	1.2	1	0.94	0.74	0.71	0.6	0.56
	Double Glazing, *e* = 0.20 on surface 2 or 3							
16	1/4" airspace	1.20	1.00	0.94	0.74	0.71	0.60	0.56
17	1/2" airspace	1.20	1.00	0.94	0.74	0.71	0.60	0.56
18	1/4" argon space	1.14	0.94	0.88	0.68	0.65	0.54	0.50
19	1/2" argon space	1.15	0.95	0.89	0.68	0.66	0.55	0.51
	Double Glazing, *e* = 0.10 on surface 2 or 3							
20	1/4" airspace	1.18	0.99	0.92	0.72	0.70	0.58	0.54
21	1/2" airspace	1.18	0.99	0.92	0.72	0.70	0.58	0.54
22	1/4" argon space	1.11	0.91	0.85	0.65	0.63	0.52	0.47
23	1/2" argon space	1.13	0.93	0.87	0.67	0.65	0.53	0.49
	Double Glazing, *e* = 0.05 on surface 2 or 3							
24	1/4" airspace	1.17	0.97	0.91	0.70	0.68	0.57	0.52
25	1/2" airspace	1.17	0.98	0.91	0.71	0.69	0.58	0.53
26	1/4" argon space	1.09	0.89	0.83	0.63	0.61	0.50	0.45
27	1/2" argon space	1.11	0.91	0.85	0.65	0.63	0.52	0.47
	Triple Glazing							
28	1/4" airspaces	1.12	0.89	0.84	0.64	0.64	0.53	0.48
29	1/2" airspaces	1.10	0.87	0.81	0.61	0.62	0.51	0.45
30	1/4" argon spaces	1.09	0.86	0.80	0.60	0.61	0.50	0.44
31	1/2" argon spaces	1.07	0.84	0.79	0.59	0.59	0.48	0.42
	Triple Glazing, e=0.20 on surface 2,3,4, or 5							
32	1/4" airspaces	1.08	0.85	0.79	0.59	0.60	0.49	0.43
33	1/2" airspaces	1.05	0.82	0.77	0.57	0.57	0.46	0.41
34	1/4" argon spaces	1.02	0.79	0.74	0.54	0.55	0.44	0.38
35	1/2" argon spaces	1.01	0.78	0.73	0.53	0.54	0.43	0.37
	Triple Glazing, e=0.20 on surfaces 2 or 3 and 4 or 5							
36	1/4" airspaces	1.03	0.80	0.75	0.55	0.56	0.45	0.39
37	1/2" airspaces	1.01	0.78	0.73	0.53	0.54	0.43	0.37
38	1/4" argon spaces	0.99	0.75	0.70	0.50	0.51	0.40	0.35
39	1/2" argon spaces	0.97	0.74	0.69	0.49	0.50	0.39	0.33
	Triple Glazing, e=0.10 on surfaces 2 or 3 and 4 or 5							
40	1/4" airspaces	1.01	0.78	0.73	0.53	0.54	0.43	0.37
41	1/2" airspaces	0.99	0.76	0.71	0.51	0.52	0.41	0.36
42	1/4" argon spaces	0.96	0.73	0.68	0.48	0.49	0.38	0.32
43	1/2" argon spaces	0.95	0.72	0.67	0.47	0.48	0.37	0.31
	Quadruple Glazing, e=0.10 on surfaces 2 or 3 and 4 or 5							
44	1/4" airspaces	0.97	0.74	0.69	0.49	0.50	0.39	0.33
45	1/2" airspaces	0.94	0.71	0.66	0.46	0.47	0.36	0.30
46	1/4" argon spaces	0.93	0.70	0.65	0.45	0.46	0.35	0.30
47	1/2" argon spaces	0.91	0.68	0.63	0.43	0.44	0.33	0.28
48	1/4" krypton spaces	0.88	0.65	0.60	0.40	0.42	0.31	0.25

For SI: 1 inch = 25.4 mm.

TABLE B-7
ASSEMBLY SOLAR HEAT GAIN COEFFICIENTS (SHGC) AND ASSEMBLY VISIBLE LIGHT TRANSMITTANCES (VLT) FOR UNLABELED SKYLIGHTS

Glass Type	Glazing Type: Number of glazing layers Number & emissivity of coatings (glazing is glass except where noted)	Unlabeled Skylights (includes glass/plastic, flat/domed, fixed/operable)					
	Frame	Metal without thermal break		Metal with thermal break		Wood/vinyl/ fiberglass	
	Characteristic	SHGC	VLT	SHGC	VLT	SHGC	VLT
Clear	Single glazing, 1/8 in. glass	0.82	0.76	0.78	0.76	0.73	0.73
	Single glazing, 1/4 in. glass	0.78	0.75	0.74	0.75	0.69	0.72
	Single glazing, acrylic/polycarbonate	0.83	0.92	0.83	0.92	0.83	0.92
	Double glazing	0.68	0.66	0.64	0.66	0.59	0.64
	Double glazing, E=0.40 on surface 2 or 3	0.71	0.65	0.67	0.65	0.62	0.63
	Double glazing, E=0.20 on surface 2 or 3	0.66	0.61	0.62	0.61	0.57	0.59
	Double glazing, E=0.10 on surface 2 or 3	0.59	0.63	0.55	0.63	0.51	0.61
	Double glazing, acrylic/polycarbonate	0.77	0.89	0.77	0.89	0.77	0.89
	Triple glazing	0.60	0.59	0.56	0.59	0.52	0.57
	Triple glazing, E=0.40 on surface 2, 3, 4, or 5	0.64	0.60	0.60	0.60	0.56	0.57
	Triple glazing, E=0.20 on surface 2, 3, 4, or 5	0.59	0.55	0.55	0.55	0.51	0.53
	Triple glazing, E=0.10 on surface 2, 3, 4, or 5	0.54	0.56	0.50	0.56	0.46	0.54
	Triple glazing, E=0.40 on surfaces 3 and 5	0.62	0.57	0.58	0.57	0.53	0.55
	Triple glazing, E=0.20 on surfaces 3 and 5	0.56	0.51	0.52	0.51	0.48	0.49
	Triple glazing, E=0.10 on surfaces 3 and 5	0.47	0.54	0.43	0.54	0.40	0.52
	Triple glazing, acrylic/polycarbonate	0.71	0.85	0.71	0.85	0.71	0.85
	Quadruple glazing, E=0.10 on surfaces 3 and 5	0.41	0.48	0.37	0.48	0.33	0.46
	Quadruple glazing, acrylic/polycarbonate	0.65	0.81	0.65	0.81	0.65	0.81
Tinted	Single glazing, 1/8 in. glass	0.70	0.58	0.66	0.58	0.62	0.56
	Single glazing, 1/4 in. glass	0.61	0.45	0.56	0.45	0.52	0.44
	Single glazing, acrylic/polycarbonate	0.46	0.27	0.46	0.27	0.46	0.27
	Double glazing	0.50	0.40	0.46	0.40	0.42	0.39
	Double glazing, E=0.40 on surface 2 or 3	0.59	0.50	0.55	0.50	0.50	0.48
	Double glazing, E=0.20 on surface 2 or 3	0.47	0.37	0.43	0.37	0.39	0.36
	Double glazing, E=0.10 on surface 2 or 3	0.43	0.38	0.39	0.38	0.35	0.37
	Double glazing, acrylic/polycarbonate	0.37	0.25	0.37	0.25	0.37	0.25
	Triple glazing	0.42	0.22	0.37	0.22	0.34	0.21
	Triple glazing, E=0.40 on surface 2, 3, 4, or 5	0.53	0.45	0.49	0.45	0.45	0.44
	Triple glazing, E=0.20 on surface 2, 3, 4, or 5	0.42	0.33	0.38	0.33	0.35	0.32
	Triple glazing, E=0.10 on surface 2, 3, 4, or 5	0.39	0.34	0.35	0.34	0.31	0.33
	Triple glazing, E=0.40 on surfaces 3 and 5	0.51	0.43	0.47	0.43	0.43	0.42
	Triple glazing, E=0.20 on surfaces 3 and 5	0.40	0.31	0.36	0.31	0.32	0.29
	Triple glazing, E=0.10 on surfaces 3 and 5	0.34	0.32	0.30	0.32	0.27	0.31
	Triple glazing, acrylic/polycarbonate	0.30	0.23	0.30	0.23	0.30	0.23
	Quadruple glazing, E=0.10 on surfaces 3 and 5	0.30	0.29	0.26	0.29	0.23	0.28
	Quadruple glazing, acrylic/polycarbonate	0.27	0.25	0.27	0.25	0.27	0.25

For SI: 1 inch = 25.4 mm.

TABLE B-8
ASSEMBLY *U*-FACTORS, ASSEMBLY SOLAR HEAT GAIN COEFFICIENTS (SHGC), AND ASSEMBLY VISIBLE LIGHT TRANSMITTANCES (VLT) FOR UNLABELED VERTICAL FENESTRATION

	Unlabeled Vertical Fenestration					
	Clear Glass			Tinted Glass		
	U-Factor	SHGC	VLT	*U*-Factor	SHGC	VLT
All frame types						
Single glazing	1.25	0.82	0.76	1.25	0.70	0.58
Glass block	0.60	0.56	0.56	n.a.	n.a.	n.a.
Wood, vinyl, or fiberglass frame						
Double glazing	0.60	0.59	0.64	0.60	0.42	0.39
Triple glazing	0.45	0.52	0.57	0.45	0.34	0.21
Metal and other frame types						
Double glazing	0.90	0.68	0.66	0.90	0.50	0.40
Triple glazing	0.70	0.60	0.59	0.70	0.42	0.22

B2.2 Walls.

B2.2.1 Above-grade walls.

B2.2.1.1 Mass wall. *U*-factors for mass walls shall be taken from Table B-9 or determined by the procedure in this subsection. It is acceptable to use the *U*-factors in Table B-9 for all mass walls, provided that the grouting is equal to or less than that specified. Heat capacity for mass walls shall be taken from Table B-10 or B-11.

Exception: *U*-factors for mass walls determined in accordance with Section B2.2.1.1.3.

B2.2.1.1.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a masonry or concrete wall. Continuous insulation is installed on the interior, exterior, or within the masonry units, or it is installed on the interior or exterior of the concrete. The *U*-factor includes R-0.17 for exterior air film and R-0.68 for interior air film, vertical surfaces. For insulated walls, the *U*-factor also includes R-0.45 for $^1/_2$-inch (12.7 mm) gypsum board. *U*-factors are provided for the following configurations:

a. Concrete wall: 8 inches (203 mm) normal weight concrete wall with a density of 145 pound per cubic foot (2323 kg/m^3).

b. Solid grouted concrete block wall: 8 inches (203 mm) medium weight ASTM C 90 concrete block with a density of 115 pound per cubic foot (1842 kg/m^3) and solid grouted cores.

c. Partially grouted concrete block wall: 8 inches (205 mm) medium weight ASTM C 90 concrete block with a density of 115 pound per cubic foot (1842 kg/m^3) having reinforcing steel every 32 inches (812 mm) vertically and every 48 inches (1219 mm) horizontally, with cores grouted in those areas only. Other cores are filled with insulating material only if there is no other insulation.

B2.2.1.1.2 Mass wall rated *R*-value of insulation.

B2.2.1.1.2.1 Mass wall heat capacity shall be determined from Table B-10 or B-11.

B2.2.1.1.2.2 The rated *R*-value of insulation is for continuous insulation uninterrupted by framing other than 20 gauge 1-inch metal clops spaced no closer than 24 inches on center (609 mm) horizontally and 16 inches on center (406 mm) vertically.

B2.2.1.1.2.3 Where other framing, including metal and wood studs, is used, compliance shall be based on the maximum assembly *U*-factor.

B2.2.1.1.2.4 Where rated *R*-value of insulation is used for concrete sandwich panels, the insulation shall be continuous throughout the entire panel.

B2.2.1.1.3 Mass wall *U*-factor.

B2.2.1.1.3.1 *U*-factors for mass walls shall be taken from Table B-10 or determined by the procedure in this subsection. It is acceptable to use the *U*-factors in Table B-9 for all mass walls, provided that the grouting is equal to or less than that specified. Heat capacity for mass walls shall be taken from Table B-10 or B-11.

Exception: For mass walls, where the requirement is for a maximum assembly U-0.151, ASTM C 90 concrete block walls, ungrouted or partially grouted at 32 inches (812 mm) or less on center vertically and 48 inches (1219 mm) or less on center horizontally, shall have ungrouted cores filled with material having a maximum thermal conductivity of 0.44 Btu in./h ft^2°F. Other mass walls with integral insulation shall meet the criteria when their *U*-factors are equal to or less than those for the appropriate thickness and density in the "Partly Grouted Cells Insulated" column of Table B-11.

TABLE B-9
ASSEMBLY *U*-FACTORS FOR ABOVE-GRADE CONCRETE WALLS AND MASONRY WALLS

Framing Type and Depth	Rated *R*-Value of Insulation Alone	Assembly *U*-Factors for 8 in. Normal Weight 145 lb/ft^3 Solid Concrete Walls	Assembly *U*-Factors for 8 in. Medium Weight 115 lb/ft^3 Concrete Block Walls: Solid Grouted	Assembly *U*-Factors for 8 in. Medium Weight 115 lb/ft^3 Concrete Block Walls: Partially Grouted (cores uninsulated except where specified)
No Framing	R-0	U-0.740	U-0.580	U-0.480
	Ungrouted Cores Filled with Loose-fill insulation	N.A.	N.A.	U-0.350
Continuous metal framing at 24 in. on center horizontally				
3.5 in.	R-11.0	U-0.168	U-0.158	U-0.149
3.5 in.	R-13.0	U-0.161	U-0.152	U-0.144
3.5 in.	R-15.0	U-0.155	U-0.147	U-0.140
4.5 in.	R-17.1	U-0.133	U-0.126	U-0.121
4.5 in.	R-22.5	U-0.124	U-0.119	U-0.114
4.5 in.	R-25.2	U-0.122	U-0.116	U-0.112
5.0 in.	R-19.0	U-0.122	U-0.117	U-0.112
5.0 in.	R-25.0	U-0.115	U-0.110	U-0.106
5.0 in.	R-28.0	U-0.112	U-0.107	U-0.103
5.5 in.	R-19.0	U-0.118	U-0.113	U-0.109
5.5 in.	R-20.9	U-0.114	U-0.109	U-0.105
5.5 in.	R-21.0	U-0.113	U-0.109	U-0.105
5.5 in.	R-27.5	U-0.106	U-0.102	U-0.099
5.5 in.	R-30.8	U-0.104	U-0.100	U-0.096
6.0 in.	R-22.8	U-0.106	U-0.102	U-0.098
6.0 in.	R-30.0	U-0.099	U-0.095	U-0.092
6.0 in.	R-33.6	U-0.096	U-0.093	U-0.090
6.5 in.	R-24.7	U-0.099	U-0.096	U-0.092
7.0 in.	R-26.6	U-0.093	U-0.090	U-0.087
7.5 in.	R-28.5	U-0.088	U-0.085	U-0.083
8.0 in.	R-30.4	U-0.083	U-0.081	U-0.079
1 in. metal clips at 24 in. on center horizontally and 16 in. vertically				
1.0 in.	R-3.8	U-0.210	U-0.195	U-0.182
1.0 in.	R-5.0	U-0.184	U-0.172	U-0.162
1.0 in.	R-5.6	U-0.174	U-0.163	U-0.154
1.5 in.	R-5.7	U-0.160	U-0.151	U-0.143
1.5 in.	R-7.5	U-0.138	U-0.131	U-0.125
1.5 in.	R-8.4	U-0.129	U-0.123	U-0.118
2.0 in.	R-7.	U-0.129	U-0.123	U-0.118
2.0 in.	R-10.0	U-0.110	U-0.106	U-0.102
2.0 in.	R-11.2	U-0.103	U-0.099	U-0.096
2.5 in.	R-9.5	U-0.109	U-0.104	U-0.101
2.5 in.	R-12.5	U-0.092	U-0.089	U-0.086
2.5 in.	R-14.0	U-0.086	U-0.083	U-0.080
3.0 in.	R-11.4	U-0.094	U-0.090	U-0.088
3.0 in.	R-15.0	U-0.078	U-0.076	U-0.074
3.0 in.	R-16.8	U-0.073	U-0.071	U-0.069
3.5 in.	R-13.3	U-0.082	U-0.080	U-0.077
3.5 in	R-17.5	U-0.069	U-0.067	U-0.065
3.5 in.	R-19.6	U-0.064	U-0.062	U-0.061

(continued)

TABLE B-9 - continued
ASSEMBLY *U*-FACTORS FOR ABOVE-GRADE CONCRETE WALLS AND MASONRY WALLS

Framing Type and Depth	Rated *R*-Value of Insulation Alone	Assembly *U*-Factors for 8 in. Normal Weight 145 lb/ft^3 Solid Concrete Walls	Assembly *U*-Factors for 8 in., Medium Weight 115 lb/ft^3 Concrete Block Walls: Solid Grouted	Assembly *U*-Factors for 8 in. Medium Weight 115 lb/ft^3 Concrete Block Walls: Partially Grouted (cores uninsulated except where specified)
No Framing	R-0	U-0.740	U-0.580	U-0.480
	Ungrouted Cores Filled with Loose-fill insulation	N.A.	N.A.	U-0.350
1 in. metal clips at 24 in. on center horizontally and 16 in. vertically				
4.0 in	R-15.2	U-0.073	U-0.071	U-0.070
4.0 in.	R-20.0	U-0.061	U-0.060	U-0.058
4.0 in.	R-22.4	U-0.057	U-0.056	U-0.054
5.0 in	R-28.0	U-0.046	U-0.046	U-0.045
6.0 in.	R-33.6	U-0.039	U-0.039	U-0.038
7.0 in.	R-39.2	U-0.034	U-0.034	U-0.033
8.0 in.	R-44.8	U-0.030	U-0.030	U-0.029
9.0 in.	R-50.4	U-0.027	U-0.027	U-0.026
10.0 in.	R-56.0	U-0.024	U-0.024	U-0.024
11.0 in.	R-61.6	U-0.022	U-0.022	U-0.022
Continuous insulation uninterrupted by framing				
No Framing	R-1.0	U-0.425	U-0.367	U-0.324
No Framing	R-2.0	U-0.298	U-0.269	U-0.245
No Framing	R-3.0	U-0.230	U-0.212	U-0.197
No Framing	R-4.0	U-0.187	U-0.175	U-0.164
No Framing	R-5.0	U-0.157	U-0.149	U-0.141
No Framing	R-6.0	U-0.136	U-0.129	U-0.124
No Framing	R-7.0	U-0.120	U-0.115	U-0.110
No Framing	R-8.0	U-0.107	U-0.103	U-0.099
No Framing	R-9.0	U-0.097	U-0.093	U-0.090
No Framing	R-10.0	U-0.088	U-0.085	U-0.083
No Framing	R-11.0	U-0.081	U-0.079	U-0.076
No Framing	R-12.0	U-0.075	U-0.073	U-0.071
No Framing	R-13.0	U-0.070	U-0.068	U-0.066
No Framing	R-14.0	U-0.065	U-0.064	U-0.062
No Framing	R-15.0	U-0.061	U-0.060	U-0.059
No Framing	R-16.0	U-0.058	U-0.056	U-0.055
No Framing	R-17.0	U-0.054	U-0.053	U-0.052
No Framing	R-18.0	U-0.052	U-0.051	U-0.050
No Framing	R-19.0	U-0.049	U-0.048	U-0.047
No Framing	R-20.0	U-0.047	U-0.046	U-0.045
No Framing	R-21.0	U-0.045	U-0.044	U-0.043
No Framing	R-22.0	U-0.043	U-0.042	U-0.042
No Framing	R-23.0	U-0.041	U-0.040	U-0.040
No Framing	R-24.0	U-0.039	U-0.039	U-0.038
No Framing	R-25.0	U-0.038	U-0.037	U-0.037
No Framing	R-30.0	U-0.032	U-0.032	U-0.031
No Framing	R-35.0	U-0.028	U-0.027	U-0.027
No Framing	R-40.0	U-0.024	U-0.024	U-0.024
No Framing	R-45.0	U-0.022	U-0.021	U-0.021
No Framing	R-50.0	U-0.019	U-0.019	U-0.019
No Framing	R-55.0	U-0.018	U-0.018	U-0.018
No Framing	R-60.0	U-0.016	U-0.016	U-0.016

For SI: 1 inch = 25.4 mm, 1 pound per cubic foot = 16.02 kg/m^3

TABLE B-10
ASSEMBLY *U*-FACTORS, C-FACTORS, R_u, R_c, AND HEAT CAPACITY FOR CONCRETE

Density in lb/ft^3	Properties	Thickness in Inches									
		3	4	5	6	7	8	9	10	11	12
20	*U*-factor	0.22	0.17	0.14	0.12	0.10	0.09	0.08	0.07	0.07	0.06
	C-factor	0.27	0.20	0.16	0.13	0.11	0.10	0.09	0.08	0.07	0.07
	R_u	4.60	5.85	7.10	8.35	9.60	10.85	12.10	13.35	14.60	15.85
	R_c	3.75	5.00	6.25	7.50	8.75	10.00	11.25	12.50	13.75	15.00
	HC	1.0	1.3	1.7	2.0	2.3	2.7	3.0	3.3	3.7	4.0
30	*U*-factor	0.28	0.22	0.19	0.16	0.14	0.12	0.11	0.10	0.09	0.09
	C-factor	0.37	0.28	0.22	0.18	0.16	0.14	0.12	0.11	0.10	0.09
	R_u	3.58	4.49	5.40	6.30	7.21	8.12	9.03	9.94	10.85	11.76
	R_c	2.73	3.64	4.55	5.45	6.36	7.27	8.18	9.09	10.00	10.91
	HC	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
40	*U*-factor	0.33	0.27	0.23	0.19	0.17	0.15	0.14	0.13	0.11	0.11
	C-factor	0.47	0.35	0.28	0.23	0.20	0.18	0.16	0.14	0.13	0.12
	R_u	2.99	3.71	4.42	5.14	5.85	6.56	7.28	7.99	8.71	9.42
	R_c	2.14	2.86	3.57	4.29	5.00	5.71	6.43	7.14	7.86	8.57
	HC	2.0	2.7	3.3	4.0	4.7	5.3	6.0	6.7	7.3	8.0
50	*U*-factor	0.38	0.31	0.26	0.23	0.20	0.18	0.16	0.15	0.14	0.13
	C-factor	0.57	0.43	0.34	0.28	0.24	0.21	0.19	0.17	0.15	0.14
	R_u	2.61	3.2	3.79	4.38	4.97	5.56	6.14	6.73	7.32	7.91
	R_c	1.76	2.35	2.94	3.53	4.12	4.71	5.29	5.88	6.47	7.06
	HC	2.5	3.3	4.2	5.0	5.8	6.7	7.5	8.3	9.2	10.0
85	*U*-factor	0.65	0.56	0.50	0.44	0.40	0.37	0.34	0.31	0.29	0.27
	C-factor	1.43	1.08	0.86	0.71	0.61	0.54	0.48	0.43	0.39	0.36
	R_u	1.55	1.78	2.01	2.25	2.48	2.71	2.94	3.18	3.41	3.64
	R_c	0.70	0.93	1.16	1.40	1.63	1.86	2.09	2.33	2.56	2.79
	HC	4.3	5.7	7.1	8.5	9.9	11.3	12.8	14.2	15.6	17.0
95	*U*-factor	0.72	0.64	0.57	0.52	0.48	0.44	0.41	0.38	0.36	0.33
	C-factor	1.85	1.41	1.12	0.93	0.80	0.70	0.62	0.56	0.51	0.47
	R_u	1.39	1.56	1.74	1.92	2.10	2.28	2.46	2.64	2.81	2.99
	R_c	0.54	0.71	0.89	1.07	1.25	1.43	1.61	1.79	1.96	2.14
	HC	4.8	6.3	7.9	9.5	11.1	12.7	14.3	15.8	17.4	19.0
105	*U*-factor	0.79	0.71	0.65	0.59	0.54	0.51	0.47	0.44	0.42	0.39
	C-factor	2.38	1.79	1.43	1.18	1.01	0.88	0.79	0.71	0.65	0.59
	R_u	1.27	1.41	1.56	1.70	1.84	1.98	2.12	2.26	2.40	2.54
	R_c	0.42	0.56	0.70	0.85	0.99	1.13	1.27	1.41	1.55	1.69
	HC	5.3	7.0	8.8	10.5	12.3	14.0	15.8	17.5	19.3	21.0
115	*U*-factor	0.84	0.77	0.70	0.65	0.61	0.57	0.53	0.50	0.48	0.45
	C-factor	2.94	2.22	1.75	1.47	1.25	1.10	0.98	0.88	0.80	0.74
	R_u	1.19	1.30	1.42	1.53	1.65	1.76	1.87	1.99	2.10	2.21
	R_c	0.34	0.45	0.57	0.68	0.80	0.91	1.02	1.14	1.25	1.36
	HC	5.8	7.7	9.6	11.5	13.4	15.3	17.3	19.2	21.1	23.0

(continued)

TABLE B-10 - continued
ASSEMBLY *U*-FACTORS, C-FACTORS, R_u, R_c, and HEAT CAPACITY FOR CONCRETE

125	*U*-factor	0.88	0.82	0.76	0.71	0.67	0.63	0.60	0.56	0.53	0.51
	C-factor	3.57	2.70	2.17	1.79	1.54	1.35	1.20	1.08	0.98	0.90
	R_u	1.13	1.22	1.31	1.41	1.50	1.59	1.68	1.78	1.87	1.96
	R_c	0.28	0.37	0.46	0.56	0.65	0.74	0.83	0.93	1.02	1.11
	HC	6.3	8.3	10.4	12.5	14.6	16.7	18.8	20.8	22.9	25.0
135	*U*-factor	0.93	0.87	0.82	0.77	0.73	0.69	0.66	0.63	0.60	0.57
	C-factor	4.55	3.33	2.70	2.22	1.92	1.67	1.49	1.33	1.22	1.11
	R_u	1.07	1.15	1.22	1.30	1.37	1.45	.52	1.60	1.67	1.75
	R_c	0.22	0.30	0.37	0.45	0.52	0.60	0.67	0.75	0.82	0.90
	HC	6.8	9.0	11.3	13.5	15.8	18.0	20.3	22.5	24.8	27.0
144	*U*-factor	0.96	0.91	0.86	0.81	0.78	0.74	0.71	0.68	0.65	0.63
	C-factor	5.26	4.00	3.23	2.63	2.27	2.00	1.79	1.59	1.45	1.33
	R_u	1.04	1.10	1.16	1.23	1.29	1.35	1.41	1.48	1.54	1.60
	R_c	0.19	0.25	0.31	0.38	0.44	0.50	0.56	0.63	0.69	0.75
	HC	7.2	9.6	12.0	14.4	16.8	19.2	21.6	24.0	26.4	28.8

For SI: 1 inch = 25.4 mm, 1 pound per cubic feet = 16.02 kg/m^3.

The *U*-factors and R_u include standard air film resistances.

The C-factors and R_c are for the same assembly without air film resistances.

Note that the following assemblies do not qualify as a mass wall or mass floor: 3-inch-thick concrete with densities of 85, 95, 125 and 135 lbs/ft^3.

B2.2.1.1.3.2 Determination of mass wall *U*-factors. If not taken from Table B-9, mass wall *U*-factors shall be determined from Tables B-10, B-11, and B-12 using the following procedure.

a. If the mass wall is uninsulated or only the cells are insulated:
   1. For concrete walls, determine the *U*-factor from Table B-10 based on the concrete density and wall thickness.
   2. For concrete block walls, determine the *U*-factor from Table B-11 based on the block size, concrete density, degree of grouting in the cells, and whether the cells are insulated.

b. If the mass wall has additional insulation:
   1. For concrete walls, determine the *Ru* from Table B-10 based on the concrete density and wall thickness. Next, determine the effective *R*-value for the insulation/ framing layer from Table B-12 based on the rated *R*-value of insulation installed, the thickness of the insulation, and whether it is installed between wood or metal framing or with no framing. Then, determine the *U*-factor by adding the *Ru* and the effective *R*-value together and taking the inverse of the total.
   2. For concrete block walls, determine the *Ru* from Table B-11 based on the block size, concrete density, degree of grouting in the cells, and whether the cells are insulated. Next, determine the effective *R*-value for the insulation/framing layer from Table B-12 based on the rated *R*-value of insulation installed, the thickness of the insulation, and whether it is installed between wood or metal framing or with no framing. Then, determine the *U*-factor by adding the *Ru* and the effective *R*-value together and taking the inverse of the total.

B2.2.1.2 Metal building walls.

B2.2.1.2.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a wall where the insulation is compressed between metal wall panels and the metal structure. Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing.

B2.2.1.2.2 Rated *R*-value of insulation for metal building walls.

B2.2.1.2.2.1 The first *rated R-value of insulation* is for insulation compressed between metal wall panels and the steel structure.

B2.2.1.2.2.2 For double-layer installations, the second *rated R-value of insulation* is for insulation installed from the inside, covering the girts.

TABLE B-11
ASSEMBLY *U*-FACTORS, C-FACTORS, R_U, R_C, AND HEAT CAPACITY FOR CONCRETE BLOCK WALLS

Density lb./ft.^{3}	Properties	Concrete Block Grouting and Cell Treatment				
		Solid grouted	Partly Grouted, Cells Empty	Partly Grouted, Cells Insulated	Unreinforced, Cells Empty	Unreinforced, Cells Insulated
6 in. block						
85	*U*-factor	0.57	0.46	0.34	0.4	0.2
	C-factor	1.11	0.75	0.47	0.6	0.23
	R_u	1.75	2.18	2.97	2.52	5.13
	R_c	0.90	1.33	2.12	1.67	4.28
	HC	10.9	6.7	7	4.2	4.6
95	*U*-factor	0.61	0.49	0.36	0.42	0.22
	C-factor	1.25	0.83	0.53	0.65	0.27
	R_u	1.65	2.06	2.75	2.38	4.61
	R_c	0.80	1.21	1.90	1.53	3.76
	HC	11.4	7.2	7.5	4.7	5.1
105	*U*-factor	0.64	0.51	0.39	0.44	0.24
	C-factor	1.38	0.91	0.58	0.71	0.3
	R_u	1.57	1.95	2.56	2.26	4.17
	R_c	0.72	1.1	1.71	1.41	3.32
	HC	11.9	7.7	7.9	5.1	5.6
115	*U*-factor	0.66	0.54	0.41	0.46	0.26
	C-factor	1.52	0.98	0.64	0.76	0.34
	R_u	1.51	1.87	2.41	2.16	3.79
	R_c	0.66	1.02	1.56	1.31	2.94
	HC	12.3	8.1	8.4	5.6	6
125	*U*-factor	0.70	0.56	0.45	0.49	0.30
	C-factor	1.70	1.08	0.73	0.84	0.4
	R_u	1.44	1.78	2.23	2.04	3.38
	R_c	0.59	0.93	1.38	1.19	2.53
	HC	12.8	8.6	8.8	6.0	6.5
135	*U*-factor	0.73	0.6	0.49	0.53	0.35
	C-factor	1.94	1.23	0.85	0.95	0.49
	R_u	1.36	1.67	2.02	1.9	2.89
	R_c	0.51	0.82	1.17	1.05	2.04
	HC	13.2	9	9.3	6.5	6.9
8 in. block						
85	*U*-factor	0.49	0.41	0.28	0.37	0.15
	C-factor	0.85	0.63	0.37	0.53	0.17
	R_u	2.03	2.43	3.55	2.72	6.62
	R_c	1.18	1.58	2.7	1.87	5.77
	HC	15	9	9.4	5.4	6
95	*U*-factor	0.53	0.44	0.31	0.39	0.17
	C-factor	0.95	0.7	0.41	0.58	0.2
	R_u	1.9	2.29	3.27	2.57	5.92
	R_c	1.05	1.44	2.42	1.72	5.07
	HC	15.5	9.6	10	6	6.6

(continued)

TABLE B-11 - continued
ASSEMBLY *U*-FACTORS, C-FACTORS, R_U, R_C, AND HEAT CAPACITY FOR CONCRETE BLOCK WALLS

8 in. block (continued)						
105	*U*-factor	0.55	0.46	0.33	0.41	0.19
	C-factor	1.05	0.76	0.46	0.63	0.22
	R_u	1.81	2.17	3.04	2.44	5.32
	R_c	0.96	1.32	2.19	1.59	4.47
	HC	16.1	10.2	10.6	6.6	7.2
115	*U*-factor	0.58	0.48	0.35	0.43	0.21
	C-factor	1.14	0.82	0.5	0.68	0.25
	R_u	1.72	2.07	2.84	2.33	4.78
	R_c	0.87	1.22	1.99	1.48	3.93
	HC	16.7	10.8	11.2	7.2	7.8
125	*U*-factor	0.61	0.51	0.38	0.45	0.24
	C-factor	1.27	0.9	0.57	0.74	0.3
	R_u	1.64	1.96	2.62	2.2	4.2
	R_c	0.79	1.11	1.77	1.35	3.35
	HC	17.3	11.4	11.8	7.8	8.4
135	*U*-factor	0.65	0.55	0.42	0.49	0.28
	C-factor	1.44	1.02	0.67	0.83	0.37
	R_u	1.54	1.83	2.35	2.05	3.55
	R_c	0.69	0.98	1.50	1.2	2.70
	HC	17.9	12.0	12.4	8.4	9.0
10 in. block						
85	*U*-factor	0.44	0.38	0.25	0.35	0.13
	C-factor	0.70	0.57	0.31	0.50	0.14
	R_u	2.29	2.61	4.05	2.84	7.87
	R_c	1.44	1.76	3.20	1.99	7.02
	HC	19.0	11.2	11.7	6.50	7.30
95	*U*-factor	0.47	0.41	0.27	0.37	0.14
	C-factor	0.77	0.62	0.35	0.55	0.16
	R_u	2.15	2.46	3.73	2.67	6.94
	R_c	1.30	1.61	2.88	1.82	6.09
	HC	19.7	11.9	12.4	7.3	8.10
105	*U*-factor	0.49	0.43	0.29	0.39	0.16
	C-factor	0.85	0.68	0.39	0.59	0.19
	R_u	2.03	2.33	3.45	2.54	6.17
	R_c	1.18	1.48	2.60	1.69	5.32
	HC	20.4	12.6	13.1	8.00	8.80
115	*U*-factor	0.52	0.45	0.31	0.41	0.18
	C-factor	0.92	0.73	0.42	0.64	0.21
	R_u	1.94	2.22	3.21	2.42	5.52
	R_c	1.09	1.37	2.36	1.57	4.67
	HC	21.1	13.4	13.9	8.70	9.50
125	*U*-factor	0.54	0.48	0.34	0.44	0.21
	C-factor	1.01	0.80	0.48	0.70	0.25
	R_u	1.84	2.10	2.95	2.28	4.81
	R_c	0.99	1.25	2.10	1.43	3.96
	HC	21.8	14.1	14.6	9.40	10.2

(continued)

TABLE B-11 - continued
ASSEMBLY *U*-FACTORS, C-FACTORS, R_U, R_C, AND HEAT CAPACITY FOR CONCRETE BLOCK WALLS

10 in. block (continued)						
135	*U*-factor	0.58	0.51	0.38	0.47	0.25
	C-factor	1.14	0.90	0.56	0.79	0.32
	R_u	1.72	1.96	2.64	2.12	4.00
	R_c	0.87	1.11	1.79	1.27	3.15
	HC	22.6	14.8	15.3	10.2	11.0
12 in. block						
85	*U*-factor	0.40	0.36	0.22	0.34	0.11
	C-factor	0.59	0.52	0.27	0.48	0.12
	R_u	2.53	2.77	4.59	2.93	9.43
	R_c	1.68	1.92	3.74	2.08	8.58
	HC	23.1	13.3	14.0	7.50	8.50
95	*U*-factor	0.42	0.38	0.24	0.36	0.12
	C-factor	0.66	0.57	0.30	0.52	0.13
	R_u	2.30	2.60	4.22	2.76	8.33
	R_c	1.53	1.75	3.37	1.91	7.48
	HC	23.9	14.2	14.8	8.30	9.30
105	*U*-factor	0.44	0.41	0.26	0.38	0.14
	C-factor	0.71	0.62	0.33	0.57	0.15
	R_u	2.25	2.47	3.90	2.62	7.35
	R_c	1.40	1.62	3.05	1.77	6.50
	HC	24.7	15.0	15.6	9.10	10.2
115	*U*-factor	0.47	0.42	0.28	0.40	0.15
	C-factor	0.77	0.66	0.36	0.61	0.18
	R_u	2.15	2.36	3.63	2.49	6.54
	R_c	1.30	1.51	2.78	1.64	5.69
	HC	25.6	15.8	16.4	10.0	11.0
125	*U*-factor	0.49	0.45	0.30	0.42	0.18
	C-factor	0.84	0.72	0.40	0.66	0.21
	R_u	2.04	2.23	3.34	2.36	5.68
	R_c	1.19	1.38	2.49	1.51	4.83
	HC	26.4	16.6	17.3	10.8	11.8
135	*U*-factor	0.52	0.48	0.34	0.46	0.21
	C-factor	0.94	0.81	0.47	0.74	0.26
	R_u	1.91	2.08	2.98	2.19	4.67
	R_c	1.06	1.23	2.13	1.34	3.82
	HC	27.2	17.5	18.1	11.60	12.6

For SI: 1 inch = 25.4 mm.

TABLE B-12
EFFECTIVE *R*-VALUES FOR INSULATION/FRAMING LAYERS ADDED TO ABOVE-GRADE MASS WALLS AND BELOW-GRADE WALLS

Depth (in.)	Framing Type	Rated *R*-Value of Insulation																									
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
		Effective R-value if continuous insulation uninterrupted by framing (includes gypsun board)																									
	None	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5	13.5	14.5	15.5	16.5	17.5	18.5	19.5	20.5	21.5	22.5	23.5	24.5	25.5
		Effective R-value if insulation is installed in cavity between framing (includes gypsum board)																									
0.5	Wood	1.3	1.3	1.9	2.4	2.7	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	0.9	0.9	1.1	1.1	1.2	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
0.75	Wood	1.4	1.4	2.1	2.7	3.1	3.5	3.8	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.0	1	1.3	1.4	1.5	1.5	1.6	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
1	Wood	1.3	1.5	2.2	2.9	3.4	3.9	4.3	4.6	4.9	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.0	1.1	1.4	1.6	1.7	1.8	1.8	1.9	1.9	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
1.5	Wood	1.3	1.5	2.4	3.1	3.8	4.4	4.9	5.4	5.8	6.2	6.5	6.8	7.1	na	na	na	na	na	na	na	na	na	na	na	na	na
	Metal	1.1	1.2	1.6	1.9	2.1	2.2	2.3	2.4	2.5	2.5	2.6	2.6	2.7	na	na	na	na	na	na	na	na	na	na	na	na	na
2	Wood	1.4	1.5	2.5	3.3	4.0	4.7	5.3	5.9	6.4	6.9	7.3	7.7	8.1	8.4	8.7	9.0	9.3	na	na	na	na	na	na	na	na	na
	Metal	1.1	1.2	1.7	2.1	2.3	2.5	2.7	2.8	2.9	3.0	3.1	3.2	3.2	3.3	3.3	3.4	3.4	na	na	na	na	na	na	na	na	na
2.5	Wood	1.4	1.5	2.5	3.4	4.2	4.9	5.6	6.3	6.8	7.4	7.9	8.4	8.8	9.2	9.6	10.0	10.3	10.6	10.9	11.2	11.5	na	na	na	na	na
	Metal	1.2	1.3	1.8	2.3	2.6	2.8	3.0	3.2	3.3	3.5	3.6	3.6	3.7	3.8	3.9	3.9	4.0	4.0	4.1	4.1	4.1	na	na	na	na	na
3	Wood	1.4	1.5	2.5	3.5	4.3	5.1	5.8	6.5	7.2	7.8	8.3	8.9	9.4	9.9	10.3	10.7	11.1	11.5	11.9	12.2	12.5	12.9	na	na	na	na
	Metal	1.2	1.3	1.9	2.4	2.8	3.1	3.3	3.5	3.7	3.8	4.0	4.1	4.2	4.3	4.4	4.4	4.5	4.6	4.6	4.7	4.7	4.8	na	na	na	na
3.5	Wood	1.4	1.5	2.6	3.5	4.4	5.2	6.0	6.7	7.4	8.1	8.7	9.3	9.8	10.4	10.9	11.3	11.8	12.2	12.6	13	13.4	13.8	14.1	14.5	14.8	15.1
	Metal	1.2	1.3	2.0	2.5	2.9	3.2	3.5	3.8	4.0	4.2	4.3	4.5	4.6	4.7	4.8	4.9	5.0	5.1	5.1	5.2	5.2	5.3	5.4	5.4	5.4	5.5
4	Wood	1.4	1.6	2.6	3.6	4.5	5.3	6.1	6.9	7.6	8.3	9.0	9.6	10.2	10.8	11.3	11.9	12.4	12.8	13.3	13.7	14.2	14.6	14.9	15.3	15.7	16
	Metal	1.2	1.3	2.0	2.6	3.0	3.4	3.7	4.0	4.2	4.5	4.6	4.8	5.0	5.1	5.2	5.3	5.4	5.5	5.6	5.7	5.8	5.8	5.9	5.9	6.0	6.0
4.5	Wood	1.4	1.6	2.6	3.6	4.5	5.4	6.2	7.1	7.8	8.5	9.2	9.9	10.5	11.2	11.7	12.3	12.8	13.3	13.8	14.3	14.8	15.2	15.7	16.1	16.5	16.9
	Metal	1.2	1.3	2.1	2.6	3.1	3.5	3.9	4.2	4.5	4.7	4.9	5.1	5.3	5.4	5.6	5.7	5.8	5.9	6.0	6.1	6.2	6.3	6.4	6.4	6.5	6.6
5	Wood	1.4	1.6	2.6	3.6	4.6	5.5	6.3	7.2	8.0	8.7	9.4	10.1	10.8	11.5	12.1	12.7	13.2	13.8	14.3	14.8	15.3	15.8	16.3	16.7	17.2	17.6
	Metal	1.2	1.4	2.1	2.7	3.2	3.7	4.1	4.4	4.7	5.0	5.2	5.4	5.6	5.8	5.9	6.1	6.2	6.3	6.5	6.6	6.7	6.8	6.8	6.9	7.0	7.1
5.5	Wood	1.4	1.6	2.6	3.6	4.6	5.5	6.4	7.3	8.1	8.9	9.6	10.3	11.0	11.7	12.4	13	13.6	14.2	14.7	15.3	15.8	16.3	16.8	17.3	17.8	18.2
	Metal	1.3	1.4	2.1	2.8	3.3	3.8	4.2	4.6	4.9	5.2	5.4	5.7	5.9	6.1	6.3	6.4	6.6	6.7	6.8	7.0	7.1	7.2	7.3	7.4	7.5	7.6

For SI: 1 inch = 25.4 mm.

TABLE B-13
ASSEMBLY *U*-FACTORS FOR METAL BUILDING WALLS

Insulation System	Rated *R*-Value of Insulation	Total Rated *R*-Value of Insulation	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Wall Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation					
				R-5.6	R-11.2	R-16.8	R-22.4	R-28.0	R-33.6
Single Layer of Mineral Fiber	None	0	1.180	0.161	0.086	0.059	0.045	0.036	0.030
	R-6	6	0.184	0.091	0.060	0.045	0.036	0.030	0.026
	R-10	10	0.134	0.077	0.054	0.041	0.033	0.028	0.024
	R-11	11	0.123	0.073	0.052	0.040	0.033	0.028	0.024
	R-13	13	0.113	0.069	0.050	0.039	0.032	0.027	0.024
Double Layer of Mineral Fiber (Second layer inside of girts) (Multiple layers are listed in order from inside to outside)	R-6 + R-13	19	0.070	Na	na	na	na	na	na
	R-10 + R-13	23	0.061	Na	na	na	na	na	na
	R-13 + R-13	26	0.057	Na	na	na	na	na	na
	R-19 + R-13	32	0.048	Na	na	na	na	na	na

TABLE B-14
ASSEMBLY *U*-FACTORS FOR STEEL FRAME WALLS

Framing Type and Spacing Width (actual depth)	Cavity Insulation *R*-Value: Rated/ (effective installed [see Table B-17])	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Wall Plus Continuous Insulation (uninterrupted by framing), Rated *R*-Value of Continuous Insulation																			
			R-1.0	R-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Steel Framing at 16 in. OC																						
(3.5 in. depth)	None(0.0)	0.352	0.260	0.207	0.171	0.146	0.128	0.113	0.102	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.03	0.026	0.023
	R-11(5.5)	0.132	0.117	0.105	0.095	0.087	0.08	0.074	0.069	0.064	0.06	0.057	0.054	0.051	0.049	0.046	0.044	0.036	0.031	0.027	0.024	0.021
	R-13(6.0)	0.124	0.111	0.10	0.091	0.083	0.077	0.071	0.066	0.062	0.059	0.055	0.052	0.050	0.048	0.045	0.043	0.036	0.030	0.026	0.023	0.021
	R-15(6.4)	0.118	0.106	0.096	0.087	0.08	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045	0.043	0.035	0.030	0.026	0.023	0.021
(6.0 in. depth)	R-19(7.1)	0.109	0.099	0.090	0.082	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.034	0.029	0.026	0.023	0.020
	R-21(7.4)	0.106	0.096	0.087	0.08	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045	0.043	0.041	0.034	0.029	0.025	0.022	0.020
Steel Framing at 24 in. OC																						
(3.5 in. depth)	None(0.0)	0.338	0.253	0.202	0.168	0.144	0.126	0.112	0.1	0.091	0.084	0.077	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.03	0.026	0.023
	R-11(6.6)	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.035	0.030	0.026	0.023	0.021
	R-13(7.2)	0.108	0.098	0.089	0.082	0.075	0.07	0.066	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.034	0.029	0.025	0.023	0.020
	R-15(7.8)	0.102	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.05	0.048	0.046	0.044	0.042	0.040	0.034	0.029	0.025	0.022	0.020
(6.0 in. depth)	R-19(8.6)	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.041	0.039	0.033	0.028	0.025	0.022	0.020
	R-21(9.0)	0.090	0.083	0.077	0.071	0.066	0.062	0.059	0.055	0.052	0.050	0.048	0.045	0.043	0.042	0.040	0.038	0.032	0.028	0.024	0.022	0.020

For SI: 1 inch = 25.4 mm.

B2.2.1.2.2.3 For continuous insulation (e.g., insulation boards) it is assumed that the insulation boards are installed on the inside of the girts and uninterrupted by the framing members.

B2.2.1.2.2.4 Insulation exposed to the *conditioned space* or *semiheated space* shall have a facing, and all insulation seams shall be continuously sealed to provide a continuous air barrier.

TABLE B-15
ASSEMBLY *U*-FACTORS FOR WOOD FRAME WALLS

Framing Type and Spacing Width (actual Depth)	Cavity Insulation *R*-Value: Rated/ [effective stalled (see Table B-3)]	Overall *U*-Factor for Entire Base Wall	Overall *U*-Factor for Assembly of Base Wall Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation																			
			R-1.0	E-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Wood Studs at 16 in. OC																						
(3.5 in. depth)	None(0.0)	0.292	0.223	0.181	0.152	0.132	0.116	0.104	0.094	0.086	0.079	0.073	0.068	0.064	0.060	0.056	0.053	0.042	0.035	0.030	0.026	0.023
	R-11(11.0)	0.096	0.087	0.079	0.073	0.068	0.063	0.059	0.056	0.053	0.05	0.048	0.046	0.044	0.042	0.040	0.038	0.032	0.028	0.024	0.022	0.020
	R-13(13.0)	0.089	0.080	0.074	0.068	0.063	0.059	0.056	0.053	0.05	0.047	0.045	0.043	0.041	0.040	0.038	0.037	0.031	0.027	0.024	0.021	0.019
	R-15(15.0)	0.083	0.075	0.069	0.064	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.030	0.026	0.023	0.020	0.019
(5.5 in. depth)	R-19(18.0)	0.067	0.062	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.04	0.038	0.037	0.036	0.034	0.033	0.032	0.027	0.024	0.021	0.019	0.018
	R-21(21.0)	0.063	0.058	0.054	0.051	0.048	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.032	0.031	0.030	0.026	0.023	0.021	0.019	0.017
(+R-10 headers)	R-19(18.0)	0.063	0.059	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.031	0.027	0.024	0.021	0.019	0.017
	R-21(21.0)	0.059	0.055	0.051	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.020	0.018	0.017
Wood Studs at 24 in.OC																						
(3.5 in. depth)	None(0.0)	0.298	0.227	0.183	0.154	0.133	0.117	0.105	0.095	0.086	0.079	0.074	0.068	0.064	0.060	0.057	0.054	0.042	0.035	0.030	0.026	0.023
	R-11(11.0)	0.094	0.085	0.078	0.072	0.067	0.062	0.059	0.055	0.052	0.05	0.047	0.045	0.043	0.041	0.040	0.038	0.032	0.027	0.024	0.022	0.019
	R-13(13.0)	0.086	0.078	0.072	0.067	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.031	0.026	0.023	0.021	0.019
	R-15(15.0)	0.080	0.073	0.067	0.062	0.058	0.055	0.052	0.049	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.029	0.026	0.023	0.020	0.018
(5.5 in. depth)	R-19(18.0)	0.065	0.060	0.056	0.053	0.050	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.027	0.024	0.021	0.019	0.018
	R-21(21.0)	0.060	0.056	0.052	0.049	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.026	0.023	0.02	0.018	0.017
(+ R-10 headers)	R-19(18.0)	0.062	0.058	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.034	0.033	0.032	0.031	0.027	0.024	0.021	0.019	0.017
	R-21(21.0)	0.057	0.053	0.05	0.047	0.045	0.043	0.041	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.025	0.023	0.020	0.018	0.017

For SI: 1 inch = 25.4 mm.

B2.2.1.2.3 *U*-factors for metal building walls. *U*-factors for metal building walls shall be taken from Table B-13. It is not acceptable to use these *U*-factors if additional insulation is not continuous.

B2.2.1.3 Steel-framed walls.

B2.2.1.3.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a wall where the insulation is installed within the cavity of the steel stud framing but where there is not a metal exterior surface spanning member. The steel stud framing is a minimum uncoated thickness of 0.043 inches (1.1 mm) for 18 gauge or 0.054 inches for 16 gauge. The *U*-factor includes R-0.17 for exterior air film, R-0.08 for stucco, R-0.56 for 0.625-inches (16 mm) gypsum board on the exterior, R-0.56 for 0.625-inches (16 mm) gypsum board on the interior, and R-0.68 for interior vertical surfaces air film. The performance of the insulation/framing layer is calculated using the values in Table B-17. Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing. *U*-factors are provided for the following configurations:

a. Standard framing: steel stud framing at 16 inches (410 mm) on center with cavities filled with 16 inch (410 mm) wide insulation for both $3^1/_2$-inch (89 mm) deep and 6-inch (152 mm) deep wall cavities.

b. Advanced framing: steel stud framing at 24 inches (610 mm) on center with cavities filled with 24 inch (610 mm) wide insulation for both $3^1/_2$-inch (89 mm) deep and 6-inch (152 mm) deep wall cavities.

TABLE B-16
ASSEMBLY C-FACTORS FOR BELOW-GRADE WALLS

Framing Type & Depth	Rated *R*-Value of Insulation Alone	Specified C-Factors (wall only, without soil & air films)
No Framing	R-0	C-1.140
Exterior Insulation continuous and uninterrupted by framing		
No Framing	5.0	0.170
No Framing	7.5	0.119
No Framing	10.0	0.092
No Framing	12.5	0.075
No Framing	15.0	0.063
No Framing	17.5	0.054
No Framing	20.0	0.048
No Framing	25.0	0.039
No Framing	30.0	0.032
No Framing	35.0	0.028
No Framing	40.0	0.025
No Framing	45.0	0.022
No Framing	50.0	0.020
Continuous Framing at 24 in. OC horizontally		
3.5 in	11.0	0.182
3.5 in	13.0	0.174
3.5 in	15.0	0.168
5.5 in	19.0	0.125
5.5 in	21.0	0.120
1 in metal clips at 24 in. OC horizontally & 16 in. vertically		
1 in	3.8	0.233
1 in	5.0	0.201
1 in	5.6	0.189
1.5 in	5.7	0.173
1.5 in	7.5	0.147
1.5 in	8.4	0.138
2 in	7.6	0.138
2 in	10.0	0.116
2 in	11.2	0.108
2.5 in	9.5	0.114
2.5 in	12.5	0.096
2.5 in	14.0	0.089
3 in	11.4	0.098
3 in	15.0	0.082
3 in	16.8	0.076
3.5 in	13.3	0.085
3.5 in	17.5	0.071
3.5 in	19.6	0.066
4 in	15.2	0.076
4 in	20.0	0.063
4 in	22.4	0.058

For SI: 1 inch = 25.4 mm.

B2.2.1.3.2 Rated *R*-value of insulation for steel-framed walls.

B2.2.1.3.2.1 The first rated *R*-value of insulation is for uncompressed insulation installed in the cavity between steel studs. It is acceptable for this insulation to also be continuous insulation uninterrupted by framing.

TABLE B-17
EFFECTIVE INSULATION/FRAMING LAYER R-VALUES FOR WALL INSULATION INSTALLED BETWEEN STEEL FRAMING

Nominal Depth of Cavity (in.)	Actual Depth of Cavity (in.)	Rated *R*-Value of Airspace or Insulation	Effective Framing/ Cavity *R*-Value at 16 in. on center	Effective Framing/Cavity at 24 in. on center
Empty cavity, no insulation				
4	3.5	R-0.91	0.79	0.91
Insulated Cavity				
4	3.5	R-11	5.5	6.6
4	3.5	R-13	6.0	7.2
4	3.5	R-15	6.4	7.8
6	6.0	R-19	7.1	8.6
6	6.0	R-21	7.4	9.0
8	8.0	R-25	7.8	9.6

For SI: 1 inch = 25.4 mm.

TABLE B-18
EFFECTIVE INSULATION/FRAMING LAYER *R*-VALUES FOR ROOF AND FLOOR INSULATION INSTALLED BETWEEN METAL FRAMING (4 FT ON CENTER)

Rated *R*-Value of Insulation	Correction Factor	Framing/Cavity *R*-Value
0	1.00	0.00
4	0.97	3.88
5	0.96	4.80
8	0.94	7.52
10	0.92	9.20
11	0.91	10.01
12	0.9.0	10.80
13	0.9.0	11.70
15	0.88	13.20
16	0.87	13.92
19	0.86	16.34
20	0.85	17.00
21	0.84	17.64
24	0.82	19.68
25	0.81	20.25
30	0.79	23.70
35	0.76	26.60
38	0.74	28.12
40	0.73	29.20
45	0.71	31.95
50	0.69	34.50
55	0.67	36.85

For SI: 1 foot = 304.8 mm.

B2.2.1.3.2.2 If there are two values, the second rated *R*-value of insulation is for continuous insulation uninterrupted by framing, etc., to be installed in addition to the first insulation.

B2.2.1.3.2.3 Opaque mullions in spandrel glass shall be covered with insulation complying with the steel-framed wall requirements.

B2.2.1.3.3 *U*-factors for steel-framed walls.

B2.2.1.3.3.1 *U-factors* for *steel-framed walls* shall be taken from Table B-14.

B2.2.1.3.3.2 For *steel-framed walls* with framing at less than 24 inches (610 mm) on center, use the

TABLE B-19
ASSEMBLY *U*-FACTORS FOR ROOFS WITH INSULATION ENTIRELY ABOVE DECK

Rated *R*-Value of Insulation Alone	Overall *U*-Factor for Entire Assembly
R-0	U-1.282
R-1	U-0.562
R-2	U-0.360
R-3	U-0.265
R-4	U-0.209
R-5	U-0.173
R-6	U-0.147
R-7	U-0.129
R-8	U-0.114
R-9	U-0.102
R-10	U-0.093
R-11	U-0.085
R-12	U-0.078
R-13	U-0.073
R-14	U-0.068
R-15	U-0.063
R-16	U-0.060
R-17	U-0.056
R-18	U-0.053
R-19	U-0.051
R-20	U-0.048
R-21	U-0.046
R-22	U-0.044
R-23	U-0.042
R-24	U-0.040
R-25	U-0.039
R-26	U-0.037
R-27	U-0.036
R-28	U-0.035
R-29	U-0.034
R-30	U-0.032
R-35	U- 0.028
R-40	U-0.025
R-45	U-0.020
R-50	U-0.020
R-55	U-0.018
R-60	U-0.016

standard framing values as described in Section B2.2.1.3.1(a).

B2.2.1.3.3.3 For *steel-framed walls* with framing from 24 inches to 32 inches (610 mm to 813 mm) on center, use the advanced framing values as described in B2.2.1.3.1(b).

B2.2.1.3.3.4 For *steel-framed walls* with framing greater than 32 inches (813 mm) on center, use the *metal building wall* values in Table B-13.

B2.2.1.4 Wood-framed walls.

B2.2.1.4.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a wall where the insulation is installed between 2 inches (51 mm) nominal wood framing. Cavity insulation is full depth, but values are taken from Table B-3 for R-19 insulation, which is compressed when installed in a 5.5 inches (368 mm) cavity. Headers are double 2 inches (51 mm) nominal wood framing. The *U*-factor includes R-0.17 for exterior air film, R-0.08 for stucco, R-0.56 for 0.625 inches (16 mm) gypsum board on the exterior, R-0.56 for 0.625 inches (16 mm) gypsum board on the interior, and R-0.68 for interior air film, vertical surfaces. Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing. *U*-factors are provided for the following configurations:

a. Standard framing: Wood framing at 16 inches (410 mm) on center with cavities filled with $14^1/_2$ inches (368 mm) wide insulation for both $3^1/_2$-inch (89 mm) deep and $5^1/_2$ inches (140 mm) deep wall cavities. Double headers leave no cavity. Weighting factors are 75-percent insulated cavity, 21-percent studs, plates, and sills, and 4-percent headers.

b. Advanced framing: Wood framing at 24 inches (610 mm) on center with cavities filled with $22^1/_2$ inches (572 mm) wide insulation for both $3^1/_2$-inch (89 mm) deep and $5^1/_2$ inches (140 mm) deep wall cavities. Double headers leave uninsulated cavities. Weighting factors are 78-percent insulated cavity, 18-percent studs, plates, and sills, and 4-percent headers.

c. Advanced framing with insulated headers: wood framing at 24 inches (610 mm) on center with cavities filled with $22^1/_2$ inches wide (572 mm) insulation for both $3^1/_2$-inch (89 mm) deep and $5^1/_2$ inches (140 mm) deep wall cavities. Double header cavities are insulated. Weighting factors are 78-percent insulated cavity, 18-percent studs, plates, and sills, and 4-percent headers.

B2.2.1.4.2 Rated *R*-value of insulation for wood-framed and other walls.

B2.2.1.4.2.1 The first rated *R*-value of insulation is for uncompressed insulation installed in the cavity between wood studs. It is acceptable for this insulation to also be continuous insulation uninterrupted by framing.

B2.2.1.4.2.2 If there are two values, the second rated *R*-value of insulation is for continuous insulation uninterrupted by framing, etc., to be installed in addition to the first insulation.

B2.2.1.4.2.3 Opaque mullions in spandrel glass shall be covered with insulation complying with the steel-framed wall requirements.

B2.2.1.4.3 *U*-factors for wood-framed walls.

TABLE B-20
ASSEMBLY *U*-FACTORS FOR METAL BUILDING ROOFS

Insulation System	Rated *R*-Value of Insulation	Total rated *R*-value of Insulation	Overall *U*-Factor for Entire Base Roof Assembly	Overall *U*-Factor for Assembly of Base Roof Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation					
				R-5.6	R-11.2	R-16.8	R-22.4	R-28.0	R-33.6
Standing Seam Roofs with Thermal Blocks									
Single Layer	None	0	1.280	0.162	0.087	0.059	0.045	0.036	0.030
	R-6	6	0.167	0.086	0.058	0.044	0.035	0.029	0.025
	R-10	10	0.097	0.063	0.046	0.037	0.031	0.026	0.023
	R-11	11	0.092	0.061	0.045	0.036	0.030	0.026	0.022
	R-13	13	0.083	0.057	0.043	0.035	0.029	0.025	0.022
	R-16	16	0.072	0.051	0.040	0.033	0.028	0.024	0.021
	R-19	19	0.065	0.048	0.038	0.031	0.026	0.023	0.020
Double Layer	R-10 + R-10	20	0.063	0.047	0.037	0.031	0.026	0.023	0.020
	R-10 + R-11	21	0.061	0.045	0.036	0.030	0.026	0.023	0.020
	R-11 + R-11	22	0.060	0.045	0.036	0.030	0.026	0.022	0.020
	R-10 + R-13	23	0.058	0.044	0.035	0.029	0.025	0.022	0.020
	R-11 + R-13	24	0.057	0.043	0.035	0.029	0.025	0.022	0.020
	R-13 + R-13	26	0.055	0.042	0.034	0.029	0.025	0.022	0.019
	R-10 + R-19	29	0.052	0.040	0.033	0.028	0.024	0.021	0.019
	R-11 + R-19	30	0.051	0.040	0.032	0.027	0.024	0.0021	0.019
	R-13 + R-19	32	0.049	0.038	0.032	0.027	0.023	0.021	0.019
	R-16 + R-19	35	0.047	0.037	0.031	0.026	0.023	0.020	0.018
	R-19 + R-19	38	0.046	0.037	0.030	0.026	0.023	0.020	0.018
(Multiple R-values are listed in order from inside to outside)									
Screw Down Roofs									
	R-10	10	0.153	0.082	0.056	0.043	0.035	0.029	0.025
	R-11	11	0.139	0.078	0.054	0.042	0.034	0.028	0.025
	R-13	13	0.130	0.075	0.053	0.041	0.033	0.028	0.024
Filled Cavity with Thermal Blocks									
	R19 + R-10	29	0.041	0.033	0.028	0.024	0.021	0.0198	0.017
(Multiple R-values are listed in order from inside to outside)									

B2.2.1.4.3.1 *U-factors for wood-framed walls* shall be taken from Table B-15.

B2.2.1.4.3.2 For *wood-framed walls* with framing at less than 24 inches (610 mm) on center, use the standard framing values as described in Section B2.2.1.4.1(a).

B2.2.1.4.3.3 For *wood-framed walls* with framing from 24 inches to 32 inches (610 mm to 813 mm) on center, use the advanced framing values as described in Section B2.2.1.4.1(b) if the headers are uninsulated or the advanced framing with insulated headers values as described in Section B2.2.1.4.1(c) if the headers are insulated.

B2.2.1.4.3.4 For *wood-framed walls* with framing greater than 32 inches (813 mm) on center, *U*-factors shall be determined in accordance with Section B1.5.

B2.2.2 Below-grade walls.

B2.2.2.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is 8 inches (203 mm) medium-weight concrete block with a density of 115 pound per cubic foot (1843 kg/m^3)and solid grouted cores. *Continuous insulation* is installed on the interior or exterior. In contrast to the *U*-factor for above-grade walls, the C-factor for below grade walls does not include *R*-values for exterior or interior air films or for soil. For insulated walls, the C-factor does include R-0.45 for 0.5 inches gypsum board.

B2.2.2.2 C-factors for below grade walls.

B2.2.2.2.1 *C-factors for below grade walls* shall be taken from Table B-16 or determined by the procedure described in this subsection.

B2.2.2.2.2 It is acceptable to use the *C-factors* in Table B-16 for all *below grade walls*.

B2.2.2.2.3 If not taken from Table B-16, below-grade wall C-factors shall be determined from Tables B-10, B-11, and B-12 using the following procedure:

a. If the below-grade wall is uninsulated or only the cells are insulated:

(1)For concrete walls, determine the C-factor from Table B-10 based on the concrete density and wall thickness.

(2)For concrete block walls, determine the C-factor from Table B-11 based on the block size, concrete density, degree of grouting in the cells, and whether the cells are insulated.

b. If the mass wall has additional insulation:

(1) For concrete walls, determine the *Rc* from Table B-10 based on the concrete density and wall thickness. Next, determine the effective *R*-value for the insulation/framing layer from Table B-12 based on the rated *R*-value of insulation installed, the thickness of the insulation, and whether it is installed between wood or metal framing or with no framing. Then, determine the C-factor by adding the *Rc* and the effective *R*-value together and taking the inverse of the total.

(2) For concrete block walls, determine the *Rc* from Table B-10 based on the block size, concrete density, degree of grouting in the cells, and whether the cells are insulated. Next, determine the effective *R*-value for the insulation/framing layer from Table B-11 based on the rated *R*-value of insulation installed, the thickness of the insulation, and whether it is installed between wood or metal framing or with no framing. Then, determine the C-factor by adding the *Rc* and the effective *R*-value together and taking the inverse of the total.

B2.3 Opaque doors. All opaque doors with *U*-factors determined, certified, and labeled in accordance with NFRC 100 as specified in Section B1.1.3 shall be assigned those *U*-factors. Unlabeled opaque doors shall be assigned those *U*-factors.

B2.3.1 Unlabeled opaque doors. Unlabeled opaque doors shall be assigned the following *U*-factors.

a. Uninsulated single-layer metal swinging doors or nonswinging doors, including single-layer uninsulated access hatches and uninsulated smoke vents: 1.45

b. Uninsulated double-layer metal swinging doors or nonswinging doors, including double-layer uninsulated access hatches and uninsulated smoke vents: 0.70

c. Insulated metal swinging doors, including fire-rated doors, insulated access hatches, and insulated smoke vents: 0.50

d. Wood doors, minimum nominal thickness of $1^3/_4$ inches (44 mm), including panel doors with minimum panel thickness of $1^1/_8$ inches (29 mm), solid core flush doors, and hollow core flush doors: 0.50.

e. Any other wood door: 0.60.

B2.4 Roofs.

B2.4.1 General. The buffering effect of suspended ceilings or attic spaces shall not be included in *U*-factor calculations.

B2.4.2 Roofs with insulation entirely above deck.

B2.4.2.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is continuous insulation over a structural deck. The *U*-factor includes R-0.17 for exterior air film, R-0 for metal deck, and R-0.61 for interior air film heat flow up. Added insulation is continuous and uninterrupted by framing. The framing factor is zero.

B2.4.2.2 Rated *R*-value of insulation. For roofs with insulation entirely above deck, the rated *R*-value of insulation is for continuous insulation.

Exception: Interruptions for framing and pads for mechanical equipment are permitted with a combined total area not exceeding 1 percent of the total opaque assembly area.

B2.4.2.3 *U*-factor. *U*-factors for roofs with insulation entirely above deck shall be taken from Table B-19. It is not acceptable to use these *U*-factors if the insulation is not entirely above deck or not continuous.

B2.4.3 Metal building roofs.

B2.4.3.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a roof where the insulation is draped over the steel structure (purlins) and then compressed when the metal spanning members are attached to the steel structure (purlins). Additional assemblies include continuous insulation, uncompressed and uninterrupted by framing.

B2.4.3.2 Rated *R*-value of insulation.

B2.4.3.2.1 The first rated *R*-value of insulation is for insulation draped over purlins and then compressed when the metal spanning members are attached, or for insulation hung between the purlins, provided there is a minimum 1 inch (25 mm) thermal break between the purlins and the metal spanning members.

B2.4.3.2.2 For double-layer installations, the second rated *R*-value of insulation is for insulation installed parallel to the purlins.

B2.4.3.2.3 For continuous insulation (e.g. insulation boards), it is assumed that the insulation boards are installed below the purlins and are uninterrupted by framing members. Insulation exposed to the condi-

tioned space or semiheated space shall have a facing, and all insulation seams shall be continuously sealed to provide a continuous air barrier.

B2.4.3.3 *U*-factor. *U*-factors for metal building roofs shall be taken from Table B-20. It is not acceptable to use these *U*-factors if additional insulated sheathing is not continuous.

B2.4.4 Attic roofs with wood joists.

B2.4.4.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base attic roof assembly is a roof with a nominal 4-inch (102 mm) deep wood as the lower chord of a roof truss or ceiling joist.

The ceiling is attached directly to the lower chord of the truss and the attic space above is ventilated. Insulation is located directly on top of the ceiling, first filling the cavities between the wood and then later covering both the wood and cavity areas. No credit is given for roofing materials. The single-rafter roof is similar to the base attic roof, with the key difference being that there is a single, deep rafter to which both the roof and the ceiling are attached. The heat flow path through the rafter is calculated to be the same depth as the insulation. The *U*-factor includes R-0.46 for semi-exterior air film, R-0.56 for 0.625 inch (16 mm) gypsum board, and R-0.61 for interior air film heat flow up. *U*-factors are provided for the following configurations:

a. Attic roof, standard framing: insulation is tapered around the perimeter with resultant decrease in thermal resistance. Weighting factors are 85-percent full-depth insulation, 5-percent half-depth insulation, and 10-percent joists.

b. Attic roof, advanced framing: Full and even depth of insulation extending to the outside edge of exterior walls. Weighting factors are 90-percent full-depth insulation and 10-percent joists.

c. Single-rafter roof: An attic roof where the roof sheathing and ceiling are attached to the same rafter. Weighting factors are 90-percent full-depth insulation and 10-percent joists.

B2.4.4.2 Rated *R*-value of insulation.

B2.4.4.2.1 For attics and other roofs, the rated *R*-value of insulation is for insulation installed both inside and outside the roof or entirely inside the roof cavity.

B2.4.4.2.2 Occasional interruption by framing members is allowed but required that the framing members be covered with insulation when the depth of the insulation exceeds the depth of the framing cavity.

B2.4.4.2.3 Insulation in such roofs shall be permitted to be tapered at the eaves where the building structure does not allow full depth.

B2.4.4.2.4 For single-rafter roofs, the requirement is the lesser of the values for attics and other roofs and those listed in Table B-21A.

TABLE B-21A
Single Rafter Roofs

Minimum Insulation R-Value or Maximum Assembly *U*-Factor		
Wood Rafter Depth, *d* (actual)		
$d < 8$ in.	$8 < d < 10$ in.	$10 < d < 12$ in.
R-19 U-0.055	R-30 U-0.036	R-38 U-0.028

TABLE B-21B
ASSEMBLY *U*-FACTORS FOR ATTIC ROOFS WITH WOOD JOISTS

Rated *R*-Value of Insulation Alone	Overall *U*-Factor for Entire Assembly
Wood-framed attic, standard framing	
None	0.613
R-11	0.091
R-13	0.081
R-19	0.053
R-30	0.034
R-38	0.027
R-49	0.021
R-60	0.017
R-71	0.015
R-82	0.013
R-93	0.011
R-104	0.010
R-115	0.009
R-126	0.008
Wood-framed attic, advanced framing	
None	0.613
R-11	0.088
R-13	0.078
R-19	0.051
R-30	0.032
R-38	0.026
R-49	0.020
R-60	0.016
R-71	0.014
R-82	0.012
R-93	0.011
R-104	0.010
R-115	0.009
R-126	0.008
Wood joists, single rafter roof	
None	0.417
R-11	0.088
R-13	0.078
R-15	0.071
R-19	0.055
R-21	0.052
R-25	0.043
R-30	0.036
R-38	0.028

TABLE B-22
ASSEMBLY *U*-FACTORS FOR ATTIC ROOFS WITH STEEL JOISTS (4.0 FT ON CENTER)

Rated *R*-Value of Insulation Area	Overall *U*-Factor for Entire Assembly
R-0	U-1.282
R-4	U-0.215
R-5	U-0.179
R-8	U-0.120
R-10	U-0.100
R-11	U-0.093
R-12	U-0.086
R-13	U-0.080
R-15	U-0.072
R-16	U-0.068
R-19	U-0.058
R-20	U-0.056
R-21	U-0.054
R-24	U-0.049
R-25	U-0.048
R-30	U-0.041
R-35	U-0.037
R-38	U-0.035
R-40	U-0.033
R-45	U-0.031
R-50	U-0.028
R-55	U-0.027

For SI: 1 foot = 304.8 mm.

B2.4.4.3 *U*-factors for attic roofs with wood joists. *U*-factors for attic roofs with wood joists shall be taken from Table B-21B. It is not acceptable to use these *U*-factors if the framing is not wood. For attic roofs with steel joists, see Section B2.4.5.

B2.4.5 Attic roofs with steel joists.

B2.4.5.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a roof supported by steel joists with insulation between the joists. The assembly represents a roof in many ways similar to a roof with insulation entirely above deck and a metal building roof. It is distinguished from the metal building roof category in that there is no metal exposed to the exterior. It is distinguished from the roof with insulation entirely above deck in that the insulation is located below the deck and is interrupted by metal trusses that provide thermal bypasses to the insulation. The *U*-factor includes R-0.17 for exterior air film, R-0 for metal deck, and R-0.61 for interior air film heat flow up. The performance of the insulation/framing layer is calculated using the values in Table B-18.

B2.4.5.2 *U*-factors for attic roofs with steel joists shall be taken from Table B-22.

B2.5 Floors.

B2.5.1 General. The buffering effect of crawl spaces or parking garages shall not be included in *U*-factor calculations. See Section B2.5.5 for slab-on-grade floors.

B2.5.2 Mass floors.

B2.5.2.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is continuous insulation over or under a solid concrete floor. The *U*-factor includes R-0.92 for interior air film—heat flow down, R-1.23 for carpet and rubber pad, R-0.50 for 8 inches (203 mm) concrete, and R-0.46 for semi-exterior air film. Added insulation is continuous and uninterrupted by framing. Framing factor is zero.

B2.5.2.2 Rated *R*-value of insulation for mass floors.

B2.5.2.2.1 *The rated R-value of insulation is for continuous insulation* uninterrupted by framing.

B2.5.2.2.2 Where framing, including metal and wood joists, is used, compliance shall be based on the maximum assembly *U-factor* rather than the minimum *rated R-value of insulation*.

B2.5.2.2.3 For waffle-slab floors, the *floor* shall be insulated either on the interior above the slab or on all exposed surfaces of the waffle.

B2.5.2.2.4 For *floors* with beams that extend below the floor slab, the floor shall be insulated either on the interior above the slab or on the exposed floor and all exposed surfaces of the beams that extend 24 inches (610 mm) and less below the exposed floor.

B2.5.2.3 *U*-factors for mass floors.

B2.5.2.3.1 The *U*-factors for mass floors shall be taken from Table B-23.

B2.5.2.3.2 It is not acceptable to use the *U*-factors in Table B-23 if the insulation is not continuous.

B2.5.3 Steel joist floors.

B2.5.3.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a floor where the insulation is either placed between the steel joists or is sprayed on the underside of the floor and the joists. In both cases, the steel provides a thermal bypass to the insulation. The *U*-factor includes R-0.92 for interior air film—heat flow down, R-1.23 for carpet and pad, R-0.25 for 4-inch (102 mm) concrete, R-0 for metal deck, and R-0.46 for semiexterior air film. The performance of the insulation/framing layer is calculated using the values in Table B-18.

B2.5.3.2 Rated *R*-value of insulation for steel joist floors.

B2.5.3.2.1 The first *rated R-value of insulation* is for uncompressed insulation installed in the cavity between steel joists or for spray-on insulation.

B2.5.3.2.2 It is acceptable for this insulation to also be *continuous insulation* uninterrupted by framing. All *continuous insulation* shall be installed either on the interior above the floor structure or below a framing cavity completely filled with insulation.

B2.5.3.3 *U*-factors for steel joist floors.

TABLE B-23
ASSEMBLY *U*-FACTORS FOR MASS FLOORS

Framing Type & Spacing Width (actual depth)	Cavity Insulation *R*-Value: Rated/ (effective installed)	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Floor Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation																			
			R-1.0	R-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Concrete Floor with Rigid Foam																						
	None(0.0)	0.322	0.243	0.196	0.164	0.141	0.123	0.110	0.099	0.090	0.083	0.076	0.071	0.066	0.062	0.058	0.055	0.043	0.036	0.030	0.026	0.023
Concrete Floor with Pinned Boards																						
	R-4.2(4.2)	0.137	0.121	0.108	0.097	0.089	0.081	0.075	0.070	0.065	0.061	0.058	0.055	0.052	0.049	0.047	0.045	0.037	0.031	0.027	0.024	0.021
	R-6.3(6.3)	0.107	0.096	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.054	0.052	0.049	0.047	0.045	0.043	0.041	0.034	0.029	0.025	0.023	0.02
	R-8.3(8.3)	0.087	0.080	0.074	0.069	0.065	0.061	0.057	0.054	0.051	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.032	0.027	0.024	0.022	0.019
	R-10.4(10.4)	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.030	0.026	0.023	0.021	0.019
	R-12.5(12.5)	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.028	0.025	0.022	0.020	0.018
	R-14.6(14.6)	0.056	0.053	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.034	0.033	0.032	0.031	0.027	0.023	0.021	0.019	0.017
	R-16.7(16.7)	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.034	0.032	0.031	0.030	0.030	0.029	0.025	0.022	0.020	0.018	0.017
Concrete Floor with Spray-on Insulation																						
(1 in.)	R-4(4.0)	0.141	0.123	0.11	0.099	0.090	0.083	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.037	0.031	0.027	0.024	0.021
(2 in.)	R-8(8.0)	0.09	0.083	0.076	0.071	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.032	0.028	0.024	0.022	0.020
(3 in.)	R-12(12.0)	0.066	0.062	0.058	0.055	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.037	0.036	0.034	0.033	0.028	0.025	0.022	0.02	0.018
(4 in.)	R-16(16.0)	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.026	0.023	0.020	0.018	0.017
(5 in.)	R-20(20.0)	0.043	0.041	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.023	0.021	0.019	0.017	0.016
(6 in.)	R-24(24.0)	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.021	0.019	0.018	0.016	0.015

For SI: 1 inch = 25.4 mm.

TABLE B-24
ASSEMBLY *U*-FACTORS FOR STEEL JOIST FLOORS

Framing Type & Spacing Width (actual depth)	Cavity Insulation *R*-Value: Rated/ (effective installed) [see Table B-18]	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Floor Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation																			
			R-1.0	R-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Steel Joist Floor with Rigid Foam																						
	None(0.0)	0.35	0.259	0.206	0.171	0.146	0.127	0.113	0.101	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.03	0.026	0.023
Steel Joist Floor with Spray-on Insulation																						
(1 in.)	R-4(3.88)	0.148	0.129	0.114	0.103	0.093	0.085	0.078	0.073	0.068	0.064	0.06	0.056	0.053	0.051	0.048	0.046	0.037	0.032	0.027	0.024	0.021
(2 in.)	R-8(7.52)	0.096	0.088	0.081	0.075	0.070	0.065	0.061	0.058	0.054	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.033	0.028	0.025	0.022	0.020
(3 in.)	R-12(10.8)	0.073	0.068	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.030	0.026	0.023	0.021	0.019
(4 in.)	R-16(13.92)	0.060	0.056	0.053	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.034	0.032	0.031	0.027	0.024	0.021	0.019	0.018
(5 in.)	R-20(17.0)	0.050	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.030	0.029	0.025	0.022	0.020	0.018	0.017
(6 in.)	R-24(19.68)	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.024	0.021	0.019	0.017	0.016
Steel Joist Floor with Batt Insulation																						
	None(0.0)	0.350	0.259	0.206	0.171	0.146	0.127	0.113	0.101	0.092	0.084	0.078	0.072	0.067	0.063	0.059	0.056	0.044	0.036	0.030	0.026	0.023
	R-11(10.01)	0.078	0.072	0.067	0.063	0.059	0.056	0.053	0.050	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.030	0.026	0.023	0.021	0.019
	R-13(11.7)	0.069	0.064	0.060	0.057	0.054	0.051	0.049	0.046	0.044	0.042	0.041	0.039	0.038	0.036	0.035	0.034	0.029	0.025	0.022	0.020	0.018
	R-15(13.2)	0.062	0.059	0.055	0.052	0.05	0.047	0.045	0.043	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.028	0.024	0.022	0.020	0.018
	R-19(16.34)	0.052	0.050	0.047	0.045	0.043	0.041	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.026	0.023	0.020	0.018	0.017
	R-21(17.64)	0.049	0.047	0.044	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020	0.018	0.017
	R-25(20.25)	0.043	0.041	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.023	0.021	0.019	0.017	0.016
	R-30C(23.70)	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.025	0.024	0.021	0.019	0.018	0.016	0.015
	R-30(23.7)	0.038	0.036	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.025	0.024	0.021	0.019	0.018	0.016	0.015
	R-38C(28.12)	0.032	0.031	0.030	0.029	0.029	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.020	0.018	0.016	0.015	0.014
	R-38(28.12)	0.032	0.031	0.030	0.029	0.029	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.020	0.018	0.016	0.015	0.014

For SI: 1 inch = 25.4 mm.

TABLE B-25
ASSEMBLY *U*-FACTORS FOR WOOD JOIST FLOORS

Framing Type & Spacing Width (actual depth)	Cavity Insulation *R*-Value: Rated/ (effective installed)	Overall *U*-Factor for Entire Base Wall Assembly	Overall *U*-Factor for Assembly of Base Floor Plus Continuous Insulation (uninterrupted by framing) Rated *R*-Value of Continuous Insulation																		
			R-1.0	R-2.0	R-3.0	R-4.0	R-5.0	R-6.0	R-7.0	R-8.0	R-9.0	R-10.0	R-11.0	R-12.0	R-13.0	R-14.0	R-15.0	R-20.0	R-25.0	R-30.0	R-35.0	R-40.0
Wood Joists																						
(5.5 in.)	None (0.0)	0.282	0.220	0.180	0.153	0.132	0.117	0.105	0.095	0.087	0.080	0.074	0.069	0.064	0.060	0.057	0.054	0.042	0.035	0.030	0.026	0.023
	R-11 (11.0)	0.074	0.069	0.064	0.060	0.057	0.054	0.051	0.048	0.046	0.044	0.042	0.040	0.039	0.037	0.036	0.035	0.030	0.026	0.023	0.020	0.019
	R-13 (13.0)	0.066	0.062	0.058	0.055	0.052	0.049	0.047	0.045	0.043	0.041	0.039	0.038	0.036	0.035	0.034	0.033	0.028	0.025	0.022	0.020	0.018
	R-15 (15.0)	0.060	0.057	0.053	0.05	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.027	0.024	0.021	0.019	0.017
	R-19 (18.0)	0.051	0.048	0.046	0.044	0.042	0.040	0.038	0.037	0.036	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.025	0.022	0.020	0.018	0.017
	R-21 (21.0)	0.046	0.043	0.042	0.040	0.038	0.037	0.035	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.023	0.021	0.019	0.017	0.016
(7.25 in.)	R-25 (25.0)	0.039	0.037	0.036	0.035	0.033	0.032	0.031	0.030	0.029	0.028	0.028	0.027	0.026	0.025	0.025	0.024	0.022	0.019	0.018	0.016	0.015
	R-30C (30.0)	0.034	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.020	0.018	0.016	0.015	0.014
(9.25 in.)	R-30 (30.0)	0.033	0.032	0.031	0.030	0.029	0.028	0.027	0.027	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.020	0.018	0.016	0.015	0.014
(11.25 in.)	R-38C (38.0)	0.027	0.026	0.025	0.025	0.024	0.024	0.023	0.022	0.022	0.021	0.021	0.020	0.020	0.020	0.019	0.019	0.017	0.016	0.015	0.014	0.013
(13.25 in.)	R-389 (38.0)	0.026	0.026	0.025	0.024	0.024	0.023	0.023	0.022	0.022	0.021	0.021	0.020	0.020	0.019	0.019	0.019	0.017	0.016	0.015	0.014	0.013

For SI: 1 inch = 25.4 mm.

TABLE B-26
ASSEMBLY F-FACTORS FOR SLAB-ON-GRADE FLOORS

Insulation Description	Rated *R*-Value of Insulation												
	R-0	R-5	R-7.5	R-10	R-15	R-20	R-25	R-30	R-35	R-40	R-45	R-50	R-55
Unheated Slabs													
None	0.73												
12 in. horizontal		0.72	0.71	0.71	0.71								
24 in. horizontal		0.70	0.70	0.70	0.69								
36 in. Horizontal		0.68	0.67	0.66	0.66								
48 in. horizontal		0.67	0.65	0.64	0.63								
12 in. vertical		0.61	0.60	0.58	0.57	0.567	0.565	0.564					
24 in. vertical		0.58	0.56	0.54	0.52	0.510	0.505	0.502					
36 in. vertical		0.56	0.53	0.51	0.48	0.472	0.464	0.460					
48 in. vertical		0.54	0.51	0.48	0.45	0.434	0.424	0.419					
Fully insulated slab		0.46	0.41	0.36	0.30	0.261	0.233	0.213	0.198	0.186	0.176	0.168	0.161
Heated Slabs													
None	1.35												
12 in. horizontal		1.31	1.31	1.30	1.30								
24 in. horizontal		1.28	1.27	1.26	1.25								
36 in. horizontal		1.24	1.21	1.20	1.18								
48 in. horizontal		1.20	1.17	1.13	1.11								
12 in. vertical		1.06	1.02	1.00	0.98	0.968	0.964	0.961					
24 in. vertical		0.99	0.95	0.90	0.86	0.843	0.832	0.827					
36 in. vertical		0.95	0.89	0.84	0.79	0.762	0.747	0.740					
48 in. vertical		0.91	0.85	0.78	0.72	0.688	0.671	0.659					
Fully insulated slab		0.74	0.64	0.55	0.44	0.373	0.326	0.296	0.273	0.255	0.239	0.227	0.217

For SI: 1 inch = 25.4 mm.

B2.5.3.3.1 *U*-factors for steel joist floors shall be taken from Table B-24.

B2.5.3.3.2 It is acceptable to use these *U*-factors for any steel joist floor.

B2.5.4 Wood-framed and other floors.

B2.5.4.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a floor attached directly to the top of the wood joist and with insulation located directly below the floor, with a ventilated airspace below the insulation. The heat flow path through the joist is calculated to be the same depth as the insulation. The *U*-factor includes R-0.92 for interior air film—heat flow down, R-1.23 for carpet and pad, R-0.94 for 0.75 inch (19 mm) wood subfloor, and R-0.46 for semi-exterior air film. The weighting factors are 91-percent insulated cavity and 9-percent framing.

B2.5.4.2 Rated *R*-value of insulation for wood-framed and other floors.

B2.5.4.2.1 The first rated R-value of insulation is for uncompressed insulation installed in the cavity between wood joists.

B2.5.4.2.2 It is acceptable for this insulation to also be continuous insulation uninterrupted by framing. All continuous insulation shall be installed either on the interior above the floor structure or below a framing cavity completely filled with insulation.

B2.5.4.3 *U*-factors for wood-framed floors

B2.5.4.3.1 *U-factors* for *wood-framed floors* shall be taken from Table B-25.

B2.5.4.3.2 It is not acceptable to use these *U-factors* if the framing is not wood.

B2.5.5 Slab-on-grade floors.

B2.5.5.1 General. For the purpose of applicant-determined assembly *U*-factors, C-factors, F-factors, or heat capacities, the base assembly is a slab floor of 6 inches (152 mm) concrete poured directly on to the earth, the bottom of the slab is at grade line, and soil conductivity is 0.75 Btu/h·ft^{2}°F. In contrast to the *U*-factor for floors, the F-factor for slab-on-grade floors is expressed per lineal foot of building perimeter. F-factors are provided for unheated slabs and for heated slabs. Unheated slab-on-grade floors do not have heating elements, and heated slab-on-grade floors do have heating elements within or beneath the slab. F-factors are provided for three insulation configurations:

a. *Horizontal insulation:* Continuous insulation is applied directly to the underside of the slab and extends inward horizontally from the perimeter for the distance specified or continuous insulation is applied downward from the top of the slab and then extends horizontally to the interior or the exterior from the perimeter for the distance specified.

b. *Vertical insulation:* Continuous insulation is applied directly to the slab exterior, extending downward from the top of the slab for the distance specified.

c. *Fully insulated slab:* Continuous insulation extends downward from the top of the slab and along the entire perimeter and completely covers the entire area under the slab.

B2.5.5.2 Rated *R*-value of insulation for slab-on-grade floors.

B2.5.5.2.1 The rated *R*-value of insulation shall be installed around the perimeter of the slab-on-grade floor to the distance specified.

Exception: For a monolithic slab-on-grade floor, the insulation shall extend from the top of the slab-on-grade to the bottom of the footing.

B2.5.5.2.2 Insulation installed outside the foundation wall shall extend from the top of the slab or downward to at least the bottom of the slab and then horizontally to a minimum of the distance specified. The horizontal insulation extending outside of the foundaiton shall be covered by pavement or by soil a minimum of 10 inches (254 mm) thick.

B2.5.5.3 F-factors for slab-on-grade floors.

B2.5.5.3.1 F-factors for slab-on-grade floors shall be taken from Table B-26.

B2.5.5.3.2 These F-factors are acceptable for all slab-on-grade floors.

B3.1 Calculation procedures.

B3.1.1 Cooling system design loads. Cooling system design loads, for the purpose of sizing HVAC systems and equipment, shall be determined in accordance with one of the procedures described in Chapter 26 of the *ASHRAE Handbook of Fundamentals* or ACCA Manual N, *Commercial Load Calculation.*

B3.1.2 Interior design conditions. Indoor design temperature and humidity conditions for general comfort applications shall be in accordance with the comfort criteria established in ANSI/ASHRAE 55-92, *Thermal Environmental Conditions for Human Occupancy,* or Chapter 8 of the 2001 *ASHRAE Handbook of Fundamentals*, except that winter humidification and summer dehumidification are not required.

B3.1.3 Exterior design conditions. Outdoor design conditions shall be selected from the *ASHRAE Handbook of Fundamentals,* or from data obtained from the National Climatic Center or a similar recognized weather data source. Cooling design temperatures shall be no greater than the temperature listed in the 2.0-percent column or statistically similar 0.5-percent annualized value. Heating design temperatures shall be no lower than the temperature listed in the 99-percent column or statistically similar 0.2-percent annualized value.

Exception: Where necessary to assure the prevention of damage to the building or to material and equipment within the building, the 1-percent column for cooling may be used.

B4.1 Lighting calculation procedures.

B4.1.1 Luminaire wattage. Luminaire wattage incorporated into the installed interior lighting power shall be determined in accordance with the following criteria:

1. The wattage of incandescent or tungsten-halogen luminaires with medium screw base sockets and not containing permanently installed ballasts shall be the maximum labeled wattage of the luminaire.
2. The wattage of luminaires with permanently installed or remote ballasts or transformers shall be the operating input wattage of the maximum lamp/auxiliary combination based on values from the auxiliary manufactuer's literature or recognized testing laboratories.
3. The wattage of line-voltage lighting track and plug-in busway that allow the addition and/or relocation of luminaires without altering the wiring of the system shall be the specified wattage of the luminaires included in the system with a minimum of 30 watts per linear foot.
4. The wattage of low-voltage lighting track, cable conductor, rail conductor, and other flexible lighting systems that allow the addition and/or relocation of luminaires without altering the wiring of the system shall be the specified wattage of the transformer supplying the system.
5. The wattage of all other miscellaneous lighting equipment shall be the specified wattage of the lighting equipment.

B5.1 Shell buildings. See Table B5.1 for envelope prescriptive measures of shell buildings.

TABLE B5.1
ENVELOPE PRESCRIPTIVE MEASURES FOR SHELL BUILDINGS

Building Element	Mandatory
Roof: Absorptance U-value	 ≤ 0.22 ≤ 0.027
Wall: Absorptance U-value	 ≤ 0.3 ≤ 0.089
Raised Floor Insulation U-value	 ≤ 0.052
Window: U-value Window Area SHGC 0-40% WW Ratio SHGC 40-50% WW Ratio	 ≤ 0.45 ≤ 50% window to wall area ratio 0.61 North 0.25 all others 0.44 North 0.25 all others
Overhang Projection Factor (PF)	0.5 (projection half the distance of window height)
Skylights: SHGC Skylight U-value	 ≤ 0.19 ≤ 1.36

Lighting and HVAC must be sufficiently efficient to meet Method A criteria for the entire space at time of build-out.

APPENDIX 13-C

SUPPLEMENTAL INFORMATION FOR SUBCHAPTER 13-6

13-C1.0 General requirements.

13-C1.1 Baseline features. Baseline features for compliance with Method A shall be as described in Section 13-613. The following features are utilized in compliance Method A of Subchapter 6 of the code as "baseline" features. These features are not code minimum efficiencies; rather, they represent standard reference design building component options utilized in establishing a budget that the building shall not exceed to comply with the code.

13-C1.2 Building envelope, insulation. All *R*-values referenced in this chapter refer to the R-values of the added insulation only. The *R*-values of structural building materials such as framing members, concrete blocks or gypsum board shall not be included. Insulation levels shall be achieved with insulation products tested and rated according to the procedures recognized by the Federal Trade Commission (FTC) in 16 CFR Part 460.

See Section 13-104.4.3 for compliance requirements pertaining to insulation installed in locations where the *R*-value is not readily apparent or the FTC label is not affixed to the installed product.

13-C1.2.1 When installing two layers of bulk or board insulation, the *R*-values of each material may be added together for a total *R*-value. When installing two separate reflective insulation products in layers, the total *R*-value of the system shall have been achieved by testing under FTC regulations, 16 CFR Part 460.

13-C1.2.2 Insulation that has been compressed to 85-percent or less of the manufacturer's rated thickness for the product shall use the R-values given in Table 13-C1.2.2. These values are to be used except where data developed by an independent testing laboratory is provided and approved by the Florida Building Commission.

TABLE 13-C1.2.2
R-VALUES OF COMPRESSED INSULATION

% OF ORIGINAL THICKNESS	R-5	R-7	R-11	R-14	R-19	R-30	R-38
90	5	6	10	13	18	28	36
80	4	6	10	12	17	26	33
70	4	5	9	11	15	24	30
60	3	5	8	10	14	22	27
50	3	4	7	9	12	18	24
40	2	4	6	8	10	15	20
30	2	3	4	6	8	12	16
20	20	2	2	3	4	10	10

13-C1.2.3 The thermal insulation materials listed below shall comply with the requirements of their respective ASTM standard specification and shall be installed in accordance with their respective ASTM installation practice in Table 13-C1.2.3.

13-C2.0 General criteria for the building envelope.

13-C2.1 Glazing. *U*-factors (thermal transmittances) or SHGC for glazed fenestration products shall be determined in accordance with NFRC 100, *Procedure for Determining Fenestration Product U-factors*, or NFRC 200, *Procedures for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence*, by an accredited, independent laboratory and labeled and certified by the manufacturer. See Section 13-104.4.5

13-C2.1.1 Unlabeled windows. When a manufacturer has not determined *U*-factor or SHGC in accordance with NFRC 100 or 200 for a particular product line, compliance with the building envelope requirements of this code shall be determined by assigning such products default *U*-factor or SHGC in accordance with Table 13-C2.1.1. Product features must be verifiable for the product to qualify for the default value associated with those features. Where the existence of a particular fea-

TABLE 13-C1.2.3
INSULATION INSTALLATION STANDARDS

Insulation Material	Standard Specification	Installation Practice
Mineral Fiber Batt/Blanket	ASTM C 665	ASTM C 1320
Mineral Fiber Loose Fill	ASTM C 764	ASTM C 1015
Cellulose Loose Fill	ASTM C 739	ASTM C 1015
Polystyrene Foam	ASTM C 578	—
Polyisocyanurate Foam	ASTM C 1289	—
Reflective	ASTM C 1224	ASTM C 727
Radiant Barrier	ASTM C 1313	ASTM C 1158
Vermiculite	ASTM C 516	–
Perlite	ASTM C 549	–
Spray-Applied Rigid Cellular Polyurethane Foam	ASTM C 1029	–
Interior Radiation Control Coating Systems	–	ASTM C 1321

ture cannot be determined with reasonable certainty, the product shall not receive credit for that feature. Where a composite of materials from two different product types are used, the product shall be assigned the higher *U*-factor or SHGC.

TABLE 13-C2.1.1
DEFAULT WINDOW ENERGY VALUES
FOR RESIDENTIAL APPLICATIONS

Type	U-factor	Solar Heat Gain Coefficient (SHGC)
Single pane clear	1.30	0.75
Single pane tine	1.30	0.64
Double pane clear	0.87	0.66
Double pane tint	0.87	0.55

13-C2.1.2 The overhang length for adjustable exterior shading devices shall be determined for the overhang at its most extended position.

13-C2.1.3 All glazing areas of a residence, including windows, sliding glass doors, glass in doors, skylights, etc., shall include the manufacturer's frame area in the total window area. Window measurements shall be as specified on the plans and specifications for the residence.

When a window in existing exterior walls is enclosed by an addition, an amount equal to the area of this window may be subtracted from the glazing area for the addition for that overhang and orientation.

13-C2.2 Walls.

13-C2.2.1 Exterior or adjacent walls consisting of more than one construction type or *R*-value shall be treated as separate walls.

13-C2.2.2 Walls separating an addition from the preexisting conditioned spaces shall not be included in the calculation.

13-C2.2.3 Common walls separating conditioned tenancies shall not be included as heat transfer areas in the as-built or baseline house envelope calculation.

13-C2.2.4 Walls that separate conditioned living space from unconditioned attic space, such as walls supporting cathedral ceilings and gambrel roofs, and skylight shafts, etc., shall be considered ceiling area for this calculation procedure.

13-C2.2.5 Net wall area (gross wall area of the building less all doors and windows) taken from the plans and specifications shall be used in the compliance calculation.

13-C2.3 Doors.

13-C2.3.1 Door areas shall be determined from the measurements specified on the plans for each exterior and adjacent door.

13-C2.3.2 All sliding glass doors and glass areas in doors shall be included in the glazing calculation and meet the requirements of Section 13-601 unless the glass is less than one-third of the area of the door.

13-C2.3.3 When meeting the requirements of Section 13-603.A.2 for data entry into the EnergyGauge USA Fla/Res computer program, the following shall apply:

13-C2.3.3.1 For doors that are opaque or where the glass is less than one-third of the area of the door, the total door area shall be included in the door calculation.

13-C2.3.3.2 For unlabeled sliding glass doors or when glass areas in doors is greater than or equal to one-third of the area of the door, the glazing portion shall be included in the glazing calculation and the opaque portion of the door shall be included in the door calculation.

13-C2.3.3.3 When glass area in doors is greater than or equal to one-third of the area of the door and meets the requirements of Section 13-104.4.5, the door shall be permitted to be entered into the EnergyGauge USA Fla/Res computer program as a total fenestration unit in the glazing calculation using the tested *U*-factor and solar heat gain coefficient.

13-C2.4 Ceilings.

13-C2.4.1 If different ceiling types or *R*-values are used in a house, each type or *R*-value shall be treated as a separate heat transfer area.

13-C2.4.2 Common ceilings shall not be included in the house envelope calculation.

13-C2.4.3 Ceilings separating an addition from the preexisting conditioned spaces shall not be included in the calculation.

13-C2.4.4 As-built ceiling area shall be the actual ceiling area exposed to attic or single assembly roof conditions, including walls that separate conditioned living space from unconditioned attic space. Baseline ceiling area shall be the total floor area within the conditioned space located directly below the roof.

13-C2.5 Floors.

13-C2.5.1 If the floor area consists of more than one type of construction or *R*-value, each floor system shall be treated as a separate floor heat transfer area.

13-C2.5.2 Common floors shall not be included in the calculation.

13-C2.5.3 Floors separating an addition from the preexisting conditioned spaces shall not be included in the calculation.

13-C2.5.4 Slab-on-grade floor perimeters shall be determined based on the linear footage of the slab which encloses the conditioned space, including both exterior and adjacent wall linear footage for single-family residential applications. In multiple-family applications, the slab linear footage between two conditioned tenancies shall be ignored.

13-C2.5.5 Raised floor areas shall be determined based on the conditioned floor area of floors above unconditioned space.

13-C3.0 Infiltration and internal gains.

13-C3.1 Infiltration area determination. The area to be considered in the infiltration calculation of Method A shall be the total conditioned floor area of the building.

* **13-C3.2** For residences that are not tested, infiltration and internal gains shall be considered the same for both the Baseline and As-built conditions. For residences with mechanical ventilation systems and with envelope leakage tested in accordance with ASHRAE Standard 119, Section 5.1, the measured air exchange rate (e) combined with the As-Built mechanical ventilation rate (f) where such mechanical ventilation rate shall not be less than $0.01 \times CFA + 7.5 \times (Nbr+1)$. See footnote (e) to Table 13-613.A.1-1.

13-C3.3 Infiltration barriers for frame construction. The following building materials and systems qualify as infiltration barriers when installed on the exterior of frame wall construction. Analogous methods apply to raised floor and ceiling construction.

13-C3.3.1 Plastic sheeting. Plastic sheeting products shall be considered air infiltration barriers when applied to a frame wall underneath an exterior finish and the following sealing requirements are met:

1. Sheeting shall be attached to the top plate by either:
   a. Mechanical fasteners and mastic, or
   b. Wrapping the sheeting over the top plate, then mechanically fastening it to the indoor faces of the plates. Sheeting shall be wrapped over the top plate prior to the trusses being set.
2. Sheeting shall be attached to the bottom plate by either:
   a. Mechanical fasteners and mastic to the bottom plate, foundation wall, header and end joists, floor deck or slab edge, or
   b. Wrapping the sheeting under the bottom plate, then mechanically fastening it to the indoor faces of the plates.
3. Sheeting shall be attached around doors and windows by either:
   a. Mechanical fasteners and mastic to the jams, or
   b. Mechanical fasteners to the framing members and mastic or pressure-sensitive tape with acrylic adhesive to metal or plastic mounting fins, or
   c. Wrapping the sheeting around the door or window opening, then attaching with mechanical fasteners to the indoor face of the framing.
4. Sheeting shall be attached with mechanical fasteners at all seams. All seams shall be sealed by either applying a mastic or a pressure sensitive tape with acrylic adhesive to the lapped ends. Rubber-based adhesive tapes shall not be used for this purpose.

Tapes of any type are not acceptable for sealing plastic sheeting to wood or masonry building components.

13-C3.3.2 Wood sheathing. Wood sheathing panels shall be considered air infiltration barriers when applied to a frame wall underneath an exterior finish and the following sealing requirements are met:

1. Joints formed by the square edges of adjoining panels shall be backed by a framing member. The joints between panels shall be sealed, or both adjoining panels sealed to the framing member using a mastic. For joints formed by tongue and groove edges, the groove of the panels shall be filled with mastic prior to mating the panels.
2. The panels shall be sealed to the top plate using a mastic.
3. The panels shall be sealed to the bottom plate, floor deck, or header and end joists using mastic.
4. The panels shall be sealed to the jambs or mounting fins of doors and windows using a mastic.

Tapes of any type are not acceptable sealants for sealing wood sheathing to wood members, mounting fins, or masonry.

13-C3.3.3 Nonwood sheathing. Nonwood sheathing panels including foam insulation boards, and foil or plastic faced boards of other materials, shall be considered air infiltration barriers when applied to a frame wall underneath an exterior finish and the following sealing requirements are met:

1. Joints between adjoining panels shall be sealed using one of the methods given for wood sheathing boards in Section 13-C4.1.2(1) above or, joints between adjoining panels shall be sealed by pressure sensitive tape with acrylic adhesive. Rubber-based adhesive tapes shall not be used for this purpose.
2. The panels shall be sealed to the top plate using a mastic.
3. The panels shall be sealed to the bottom plate, foundation wall, header and end joists, floor deck, or slab using mastic.
4. The panels shall be sealed to the jams or mounting fins of doors and windows using a mastic. Acrylic-based tape may be used to seal metal and plastic door and window mounting fins to the sheathing panels.

Tapes of any type are not acceptable sealants for sealing nonwood sheathing to wood or masonry building components.

13-C3.3.4 Stucco infiltration barrier. Stucco on exterior frame walls shall may qualify as an infiltration barrier if the following conditions are met:

1. Top plates, sill plates and sole plates or foundation joints to the stucco shall be sealed.
2. All holes in the outer wall face shall be patched. The entire exterior wall shall be coated with a weather-resistant stucco layer of at least a $^5/_8$ inch

(16 mm) thickness for cementitious stucco or 1/2 inch (12.7 mm) for polymeric stucco.

13-C3.4 Infiltration criteria for log wall construction. The following building materials, systems, or testing qualify as meeting the infiltration criteria for log wall construction:

13-C3.4.1 Continuous groove logs. A continuous spline shall be caulked in place, or sealed with compressible foam gasket tape.

13-C3.4.2 Single, double and/or multiple tongue and groove joints. Tongue and groove joints shall be caulked in place or sealed with compressible foam gasket tape.

13-C3.4.3 Testing. The wall system shall have been tested by either a whole house air infiltration test procedure approved by the Department of Community Affairs or by ASTM E 283 to demonstrate a maximum air change per hour (ACH) rate of 17.5 at 50 pascals of pressure difference. Air flow rates in cubic feet per minute (CFM) shall be converted to air changes per hour (ACH).

13-C4.0 Heating, ventilating and air conditioning.

13-C4.1 General.

13-C4.1.1 Existing equipment. Minimum efficiencies for existing equipment shall be assumed from Tables 13-C4.1.1A and 13-C4.1.1B by the age of the unit unless documentation is available to demonstrate a higher efficiency.

TABLE 13-C4.1.1A
COOLING SYSTEM ASSUMED, MINIMUM RATINGS BY DATE PERMITTED AIR CONDITIONERS

Date Building Permitted	Assumed Rating
Prior to 1979, average	EER 6.1
3/15/79 - 8/31/82	EER 6.1
9/1/82 - 5/31/84	EER 6.8
1/1/84 - 12/30/88	SEER 7.8
1/1/89 - 12/30/90	SEER 7.8
1/1/91 - 12/30/91	SEER 8.9
1/1/92 - 12/7/06	SEER 10.0
12/8/06 - present	SEER 13.0

TABLE 13-C4.1.1B
HEATING SYSTEM ASSUMED, MINIMUM RATINGS BY DATE PERMITTED HEAT PUMPS

Date Building Permitted	Assumed Rating
Prior to 1979, average	COP 2.2
3/15/79 - 8/31/82	COP 2.2
9/1/82 - 5/31/84	COP 2.2
6/1/84 - 12/31/86	COP 2.5
1/1/87 - 12/30/90	COP 2.7
1/1/91 - 12/30/91	HSPF 6.8
1/1/92 - 12/7/06	HSPF 6.8
12/8/06 - present	HSPF 7.7

13-C4.1.2 Multiple heating or cooling systems. Where two or more systems of the same type are installed with different levels of efficiency serving different parts of the house, a capacity-weighted performance rating shall be used to determine compliance.

13-C4.1.3 Cross ventilation. The cross ventilation option may be used in the EnergyGauge USA Fla/Res computer program for cross ventilating a house where windows or doors are provided that meet the following criteria:

1. Operable aperture areas totaling a minimum of 12 percent of the floor area of the room shall be provided for all primary living areas and main bedrooms.
2. Insect screens shall be provided for all windows and doors to be considered operable aperture area. All screened entry doors and interior doors in the ventilated areas shall be provided with either (1) mechanically attached door stops (or similar devices) to hold the door in an open position or (2) operable louvers.
3. The total aperture area shall be provided by a minimum of two distinct windows. Each window shall provide not more than 70 percent of the total aperture area. The windows (or sliding glass doors) shall be placed in adjacent or opposite walls. The windows may be placed on a single outside wall if wing walls are used.
4. Where wing walls are included in the building design for ventilation purposes, they shall be placed between windows to create a high-pressure and a low-pressure zone on each window. Wing walls shall extend from the ground to eve height, be located on the windward side of the building, and extend outward from the building a distance at least equal to one-half the width of the window.

   NOTE: This technique is effective only for areas which experience significant and continuous winds during the cooling months.

13-C4.1.4 Whole house fan. The whole house fan option may be used in the EnergyGauge USA Fla/Res computer program where a whole house fan is installed that meets following criteria:

1. The whole house fan has been sized to provide a minimum of 20 air changes per hour for the entire house.
2. The fan installed shall have a free air cfm rating of at least three times the square footage of the conditioned area of the house.
3. To ensure adequate air exhaust, the house attic shall have gable, ridge or wind turbine vents whose total opening area is equal to four times the ceiling cutout area for the whole house fan. Soffit vents shall not be included in the exhaust vent area.

13-C5.0 Air distribution systems.

13-C5.1 Ducts in conditioned space. For ductwork to qualify as being in conditioned space, it shall be located interior

* to both the thermal envelope and the pressure envelope of the building. These spaces shall not require supply or return outlets. Systems having no return air ducts or plenums between the air intake and the air handler, such as those in mechanical closets which communicate with the conditioned space, shall be considered systems with return ducts in conditioned space. Systems which have no ducts, such as * PTACs and room air conditioners, shall be treated as ductless systems.

13-C5.2 Multiple duct systems. Where parts of the structure are to be served by ductwork of different *R*-values, or by ducts in conditioned space, the duct calculation shall be performed by one of the following methods.

1. The smallest *R*-value may be used.
2. Each of the different duct *R*-values may be multiplied by the total duct area that has this insulation rating. The results are then summed and divided by the total area of the ductwork.

13-C5.3 Additions. If ducts are added to supply conditioned air to the addition, the ducts shall meet or exceed the minimum *R*-value requirements of this code. If conditioning is provided by existing ducts and registers or diffusers, a baseline duct shall be assumed.

13-C6.0 Service hot water.

13-C6.1 Water heater area determination. Water heating requirements are estimated based on the number of bedrooms in the residence. Any room which has an area of 70 square feet (7 m^2) or more and a clothes storage closet, and is not part of the common living area, shall be considered a bedroom for calculation purposes.

13-C6.2 Multiple water heating systems. Where two or more water heating systems are installed with different levels of efficiency, a single capacity-weighted efficiency shall be calculated for determining compliance with this code.

SUB-APPENDIX 13-2C

SUPPLEMENTAL CRITERIA FOR THE ALTERNATE RESIDENTIAL POINTS SYSTEM METHOD

13-2C1.0 General requirements.

13-2C1.1 Baseline features. The features in Section 13-613 are utilized in compliance Method A as "baseline" features. These features are not code minimum efficiencies; rather, they represent standard reference design building component options utilized in establishing a budget that the building shall not exceed to comply with the code.

13-2C1.2 Interpolation from tables. Interpolation of multipliers for the Alternate Residential Points System Method is allowed by Equation 13-2C1.2 where rated efficiencies of installed components fall within a range. Extrapolations of multipliers above the highest value given or below the lowest values given shall not be permitted.

$$M_i = \frac{M_t - [(R_i - R_t) \times (M_t - M_n)]}{R_n - R_t} \quad \textbf{(Equation 13-2C1.2)}$$

Where:

M_i = Multiplier for rating of installed component

M_n = Multiplier for next (more efficient) range

M_t = Multiplier for range within which installed component falls

R_i = Efficiency rating of installed component

R_n = Reference rating for next (more efficient) range

R_t = Reference rating for range within which installed component falls

13-C2.0 Building envelope performance criteria.

13-C2.1 Windows

13-2C.2.1.1 Glass multipliers. Glass multipliers for the Alternate Residential Points System Method shall be as provided on Form 600A and expanded by Tables 13-2C2.1.1A through 13-2C2.1.1C of this appendix.

13-2C2.1.2 Assumptions. Three basic underlying assumptions were used in development of the FLA/RES window load correlation coefficients:

1. Frame area equals 25 percent of the total window area.
2. Frame *U*-factor equals glass *U*-factor equals overall *U*-factor.
3. Interior shading factor equals 0.70 in summer and 0.9 in winter.

The general equation for determining the window point multipliers is as follows:

$$PM = A_1 \times SC_o + A_2 \times U_o + A_3 \times (SC_o \times U_o) + A_4 \times SC_o^2 + A_5 \times U_o^2 \quad \textbf{(Equation 13-2C2.1.2A)}$$

Where:

PM = Point multipliers (load coefficient in kBtu/ft^2 of window)

SC_o = Overall shading coefficient of entire installed system including glass, frame and sash and interior treatments.

U_o = Overall *U*-factor of entire installed window system, including glass, frame and sash

A_i = Regression coefficients

Coefficients A_1 through A_5 vary by (1) season of the year, (2) by climate zone and (3) and by glass orientation (8 + horizontal = 9), such that there are 54 sets of A-coefficients needed to fully describe the window point multipliers (load correlation coefficients in the *Florida Energy Code*).

The general equation for window shading is given as follows:

$$SHGC_t = (A_f \times SHGC_f + A_g \times SHGC_g)/A_w \quad \textbf{(Equation 13-2C2.1.2B)}$$

Where:

$SHGC_t$ = SHGC of total window system

A_f = frame area = 0.25

$SHGC_f$ = SHGC of the frame and sash

A_g = glass area = 0.75

$SHGC_g$ = SHGC of the glass

A_w = total window area = 1.00

The equation for the solution of $SHGC_f$ is as follows:

$$SHGC_f = k \times a \times U_f/h_o \quad \textbf{(Equation 13-2C2.1.2C)}$$

Where:

$SHGC_f$ = SHGC of the window frame and sash

k = frame shape factor = 1.00

a = solar absorptance of frame = 0.77

U_f = *U*-factor of frame and sash = U_g

h_o = exterior air film coefficient = 4.00 Btu/hr-ft^2-F

On substitution, Equation 13-2C2.1.2 reduces to:

$$SHGC_f = 1.00 \times 0.77 \times U_g / 4.00 = 0.1925 \times U_g$$

The overall solar heat gain coefficient ($SHGC_o$) of the installed window system and its treatments may be determined by multiplying the total solar heat gain coefficient ($SHGC_t$) by the interior window treatment coefficient (ITC) as follows:

$$SHGC_o = SHGC_t \times ITC \quad \textbf{(Equation 13-2C2.1.2D)}$$

Where:

$SHGC_o$ = Combined SHGC of glass, frame, sash, interior window treatments

ITC = Interior window treatment coefficient

13-C2.1.1 Glass point multipliers, Form 600A supplemental.

TABLE 13-2C2.1.1A
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 1, 2, 3

NORTH FLORIDA DEFAULT WINDOW POINT MULTIPLIERS

Single Pane: Default U-factor = 1.3								
Solar Heat Gain Coefficient	0.60-0.56	0.55-0.51	0.50-0.46	0.45-0.41	0.40-0.36	0.35-0.31	0.30-0.26	0.25-0
Summer:								
N	15.653	13.655	11.632	9.637	7.619	5.602	3.614	1.601
NE	25.108	22.329	19.518	16.745	13.939	11.136	8.373	5.576
E	36.576	32.840	29.057	25.325	21.545	17.768	14.041	10.267
SE	37.154	33.367	29.532	25.748	21.915	18.084	14.303	10.473
S	30.889	27.623	24.316	21.054	17.750	14.449	11.192	7.894
SW	34.846	31.256	27.621	24.035	20.403	16.773	13.193	9.567
W	33.301	29.831	26.318	22.852	19.343	15.836	12.377	8.874
NW	21.774	19.259	16.712	14.200	11.657	9.116	6.610	4.073
H	63.283	56.313	49.256	42.296	35.249	28.207	21.261	14.229
Winter:								
N	34.372	34.749	35.129	35.502	35.879	36.254	36.623	36.995
NE	33.421	33.874	34.331	34.782	35.236	35.690	36.136	36.586
E	28.826	29.622	30.429	31.225	32.032	32.839	33.635	34.442
SE	25.137	26.234	27.349	28.452	29.571	30.694	31.804	32.932
S	23.845	25.042	26.258	27.462	28.686	29.913	31.128	32.363
SW	26.976	27.933	28.904	29.866	30.842	31.821	32.789	33.773
W	30.859	31.523	32.195	32.857	33.527	34.196	34.856	35.523
NW	34.141	34.538	34.938	35.332	35.730	36.126	36.515	36.907
H	32.315	33.354	34.411	35.459	36.526	37.597	38.660	39.741

(continued)

TABLE 13-2C2.1.1A (continued)
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 1,2,3

SKYLIGHTS

Solar Heat Gain Coefficient	.481-.417	.416-.351	.350-.286	.285-.221	.22-.156	.155-.09	.89-.01
Summer	54.850	45.920	36.999	28.086	19.182	10.285	1.397
Winter	11.091	12.422	13.761	15.108	16.463	17.827	19.199

Double Pane: Default U-factor = 0.87								
Solar Heat Gain Coefficient	**0.50-0.46**	**0.45-0.41**	**0.40-0.36**	**0.35-0.31**	**0.30-0.26**	**0.25-0.21**	**0.20-0.16**	**0.15-0**
Summer:								
N	12.854	10.866	8.906	6.923	4.942	2.988	1.036	-0.965
NE	20.713	17.944	15.214	12.451	9.690	6.969	4.251	1.464
E	30.171	26.442	22.764	19.039	15.315	11.643	7.971	4.206
SE	30.708	26.929	23.201	19.425	15.650	11.926	8.202	4.381
S	25.488	22.234	19.025	15.776	12.528	9.324	6.123	2.839
SW	28.732	25.150	21.616	18.038	14.461	10.933	7.406	3.789
W	27.481	24.019	20.605	17.147	13.692	10.283	6.876	3.382
NW	17.981	15.477	13.007	10.506	8.007	5.543	3.081	0.556
H	52.565	45.607	38.743	31.794	24.851	18.002	11.158	4.138
Winter:								
N	25.735	26.095	26.448	26.805	27.160	27.508	27.856	28.210
NE	24.963	25.398	25.825	26.257	26.688	27.112	27.534	27.966
E	21.287	22.070	22.843	23.625	24.408	25.180	25.953	26.746
SE	18.143	19.228	20.301	21.391	22.483	23.564	24.647	25.762
S	17.052	18.238	19.413	20.607	21.805	22.991	24.180	25.405
SW	19.729	20.674	21.608	22.557	23.509	24.451	25.394	26.366
W	22.801	23.449	24.089	24.735	25.381	26.018	26.654	27.306
NW	25.522	25.903	26.278	26.656	27.033	27.403	27.771	28.148
H	23.141	24.181	25.213	26.263	27.319	28.365	29.416	30.499

TABLE 13-2C2.1.1B
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 4,5,6

CENTRAL FLORIDA DEFAULT WINDOW POINT MULTIPLIERS

Single Pane: Default U-factor = 1.3								
Solar Heat Gain Coefficient	0.60-0.56	0.55-0.51	0.50-0.46	0.45-0.41	0.40-0.36	0.35-0.31	0.30-0.26	0.25-0
Summer:								
N	22.362	19.786	17.179	14.608	12.007	9.408	6.846	4.253
NE	35.861	32.162	28.417	24.724	20.985	17.250	13.566	9.837
E	49.341	44.524	39.647	34.837	29.966	25.099	20.299	15.438
SE	47.026	42.405	37.726	33.112	28.441	23.774	19.171	14.511
S	36.765	32.993	29.174	25.407	21.593	17.782	14.023	10.217
SW	43.756	39.399	34.988	30.636	26.230	21.826	17.482	13.084
W	44.311	39.910	35.453	31.057	26.606	22.158	17.770	13.327
NW	30.755	27.475	24.154	20.879	17.564	14.251	10.984	7.677
H	82.534	73.595	64.543	55.616	46.577	37.544	28.634	19.613
Winter:								
N	15.495	15.635	15.777	15.916	16.057	16.198	16.336	16.477
NE	15.202	15.367	15.534	15.699	15.865	16.030	16.194	16.359
E	13.280	13.581	13.887	14.190	14.498	14.806	15.111	15.421
SE	11.818	12.226	12.640	13.050	13.467	13.885	14.299	14.719
S	11.246	11.693	12.147	12.597	13.055	13.514	13.968	14.430
SW	12.642	12.990	13.344	13.693	14.048	14.403	14.754	15.110
W	13.998	14.246	14.498	14.747	14.999	15.252	15.502	15.756
NW	15.426	15.575	15.726	15.874	16.024	16.173	16.320	16.468
H	15.912	16.289	16.672	17.053	17.440	17.830	18.216	18.609

(continued)

TABLE 13-2C2.1.1B (continued)
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 4,5,6

SKYLIGHTS

Solar Heat Gain Coefficient	.481-.417	.416-.351	.350-.286	.285-.221	.22-.156	.155-.09	.89-.01
Summer	70.588	59.150	47.772	36.304	24.897	13.499	2.113
Winter	5.853	6.329	6.809	7.292	7.779	8.268	8.761

Double Pane: Default U-factor = 0.87								
Solar Heat Gain Coefficient	**0.50-0.46**	**0.45-0.41**	**0.40-0.36**	**0.35-0.31**	**0.30-0.26**	**0.25-0.21**	**0.20-0.16**	**0.15-0**
Summer:								
N	18.078	15.517	12.993	10.438	7.886	5.370	2.857	0.280
NE	29.229	25.546	21.913	18.236	14.562	10.939	7.319	3.607
E	40.368	35.565	30.828	26.032	21.239	16.511	11.787	6.942
SE	38.495	33.888	29.346	24.747	20.152	15.620	11.092	6.449
S	29.943	26.189	22.487	18.738	14.993	11.298	7.606	3.820
SW	35.752	31.411	27.129	22.793	18.459	14.185	9.913	5.531
W	36.219	31.831	27.502	23.119	18.739	14.418	10.100	5.671
NW	25.029	21.764	18.544	15.285	12.028	8.816	5.607	2.315
H	68.105	59.186	50.389	41.482	32.581	23.801	15.028	6.030
Winter:								
N	11.416	11.548	11.677	11.807	11.938	12.066	12.194	12.325
NE	11.191	11.345	11.497	11.651	11.804	11.955	12.106	12.260
E	9.750	10.042	10.331	10.625	10.920	11.211	11.503	11.804
SE	8.576	8.975	9.371	9.773	10.176	10.575	10.975	11.386
S	8.142	8.584	9.021	9.466	9.912	10.353	10.797	11.253
SW	9.199	9.539	9.875	10.216	10.557	10.894	11.232	11.579
W	10.306	10.545	10.781	11.022	11.262	11.500	11.738	11.983
NW	11.350	11.489	11.625	11.763	11.900	12.035	12.169	12.307
H	11.386	11.761	12.133	12.512	12.893	13.271	13.650	14.042

TABLE 13-2C2.1.1C
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 7,8,9

SOUTH FLORIDA DEFAULT WINDOW POINT MULTIPLIERS

Single Pane: Default U-factor = 1.3								
Solar Heat Gain Coefficient	0.60-0.56	0.55-0.51	0.50-0.46	0.45-0.41	0.40-0.36	0.35-0.31	0.30-0.26	0.25-0
Summer:								
N	26.711	23.503	20.256	17.054	13.814	10.577	7.385	4.155
NE	42.060	37.600	33.086	28.634	24.127	19.624	15.183	10.688
E	60.515	54.528	48.468	42.492	36.444	30.401	24.442	18.411
SE	61.399	55.339	49.204	43.155	37.031	30.912	24.878	18.770
S	51.083	45.869	40.591	35.387	30.118	24.854	19.664	14.409
SW	56.262	50.617	44.901	39.263	33.555	27.850	22.222	16.524
W	53.940	48.479	42.950	37.496	31.974	26.456	21.013	15.502
NW	36.260	32.258	28.208	24.213	20.169	16.128	12.143	8.109
H	100.191	89.152	77.975	66.951	55.790	44.636	33.635	22.497
Winter:								
N	6.142	6.177	6.211	6.245	6.279	6.313	6.345	6.377
NE	5.999	6.051	6.103	6.155	6.207	6.259	6.311	6.362
E	5.158	5.286	5.416	5.545	5.675	5.806	5.936	6.068
SE	4.696	4.855	5.019	5.181	5.347	5.515	5.682	5.853
S	4.904	5.038	5.174	5.308	5.443	5.578	5.711	5.845
SW	5.336	5.429	5.523	5.616	5.711	5.806	5.900	5.995
W	5.702	5.771	5.841	5.910	5.980	6.050	6.120	6.190
NW	6.117	6.154	6.191	6.227	6.263	6.298	6.333	6.367
H	6.690	6.789	6.890	6.989	7.090	7.191	7.291	7.392

(continued)

TABLE 13-2C2.1.1C (continued)
SUBSTITUTE GLASS POINT MULTIPLIERS BY GLASS SOLAR HEAT GAIN COEFFICIENT AND ORIENTATION FOR CLIMATE ZONES 7,8,9

SKYLIGHTS

Solar Heat Gain Coefficient	.481-.417	.416-.351	.350-.286	.285-.221	.22-.156	.155-.09	.89-.01
Summer	86.556	72.430	58.316	44.216	30.129	16.055	1.994
Winter	2.633	2.761	2.889	3.017	3.145	3.273	3.401

Double Pane: Default U-factor = 0.87								
Solar Heat Gain Coefficient	**0.50-0.46**	**0.45-0.41**	**0.40-0.36**	**0.35-0.31**	**0.30-0.26**	**0.25-0.21**	**0.20-0.16**	**0.15-0**
Summer:								
N	21.754	18.568	15.427	12.247	9.071	5.939	2.811	-0.396
NE	34.356	29.913	25.531	21.096	16.664	12.294	7.927	3.450
E	49.539	43.570	37.683	31.725	25.773	19.903	14.040	8.028
SE	50.314	44.270	38.310	32.277	26.249	20.305	14.365	8.275
S	41.877	36.684	31.564	26.381	21.202	16.096	10.994	5.762
SW	46.096	40.468	34.916	29.295	23.678	18.137	12.599	6.920
W	44.221	38.777	33.407	27.970	22.536	17.177	11.821	6.328
NW	29.645	25.663	21.737	17.762	13.790	9.874	5.961	1.948
H	82.992	71.977	61.113	50.114	39.123	28.282	17.449	6.338
Winter:								
N	4.484	4.517	4.548	4.579	4.610	4.640	4.669	4.698
NE	4.334	4.383	4.432	4.481	4.530	4.578	4.626	4.675
E	3.679	3.799	3.917	4.037	4.158	4.278	4.397	4.520
SE	3.350	3.502	3.654	3.809	3.966	4.123	4.281	4.445
S	3.529	3.658	3.785	3.913	4.041	4.167	4.293	4.421
SW	3.915	4.004	4.092	4.181	4.271	4.360	4.448	4.540
W	4.186	4.252	4.317	4.383	4.449	4.514	4.579	4.645
NW	4.463	4.497	4.530	4.564	4.596	4.628	4.659	4.691
H	4.797	4.896	4.995	5.094	5.194	5.292	5.391	5.492

Combining Equation 13-2C2.1.2B thru Equation 13-2C2.1.2D yields the following simplified general equation for $SHGC_o$:

$$SHGC_o = (0.048125 \times U_g + 0.75 \times SHGC_g) \times ITC$$

(Equation 13-2C2.1.2E)

A solar heat gain coefficient ($SHGC_i$) may also be defined in terms of a corresponding shading coefficient (SC_i) using the following constitutive relationship given by ASHRAE:

$$SHGC_i = SC_i \times 0.87$$ **(Equation 13-2C2.1.2F)**

Thus, Equation 13-2C2.1.2E can be recast in terms of a glass shading coefficient (SC_g) as follows:

$$SC_o = (0.55316 \times U_g + 0.75 \times SC_g) \times ITC$$

(Equation 13-2C2.1.2G)

Where:

SC_g = Shading coefficient at the center-of-glass

Or, more simply, in terms of the most likely window manufacturer's product specification ($SHGC_t$), the equation becomes:

$$SC_o = SHGC_t / 0.87 \times ITC$$

(Equation 13-2C2.1.2H)

13-2C2.1.3 Glass orientation. Multipliers are provided on Form 600A by the glass orientation: N, NE, E, SE, S, SW, W, NW or H (horizontal).

13-2C2.1.4 Glass types. Multipliers are provided on Form 600A by glazing type, either single- or double-paned glass with either clear or tinted shading.

Where a SHGC for glazed fenestration products (windows, glazed doors and skylights) has been determined in accordance with NFRC 200, *Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence*, by an accredited, independent laboratory and labeled and certified by the manufacturer to be 0.57 or lower, a more favorable multiplier may be obtained from Tables 13-2C2.1.1A through 13-2C2.1.1C based on the climate zone in which it will be installed.

13-2C2.1.5 Glass overhangs. Overhang factors shall be determined from Tables 6A-1 and 6A-10 on Form 600A by matching either the overhang ratio or the overhang length (in feet) with the orientation of the glass it shades. The overhang ratio shall be calculated by the following equation:

$$\text{OH Ratio} = \frac{OH_{Length}}{OH_{Height}}$$

Where:

OH_{Length} = The horizontal measure of how far a window overhang projects out from the glass surface.

OH_{Height} = The vertical measure of the distance from the bottom of a window to the bottom of the overhang.

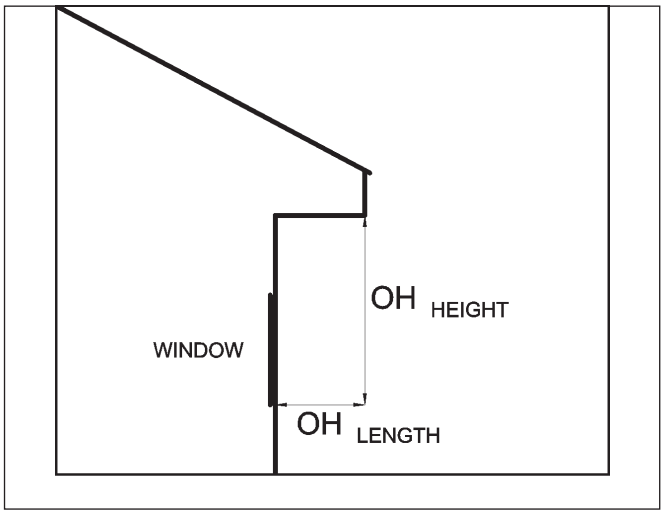


FIGURE 13-2C.2.1.5

13-2C2.1.5.1 To select the overhang factor by the overhang length, no part of the glass shall be more than 8 feet (2438 mm) below the overhang.

13-2C2.1.6 Between range calculation. In cases where an overhang length or solar heat gain coefficient falls between two glass percentage ranges and the glass type is the same throughout the addition, the specific glass percentage allowed may be determined by using the following equations:

Overhang (OH):

$$\text{Glass \% Allowed} = \text{Low\% Glass} + \frac{\text{High\% Glass} - \text{Low\% Glass}}{OH_{High\%} - OH_{Low\%}} \times [OH_{Installed} - OH_{Low\%}]$$

Solar heat Gain Coefficient (SHGC):

$$\text{Glass \% Allowed} = \text{Low\% Glass} + \frac{\text{High\% Glass} - \text{Low\% Glass}}{SHGC_{High\%} - SHGC_{Low\%}} \times [SHGC_{Installed} - SHGC_{Low\%}]$$

13-C2.2 Walls.

13-C2.2.1 Multipliers for lightweight concrete block shall be determined from Table 13-2C2.2.1. Light-weight block shall have an aggregate density of no greater than 105 pounds per cubic foot (1682 kg/m^3).

13-C2.2.2 Multipliers for polystyrene bead aggregate block shall be determined from Table 13-2C2.2.2. Polystyrene bead aggregate block shall be composed of at least 60 percent polystyrene beads by volume, and shall achieve at least an R-8 insulation value when tested to ASTM C 236.

13-2C2.2.3 Interpolation of multipliers for efficiencies falling within ranges may be made in accordance with Section 13-2C1.2 of this appendix.

13-2C2.3 Doors. Doors shall be identified as either exterior or adjacent, based on the type of wall in which they are located, and as wood or insulated. Multipliers for the type of door to be

installed shall be determined from Tables 6A-3 and 6A-12 on Form 600A.

13-C2.4 Ceilings.

13-2C2.4.1 Supplemental multipliers for ceilings under attics may be taken from Table 13-2C2.4.1

13-2C2.4.2 Supplemental multipliers for single assembly ceilings may be taken from Table 13-2C2.4.2.

13-2C2.4.3 Supplemental multipliers for concrete deck roofs with exposed ceilings may be taken from Table 13-2C2.4.3.

13-2C2.4.4 Supplemental multipliers for concrete roof decks with dropped ceilings may be taken from Table 13-2C2.4.4.

13-2C2.5 Floors.

13-2C2.5.1 Raised floors supported by stem walls with under floor insulation. Floor multipliers for stem walls with stem wall insulation shall be taken from Table 13-2C2.5.1.

13-2C2.5.1.1 Floor vent area.

1. In raised floors supported by stem walls with under floor insulation, the vent area for the subfloor space shall not exceed 1 square foot (.0929 m^2) per 150 square feet (14 m^2) of floor area.
2. In raised floors supported by stem walls with stem wall insulation, the vent area for the subfloor space shall not exceed $^1/_{10}$ square foot (.009 m^2) of open vent area per 150 square feet (14 m^2) of floor area when utilizing the stem wall with stem wall insulation multipliers. A continuous vapor barrier shall be applied over the ground under the floor.

TABLE 13-2C2.2.1
CONCRETE BLOCK MULTIPLIERS – LIGHT WEIGHT

	ZONES 1,2,3				ZONES 4,5,6				ZONES 7,8,9			
	Interior Insulation		Exterior Insulation		Interior Insulation		Exterior Insulation		Interior Insulation		Exterior Insulation	
R-Value	SPM	WPM	SPM	WPM	SPM	WPM	SPM	WPM	SPM	WPM	SPM	WPM
0 - 2.9	1.7	8.8	1.7	8.8	1.8	4.7	1.8	4.7	3.3	1.5	3.3	1.5
3 - 4.9	1.0	6.1	0.7	4.9	1.1	3.1	0.8	2.3	2.2	0.9	1.5	0.5
5 - 6.9	0.8	4.8	0.4	3.9	0.8	2.4	0.3	1.7	1.6	0.7	1.1	0.3
7 - 10.9	0.6	4.0	0.2	3.1	0.6	1.9	0.1	1.2	1.3	0.5	0.7	0.2
11 - 18.9	0.4	2.8	0.1	2.2	0.3	1.3	0.0	0.8	0.9	0.3	0.4	0.0
19 - 25.9	0.2	1.8	—	—	0.1	0.8	—	0.5	0.2	—	—	—
26 & up	0.1	1.3	—	—	0.0	0.5	—	—	0.3	0.1	—	—

TABLE 13-2C2.2.2
CONCRETE BLOCK MULTIPLIERS POLYSTYRENE BEAD AGGREGATE

	Zones 1,2,3		Zones 4,5,6		Zones 7,8,9	
R-Value	SPM	WPM	SPM	WPM	SPM	WPM
0 & Up	0.8	5.3	0.6	2.4	2.0	0.6

TABLE 13-2C2.4.1
CEILING UNDER ATTIC SUMMER AND WINTER POINT MULTIPLIERS

North 1,2,3			Central 4,5,6			South 7,8,9		
R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points
R0	27.28	25.53	R0	10.81	30.53	R0	2.14	39.93
R5	7.44	6.80	R5	2.64	8.13	R5	0.46	10.67
R10	4.28	3.80	R10	1.46	4.60	R10	0.25	6.00
R15	3.19	2.80	R15	1.05	3.33	R15	0.18	4.40
R20	2.62	2.27	R20	0.84	2.73	R20	0.14	3.60
R25	2.28	1.93	R25	0.73	2.33	R25	0.11	3.13
R30	2.05	1.73	R30	0.64	2.13	R30	0.10	2.80
R35	1.89	1.60	R35	0.57	1.987	R35	0.09	2.53
R40	1.77	1.47	R40	0.52	1.80	R40	0.08	2.40
R45	1.66	1.40	R45	0.50	1.67	R45	0.07	2.20
R50	1.59	1.33	R50	0.48	1.60	R50	0.06	2.13

TABLE 13-2C2.4.2
CEILING SINGLE ASSEMBLY SUMMER AND WINTER POINT MULTIPLIERS

North 1,2,3			Central 4,5,6			South 7,8,9		
R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points
R0	16.50	41.20	R0	7.01	49.80	R0	1.21	65.50
R5	4.87	13.80	R5	1.87	16.80	R5	0.30	22.27
R10	2.87	8.40	R10	1.02	10.27	R10	0.16	13.67
R15	2.16	6.47	R15	0.75	7.93	R15	0.11	10.53
R20	1.80	5.47	R20	0.59	6.67	R20	0.10	8.87
R25	1.59	4.87	R25	0.52	5.93	R25	0.09	7.93
R30	1.43	4.40	R30	0.46	5.40	R30	0.08	7.27
R35	1.32	4.13	R35	0.41	5.07	R35	0.08	6.80
R40	1.25	3.87	R40	0.39	4.80	R40	0.08	6.40
R45	1.18	3.73	R45	0.36	4.60	R45	0.07	6.13
R50	1.14	3.60	R50	0.34	4.40	R50	0.07	6.27

TABLE 13-2C2.4.3
CONCRETE DECK ROOF: EXPOSED SUMMER AND WINTER POINT MULTIPLIERS

North 1,2,3			Central 4,5,6			South 7,8,9		
R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points
R0	23.28	54.20	R0	9.99	65.67	R0	1.82	86.67
R5	6.01	16.40	R5	2.30	20.00	R5	0.36	26.33
R10	3.16	9.13	R10	1.16	11.13	R10	0.18	14.73
R15	2.18	6.47	R15	0.77	7.93	R15	0.14	10.53
R20	1.66	5.13	R20	0.59	6.27	R20	0.09	8.33
R25	1.37	4.33	R25	0.48	5.27	R25	0.08	7.00
R30	1.16	3.80	R30	0.39	4.60	R30	0.07	6.13
R35	1.02	3.40	R35	0.34	4.13	R35	0.06	5.47
R40	0.91	3.07	R40	0.30	3.73	R40	0.05	5.00
R45	0.82	2.87	R45	0.25	3.47	R45	0.05	4.60
R50	0.75	2.67	R50	0.23	3.27	R50	0.05	4.33

13-2C3.0 Infiltration and internal gains.

13-2C3.1 Infiltration and internal gains multipliers. Infiltration and internal gains shall be considered the same for both the baseline and as-built conditions. Multipliers for infiltration and internal gains shall be determined from Table 6A-6 on Form 600A for the cooling load and from Table 6A-15 for the heating load.

13-2C4.0 Heating, ventilating and air conditioning.

13-2C4.1 General.

13-2C4.1.1 Multiple heating or cooling. Where two or more systems of the same type are installed with different levels of efficiency serving different parts of the house, a single system multiplier may be calculated. To select a multiplier for a dual system, the efficiency ratings for the two systems shall be combined based on the percentage of the total capacity supplied by each system. The new effective efficiency rating shall be calculated by Equation 13-2C4.1.1.

$$ER_{new} = \frac{(CR_a \times ER_a)}{CR_t} + \frac{(CR_b \times CR_b)}{CR_t}$$

(Equation 13-2C4.1.1)

Where:

ER_{new} = Efficiency to be used in selecting multiplier

CR_a = Capacity Rating of system A

CR_b = Capacity Rating of system B

CR_t = Combined capacity of both systems

ER_a = Efficiency rating of system A

ER_b = Efficiency rating of system B

Where two or more dissimilar systems, such as electric and fuel-fired systems, are utilized, separate calculations shall be made for the separate zones of the structure serviced by each.

TABLE 13-2C2.4.4
CONCRETE ROOF DECK: DROPPED SUMMER AND WINTER POINT MULTIPLIERS

North 1,2,3			Central 4,5,6			South 7,8,9		
R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points	R-Value	Heating Points	Cooling Points
R0	20.09	48.53	R0	8.26	58.00	R0	1.43	76.53
R5	5.42	15.0	R5	2.05	13.88	R5	0.32	24.13
R10	2.91	8.47	R10	1.05	10.40	R10	0.16	13.67
R15	2.00	6.07	R15	0.71	7.47	R15	0.11	9.87
R20	1.57	4.87	R20	0.57	6.20	R20	0.09	7.87
R25	1.30	4.07	R25	0.43	5.07	R25	0.07	6.67
R30	1.09	3.60	R30	0.36	4.47	R30	0.06	5.87
R35	0.98	3.27	R35	0.32	4.00	R35	0.05	5.27
R40	0.86	2.93	R40	0.27	3.67	R40	0.04	4.87
R45	0.80	2.73	R45	0.25	3.40	R45	0.04	4.47

TABLE 13-2C2.5.1
FLOORS MULTIPLIERS FOR STEM WALL WITH STEM WALL INSULATION

	ZONES 1,2,3		ZONES 4,5,6		ZONES 7,8,9	
R-Value	SPM	WPM	SPM	WPM	SPM	WPM
0	-4.7	3.5	-5.8	1.8	-4.2	0.3
3.5	-4.7	2.6	-5.8	1.4	-4.5	0.2
7	-4.7	2.4	-5.8	1.3	-4.6	0.2
11	-4.7	2.3	-5.8	1.3	-4.7	0.2

13-2C4.1.2 Existing systems. Multipliers for existing HVAC systems shall be taken from Table 13-2C4.1.2A or 13-2C4.1.2B based on the year the system was permitted unless documentation is available to demonstrate another efficiency.

TABLE 13-2C4.1.2A
COOLING SYSTEM MULTIPLIER ASSUMED MINIMUM RATINGS BY DATE PERMITTED AIR CONDITIONERS

Date Building Permitted	Assumed Rating	Cooling System Multiplier (all zones)
Prior to 1979, average	EER 6.1	0.56
3/15/79 - 8/31/82	EER 6.1	0.56
9/1/82 - 5/31/84	EER 6.8	0.50
1/1/84 - 12/30/88	SEER 7.8	0.44
1/1/89 - 12/30/90	SEER 7.8	0.40
1/1/91 - 12/30/91	SEER 8.9	0.38
1/1/92 - 12/7/06	SEER 10.0	0.34
12/8/06 - present	SEER 13.0	0.26

TABLE 13-2C4.1.2B
HEATING SYSTEM MULTIPLIER ASSUMED MINIMUM RATINGS BY DATE PERMITTED HEAT PUMPS

Date Building Permitted	Assumed Rating	Heating System Multiplier		
		North	Central	South
Prior to 1979, average	COP 2.2	0.63	0.63	0.63
3/15/79 - 8/31/82	COP 2.2	0.63	0.63	0.63
9/1/82 - 5/31/84	COP 2.2	0.63	0.63	0.63
6/1/84 - 12/31/86	COP 2.5	0.56	0.54	0.53
1/1/87 - 12/30/90	COP 2.7	0.52	0.50	0.49
1/1/91 - 12/30/91	HSPF 6.8	0.53	0.53	0.53
1/1/92 - 12/7/06	HSPF 6.8	0.50	0.50	0.50
12/8/06 - present	HSPF 7.7	0.45	0.45	0.45

13-2C4.1.3 Interpolation of multipliers. Interpolation of multipliers for equipment efficiencies falling within ranges may be made in accordance with Section 13-2C1.2 of this appendix.

13-2C4.2 Cooling system. Multipliers shall be determined for air conditioners based on the appropriate efficiency rating for the system to be installed or from Table 6A-9 on Form 600A. Cooling system performance criteria and multipliers for systems not found on Form 600A may be found in Table 13-2C4.2. Interpolation of multipliers for equipment efficien-

cies falling within ranges may be made in accordance with Section 13-2C1.2 of this appendix.

13-2C4.2.1 Cooling system credits.

13-2C4.2.1.1 Ceiling fan credit. Ceiling fan credit may be taken if one or more ceiling fans are installed in each of the bedrooms and a minimum of one ceiling fan is installed in all primary living areas (living rooms, family rooms, or great rooms). This shall not include spaces designed to be dining rooms or dining areas. Areas separated by permanently fixed archways, walls, or dividers shall be considered separate rooms. The following criteria shall be met:

1. Ceiling fans shall be installed with minimum fan blade diameters of no less than those listed in Table 13-2C4.2.1.1 for the size and shape of the room.
2. Where a primary living area is an "L-shaped" room and the smaller portion of this area is 8 feet by 10 feet (2438 mm by 3048 mm) or larger, a fan shall be installed in both the larger and smaller portions of the primary living area.

Exception: Credit shall not be taken for both ceiling fans and cross ventilation.

TABLE 13-2C4.2.1.1
FAN SIZING TABLE

LONGEST WALL LENGTH (feet)	MINIMUM FAN SIZE (inches)
≤ 12	36
> 12 - 16	48
> 16 - 17.5	52
> 17.5 - 25	56
> 25	2 fans (minimum of 48 inches each)

For SI: 1 inch = 25.4, 1 foot = 304.8 mm.

13-2C4.2.1.2 Multizone practice. Multizone credit may be taken if two or more spaces (zones) are completely separated from one another by walls, ceilings, floor and totally closing doors and meet the following criteria:

1. A separate thermostatic control shall be provided for each zone which provides independent conditioning.
2. Zones shall be completely separated from one another by walls, ceilings, floor and totally closing doors and shall be configured such that air exchange between them does not exist in a free flow manner. Doors between zones shall not exceed a total of 40 square feet (4 m^2).

   Exceptions:

   a. Where one zone consists of multiple rooms which may be isolated with closeable doors and are served by one air conditioning system, separation criteria may be met by providing separate return air ducts to each room. The common space connecting the rooms shall be part of another zone.
   b. Between lower and upper floors in a multiple-story home.
3. No zone shall constitute more than 75 percent of the total conditioned floor area.

The multizone credit multiplier shall be determined from Table 6A-19 on Form 600A.

13-2C4.2.1.3 Ventilation. Ventilation cooling credit may be taken for either cross ventilating a house or by installing a whole house fan, but credit shall not be taken for both. Cooling credit for ventilation shall be determined from Table 6A-19 on Form 600A.

13-2C4.2.1.3.1 Cross ventilation credit. Cross ventilation credit may be claimed where windows or doors are provided that meet the following criteria:

1. Operable aperture areas totaling a minimum of 12 percent of the floor area of the room shall be provided for all primary living areas and main bedrooms.
2. Insect screens shall be provided for all windows and doors to be considered operable aperture area. All screened entry doors and interior doors in the ventilated areas shall be provided with either (1) mechanically attached door stops (or similar devices) to hold the door in an open position or (2) operable louvers.
3. The total aperture area shall be provided by a minimum of two distinct windows. Each window shall provide not more than 70 percent of

TABLE 13-2C4.2
COOLING SYSTEM MULTIPLIERS GAS FUELED AIR CONDITIONERS

Natural Gas										
COP	.4–.49	.5–.59	.6–.69	.7–.79	.8–.89	.9–.99	1.0–1.09	1.1–1.19	1.2–1.29	1.3&Up
Zones 1,2,3	0.99	0.79	0.66	0.57	0.50	0.44	0.40	0.36	0.33	0.31
Zones 4,5,6	1.03	0.82	0.69	0.59	0.52	0.46	0.41	0.37	0.34	0.32
Zones 7,8,9	0.95	0.76	0.64	0.54	0.48	0.42	0.38	0.35	0.32	0.29

LP Gas										
COP	.4–.49	.5–.59	.6–.69	.7–.79	.8–.89	.9–.99	1.0–1.09	1.1–1.19	1.2–1.29	1.3&Up
Zones 1,2,3	1.35	1.08	0.90	0.77	0.67	0.60	0.54	0.49	0.45	0.41
Zones 4,5,6	1.26	1.01	0.84	0.72	0.63	0.56	0.50	0.46	0.42	0.39
Zones 7,8,9	1.21	0.97	0.81	0.69	0.61	0.54	0.49	0.44	0.40	0.37

the total aperture area. The windows (or sliding glass doors) shall be placed in adjacent or opposite walls. The windows may be placed on a single outside wall if wing walls are used.

4. Where wing walls are included in the building design for ventilation purposes, they shall be placed between windows to create a high-pressure and a low-pressure zone on each window. Wing walls shall extend from the ground to eve height, be located on the windward side of the building, and extend outward from the building a distance at least equal to one-half the width of the window.

   NOTE: This technique is effective only for areas which experience significant and continuous winds during the cooling months.

13-2C4.2.1.3.2 Whole house fan credit. Whole house fan credit may be claimed where a whole house fan is installed and the following criteria are met:

1. The whole house fan has been sized to provide a minimum of 20 air changes per hour for the entire house.
2. The fan installed shall have a free air cfm rating of at least three times the square footage of the conditioned area of the house.
3. To ensure adequate air exhaust, the house attic shall have gable, ridge or wind turbine vents whose total opening area is equal to four times the ceiling cutout area for the whole house fan. Soffit vents shall not be included in the exhaust vent area.

13-2C4.2.1.4 Attic radiant barrier credit. Cooling credit may be taken for attic radiant barriers where a radiant barrier system is to be installed in one of the configurations depicted in Figure 13-2C4.2.1.4 and the following conditions are met:

1. It shall be fabricated over a ceiling insulated to a minimum of R-19 with conventional insulation. The radiant barrier credit shall not be used as a means to achieve partial or whole compliance with the minimum attic insulation level of R-19 prescribed in Section 13-604.ABC.1. Either a sheet type or spray applied interior radiation control coating (IRCC) may be used.
2. If the radiant barrier material has only one surface with high reflectivity or low emissivity it shall be facing downward toward the ceiling insulation.
3. The attic airspace shall be vented in accordance with Section 2309.7 of the *Florida Building Code, Building*.
4. The radiant barrier system shall conform to ASTM C 1313, *Standard Specification for Sheet Radiant Barriers for Building Construction Applications,* or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction* as appropriate for the type of radiant barrier to be installed. The operative surface shall have an emissivity not greater than 0.06 for sheet radiant barriers or 0.25 for interior radiation control coatings as demonstrated by independent laboratory testing according to ASTM C 1371.
5. The radiant barrier system (RBS) shall conform with ASTM C 1158, *Use and Installation of Radiant Barrier Systems (RBS) in Building Constructions for Sheet Radiant Barriers*, or ASTM C 1321, *Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCCS) in Building Construction* for IRCC systems.
6. The radiant barrier shall be installed so as to cover gable ends without closing off any soffit, gable or roof ventilation.

Cooling credit shall be taken against the ceiling load by multiplying the summer point multiplier for the ceiling configuraiton and insulation level chosen from Table 6A-4 on Form 600A by a credit multiplier of the following:

Sheet type radiant barriers:

0.70 (all climate zones)

Interior Radiation Control Coatings:

0.849 North Florida

0.864 Central Florida

0.865 South Florida

13-2C4.2.1.5 Cool roof credit. Cool roof credit may be taken where a roof is installed that has a tested solar reflectance of greater than 4 percent when evaluated in accordance with ASTM E-903. Testing of a qualifying sample of the roofing material shall be performed by an approved independent laboratory with these results provided by the manufacturer.

Cooling credit shall be taken against the ceiling load by multiplying the summer point multiplier for the ceiling configuration and insulation level chosen on Form 600A by a credit multiplier according to the tested reflectance:

CM = 1.155 – 0.935 (Reflectance)

Where:

Reflectance = fractional (0–1)

Note that where a tested reflectance is not available the assumed roof reflectance will be 4 percent and a CM value of 1.118 will be used for those which are untested. This is also true for those roofs that do not use the cool roof credit.

13-2C4.2.1.6 Programmable thermostats. The cooling credit multiplier for programmable thermostats shall be determined from Table 6A-19 on Form 600A.

13-2C4.3 Heating systems. Multipliers shall be determined for the type of heating systems based on the appropriate efficiency rating for the system to be installed or from Table 6A-18 on Form 600A. Interpolation of multipliers for equipment efficiencies falling within ranges may be made in accordance with Section 13-2C1.2.

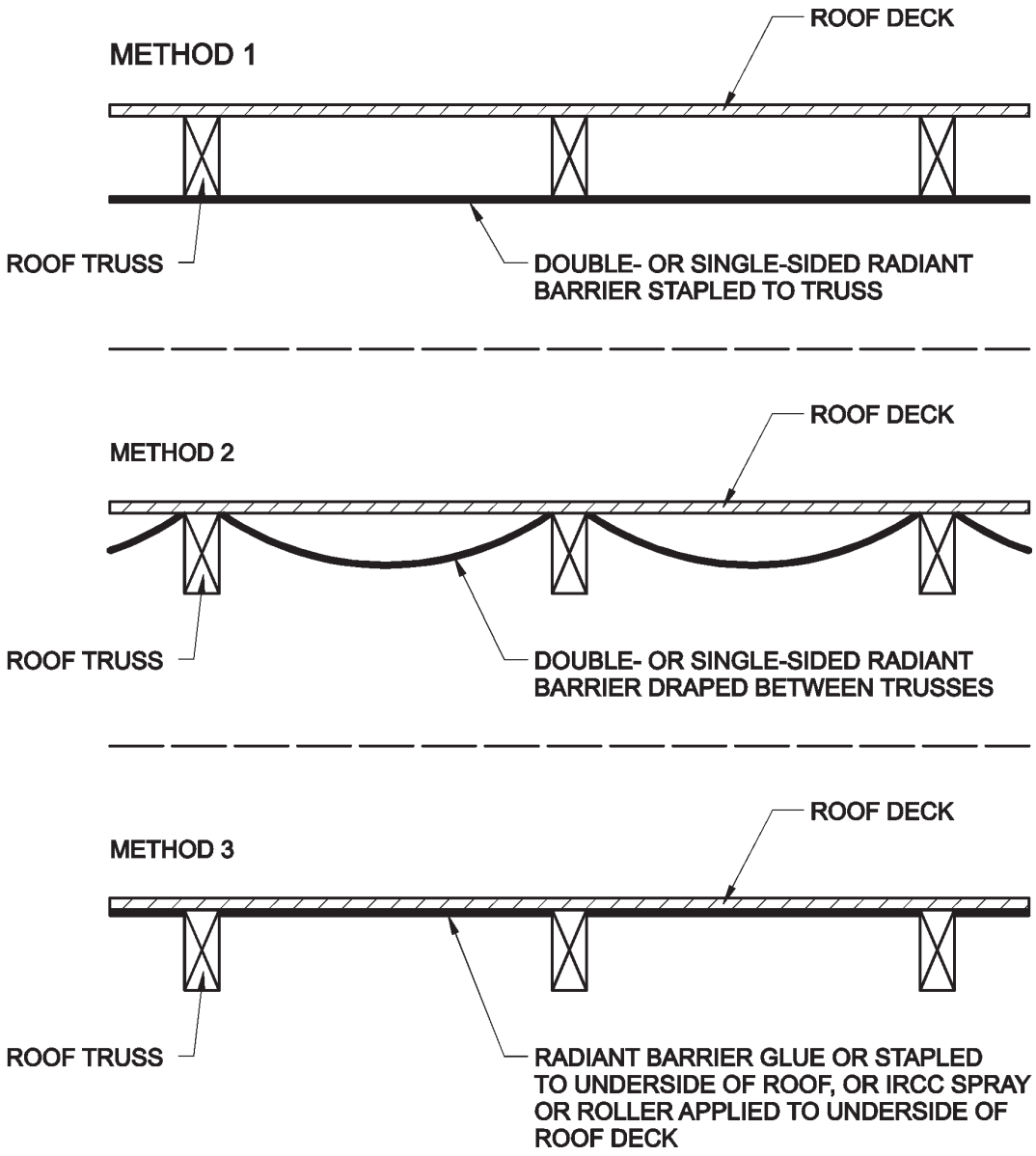


FIGURE 13-2C4.2.1.4
ACCEPTABLE ATTIC RADIANT BARRIER CONFIGURATIONS

13-2C4.3.1 Heating system credits. Heating credit multipliers (HCM) are given for certain technologies which reduce energy use or cost. Heating credit may be taken for the options in this section where the criteria of 13-2C4.3.1.1 through 13-2C4.3.1.5 have been met for that option. Where more than one heating credit is taken, the multipliers for each option shall be multiplied together to obtain one multiplier.

13-2C4.3.1.1 Attic radiant barriers. Attic radiant barrier credit may be taken when an attic radiant barrier is installed that is compliant with all requirements in Section 13-2C4.2.1.4. Heating credit shall be taken against the ceiling load by multiplying the winter point multiplier for the ceiling configuration and insulation level chosen from Table 6A-13 on Form 600A by a credit multiplier of the following:

Sheet type radiant barriers	0.85 (all climate zones)
Interior radiation control coatings	0.912 North Florida
	0.905 Central Florida
	0.899 South Florida

13-2C4.3.1.2 Multizone practice. Multizone credit may be taken where two or more independent heating zones occur in a building that meets the prescriptive construction requirements in Section 13-2C4.1.2. The heating credit multiplier for multizone systems shall be determined from Table 6A-18 on Form 600A.

13-2C4.3.1.3 Hydronic space water heating. Hydronic space gas heating credit multipliers may be used for houses where hydronic space gas water heating systems are installed where the effective space heating efficiency (CA_{afue}) of the system (as listed by GAMA) has not been tested to ANSI/ASHRAE 124. Combined gas instantaneous (tankless) water heating and space heating systems may be rated based on the Thermal Efficiency (Et) rating of the gas instantaneous (tankless water heater in accordance with ANSI test method Z21.10.3. The heating system credit multiplier for combined hydronic space gas water heating with a storage tank shall be taken from Table 13-2C4.3.1.3A. The heating system credit multiplier for combined hydronic instantaneous (tankless) gas water heating shall be taken from Table 13-2C4.3.1.3B. A gas instantaneous (tankless) water heater shall be as defined in Section 13-612.AB.3.2.3.

TABLE 13-2C4.3.1.3A
HEATING SYSTEM CREDIT MULTIPLIERS FOR COMBINED HYDRONIC SPACE GAS WATER HEATING WITH A STORAGE TANK

Gas Water Heater Recovery Efficiency	Zones 1,2,3	Zones 4,5,6	Zones 7,8,9
0.76	0.54	0.56	0.52
0.83	0.49	0.51	0.47
0.94	0.44	0.45	0.42

TABLE 13-2C4.3.1.3B
HEATING SYSTEM CREDIT MULTIPLIERS FOR COMBINED HYDRONIC INSTANTANEOUS (TANKLESS) GAS WATER HEATING

Tankless Water Heater Thermal Efficiency (E_t)	Zones 1,2,3	Zones 4,5,6	Zones 7,8,9
.78	.52	.55	.57
.80	.51	.54	.57
.84 and up	.49	.52	.56

13-2C4.3.1.4 Programmable thermostats. Programmable thermostat credit may be claimed for houses installed with programmable thermostats that are capable of being set as follows:

Winter: 68°F (20°C) from 6 am - 11 pm
66°F (19°C) from 11 pm - 6 am

Houses for which programmable thermostat credit is claimed shall have one or more features on the thermostat that prevent supplemental heat from being automatically engaged. The heating credit multiplier for programmable thermostats shall be determined from Table 6A-21 on Form 600A.

13-2C4.3.1.5 Cool roofs. Cool roof credit may be claimed for houses when a cool roof system is installed that is compliant with all requirements in Section 13-2C4.2.1.5. Heating credit shall be taken against the ceiling load by multiplying the winter point multiplier for the ceiling configuration and insulation level chosen on Form 600A by a credit multiplier. Credit shall not be taken for both attic radiant barrier and cool roofs in conjunction.

HM = 0.987 + 0.088 (Reflectance)

Note that where a tested reflectance is not available the assumed roof reflectance will be 4 percent and a HM value of 0.987 will be used for those which are untested. This is also true for those roofs that do not use the cool roof credit.

13-2C4.3.2 Other gas systems.

13-2C4.3.2.1 Gas fueled heat pumps. Heating system multipliers for gas-fueled air conditioners and heat pumps shall be taken from Table 13-2C4.3.2.1.

13-2C4.3.2.2 Combination gas hydronic systems; hydronic space water heating. Hydronic space gas heating multipliers may be used for houses where hydronic space gas water heating systems are installed in accordance with the following criteria:

1. Combined gas storage tank water heating and space heating systems that have been tested to ANSI/ASHRAE 124 may be rated based on the effective space heating efficiency (CA_{afue}) as listed by the GAMA, or
2. Combined gas instantaneous (tankless) water heating and space heating systems may be rated based on the Thermal Efficiency (E_t) rating of the gas instantaneous (tankless) water heater in accordance with ANSI test method Z21.10.3.

Heating system multipliers to be used for combined gas storage tank water heating and space heating systems may be determined from Table 6A-18 on Form 600A based on the effective space heating efficiency (CA_{afue}) as listed by GAMA where the system has been tested to ANSI/ASHRAE 124.

13-2C5.0 Air distribution systems.

13-2C5.1 General.

TABLE 13-2C4.3.2.1
HEATING SYSTEM MULTIPLIERS GAS FUELED HEAT PUMPS

	Natural Gas		LP Gas	
COP	1.25	1.30	1.25	1.30
Climate Zones 1,2,3	0.32	0.31	0.43	0.41
Climate Zones 4,5,6	0.33	0.32	0.40	0.39
Climate Zones 7,8,9	0.30	0.29	0.39	0.37

13-2C5.1.1 Ducts in conditioned space. For ductwork to qualify as being in conditioned space, it shall be located on the conditioned side of the envelope insulation and be situated in such a manner that any air leakage will be discharged into the conditioned space. Systems having no return air ducts or plenums between the air intake and the air handler, such as those in mechanical closets which communicate with the conditioned space, shall be considered systems with return ducts in conditioned space.

13-2C5.1.2 Multiple duct systems. Where parts of the structure are to be served by ductwork of different *R*-values, or by ducts in conditioned space, the duct calculation shall be performed by one of the following methods.

1. The smallest *R*-value may be used.
2. Each of the different *R*-values may be multiplied by the total duct area that has this insulation rating. The results are then summed and divided by the total area of the ductwork.

13-2C5.1.3 Additions. If ducts are added to supply conditioned air to the addition, the ducts shall meet or exceed the minimum *R*-value requirements of this code. If conditioning is provided by existing ducts and registers or diffusers, a baseline duct shall be assumed.

13-2C5.2 Air distribution system multipliers.

13-2C5.2.1 Duct multipliers. Multipliers for the type of duct system and insulation level to be installed shall be determined from Tables 6A-7 and 6A-16 on Form 600A. Multipliers for duct conditions not found on Form 600A may be found in Tables 13-2C5.2.1A through 13-2C5.2.1C for the climate zone where they are to be installed.

13-2C5.2.1.1 Duct length determination. An estimate of the linear footage of duct shall be utilized on Form 600A.

13-2C5.2.2 Air-handling unit multipliers. Air-handling multipliers shall be determined from Tables 6A-7 and 6A-16 on Form 600A by the location of the air handler in the building for summer and winter conditions.

13-2C5.2.2.1 Air distribution system credits. Credits are given for air distribution system practices described in Sections C5.2.2.1.1 and C5.2.2.1.2. AHU credit multipliers shall be entered into the as-built AHU boxes on Form 600A and calculated as part of the cooling and heating loads for the building.

13-2C5.2.2.1.1 Air-tight duct credit. An air-tight duct credit multiplier of 1.0 may be taken if the duct work has been demonstrated to be "substantially leak free". "Substantially leak free" shall mean distribution system air leakage to outdoors no greater than 3 cfm per 100 square feet of conditioned floor area and distribution system total air leakage to indoors and outdoors no greater than 9 cfm per 100 square feet of conditioned floor area at a pressure differential of 25 Pascal (0.10 in. w.c.) across the entire air distribution system, including the manufacturer's air handler enclosure. Distribution system total air leakage no greater than 3 cfm per 100 square feet of conditioned floor area at a pressure difference of 25 Pascal across the entire system, including the manufacturer's air handler enclosure, shall be deemed to meet this requirement without measurement of distribution system air leakage to outdoors. Substantially leak free air distribution systems shall be certified by means of a test report prepared by a state-approved performance tester. A state-approved performance tester means a Class 1 Florida Energy Gauge Certified Energy Rater, State of Florida mechanical contractor or recognized test and balance agent. Contractors shall not test their own systems.

13-2C5.2.2.1.2 Factory-sealed air-handling unit credit. A factory-sealed air-handling unit credit multiplier of 0.95 may be claimed if the unit has been tested and certified by the manufacturer to have achieved a 2 percent or less leakage rate at 1-inch water gauge when all air inlets, air outlets and condensate drain port(s), when present, are sealed at an air pressure of 1-inch water gauge with no greater than 2-percent design cubic foot per minute discharge.

13-2C6.0 Service hot water.

13-2C6.1 General.

13-2C6.1.1 Water heater area determination. Water heating requirements are estimated based on the number of bedrooms in the residence. Any room which has an area of 70 square feet (7 m^2) or more and a clothes storage closet, and is not part of the common living area, shall be considered a bedroom for calculation purposes.

13-2C6.1.2 Multiple water heating systems. Where two or more water heating systems are installed with different levels of efficiency, a single multiplier shall be calculated for determining compliance with this code as per the Equation 13-2C4.1.1 in Section 13-2C4.1.1 of this appendix.

13-2C6.2 Water heater types and multipliers. Hot water multipliers for the water heating system to be installed shall be determined from Table 6A-22 on Form 600A based on the EF of the system.

13-2C6.2.1 Gas instantaneous (tankless) water heater multipliers. Multipliers for gas instantaneous (tankless) water heaters shall be taken from Table 13-2C6.2.1.

13-2C6.2.2 Water heater credit multipliers. Hot water credit multipliers (HWCM) may be taken if supplemental water heating systems or alternate systems are installed which meet the criteria in Sections 13-2C6.2.2.1 through 13-2C6.2.2.4. Electric resistance or natural gas water heating systems may be installed as backup to alternate water heating systems. HWCM shall be determined from Table 6A-23 on Form 600A for the alternate water heating system installed. Both a hot water multiplier (HWM) and a credit multiplier (HWCM) shall be used in the hot water calculation.

Electric resistance or natural gas water heating systems may be installed as backup to alternate water heating systems.

TABLE 13-2C5.2.1A
DUCT MULTIPLIERS NORTH FLORIDA

Supply duct location	Duct R-value	Return Duct Location					
		Unconditioned		Attic w/RBS		Attic w/white roof	
		WDM	SDM	WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.497	1.382	1.454	1.382	1.480	1.384
	2.0	1.164	1.189	1.150	1.180	1.157	1.180
	4.2	1.093	1.118	1.086	1.111	1.089	1.111
	6.0	1.069	1.090	1.064	1.084	1.066	1.084
	8.0	1.053	1.071	1.049	1.066	1.051	1.066
	10.0	1.044	1.059	1.041	1.055	1.042	1.054
Attic w/RBS	0.0	1.237	1.222	1.197	1.190	—	—
	2.0	1.107	1.113	1.093	1.102	—	—
	4.2	1.067	1.072	1.059	1.066	—	—
	6.0	1.051	1.056	1.045	1.051	—	—
	8.0	1.040	1.045	1.036	1.041	—	—
	10.0	1.034	1.037	1.030	1.034	—	—
Attic w/white roof	0.0	1.552	1.256	—	—	1.512	1.224
	2.0	1.182	1.113	—	—	1.169	1.102
	4.2	1.104	1.068	—	—	1.096	1.062
	6.0	1.076	1.051	—	—	1.071	1.047
	8.0	1.059	1.040	—	—	1.055	1.036
	10.0	1.049	1.033	—	—	1.045	1.030
Attic w/ IRCC	0.0	1.406	1.289	—	—	—	—
	2.0	1.161	1.153	—	—	—	—
	4.2	1.096	1.099	—	—	—	—
	6.0	1.072	1.076	—	—	—	—
	8.0	1.056	1.061	—	—	—	—
	10.0	1.047	1.051	—	—	—	—
Conditioned space	0.0	1.040	1.032	1.029	1.021	1.040	1.014
	2.0	1.014	1.011	1.012	1.009	1.014	1.005
	4.2	1.008	1.006	1.007	1.005	1.008	1.003
	6.0	1.006	1.005	1.005	1.004	1.006	1.002
	8.0	1.005	1.004	1.004	1.003	1.005	1.002
	10.0	1.004	1.003	1.003	1.003	1.004	1.001

(continued)

TABLE 13-2C5.2.1A - continued
DUCT MULTIPLIERS NORTH FLORIDA

Supply duct location	Duct R-value	Return Duct Location			
		Attic w/ IRCC		Conditioned Space	
		WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.468	1.387	1.438	1.366
	2.0	1.155	1.182	1.143	1.174
	4.2	1.088	1.112	1.081	1.107
	6.0	1.065	1.085	1.060	1.081
	8.0	1.051	1.067	1.046	1.064
	10.0	1.042	1.055	1.038	1.053
Attic w/RBS	0.0	—	—	1.180	1.185
	2.0	—	—	1.083	1.095
	4.2	—	—	1.052	1.061
	6.0	—	—	1.040	1.047
	8.0	—	—	1.032	1.037
	10.0	—	—	1.026	1.031
Attic w/white roof	0.0	—	—	1.452	1.219
	2.0	—	—	1.147	1.096
	4.2	—	—	1.083	1.057
	6.0	—	—	1.061	1.043
	8.0	—	—	1.048	1.034
	10.0	—	—	1.039	1.028
Attic w/ IRCC	0.0	1.366	1.257	1.327	1.248
	2.0	1.148	1.141	1.129	1.132
	4.2	1.088	1.092	1.077	1.084
	6.0	1.066	1.071	1.057	1.065
	8.0	1.052	1.057	1.045	1.052
	10.0	1.043	1.048	1.037	1.043
Conditioned space	0.0	1.042	1.029	1.000	1.000
	2.0	1.016	1.011	1.000	1.000
	4.2	1.010	1.007	1.000	1.000
	6.0	1.007	1.005	1.000	1.000
	8.0	1.006	1.004	1.000	1.000
	10.0	1.005	1.003	1.000	1.000

TABLE 13-2C5.2.1B
DUCT MULTIPLIERS CENTRAL FLORIDA

Supply duct location	Duct R-value	Return Duct Location					
		Unconditioned		Attic w/RBS		Attic w/white roof	
		WDM	SDM	WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.589	1.334	1.536	1.339	1.566	1.342
	2.0	1.190	1.176	1.173	1.169	1.180	1.169
	4.2	1.107	1.113	1.098	1.107	1.102	1.107
	6.0	1.078	1.087	1.072	1.081	1.075	1.081
	8.0	1.061	1.069	1.056	1.064	1.058	1.064
	10.0	1.050	1.057	1.046	1.054	1.048	1.053
Attic w/RBS	0.0	1.277	1.212	1.230	1.181	—	—
	2.0	1.123	1.111	1.107	1.100	—	—
	4.2	1.076	1.072	1.067	1.066	—	—
	6.0	1.058	1.056	1.051	1.051	—	—
	8.0	1.046	1.045	1.041	1.041	—	—
	10.0	1.038	1.038	1.034	1.034	—	—
Attic w/white roof	0.0	1.661	1.246	—	—	1.614	1.214
	2.0	1.213	1.113	—	—	1.197	1.102
	4.2	1.119	1.069	—	—	1.110	1.063
	6.0	1.088	1.052	—	—	1.081	1.047
	8.0	1.068	1.041	—	—	1.063	1.037
	10.0	1.056	1.034	—	—	1.051	1.031
Attic w/ IRCC	0.0	1.413	1.288	—	—	—	—
	2.0	1.164	1.152	—	—	—	—
	4.2	1.097	1.098	—	—	—	—
	6.0	1.073	1.076	—	—	—	—
	8.0	1.057	1.060	—	—	—	—
	10.0	1.047	1.051	—	—	—	—
Conditioned space	0.0	1.047	1.031	1.034	1.02	1.047	1.014
	2.0	1.016	1.011	1.014	1.00	1.016	1.005
	4.2	1.009	1.006	1.008	1.00	1.009	1.003
	6.0	1.007	1.005	1.006	1.00	1.007	1.002
	8.0	1.005	1.004	1.005	1.00	1.005	1.002
	10.0	1.004	1.003	1.004	1.00	1.004	1.001

(continued)

TABLE 13-2C5.2.1B - continued
DUCT MULTIPLIERS CENTRAL FLORIDA

Supply duct location	Duct R-value	Return Duct Location			
		Attic w/ IRCC		Conditioned Space	
		WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.546	1.346	1.517	1.322
	2.0	1.176	1.172	1.164	1.163
	4.2	1.100	1.108	1.092	1.103
	6.0	1.074	1.083	1.068	1.079
	8.0	1.057	1.065	1.052	1.062
	10.0	1.047	1.054	1.043	1.052
Attic w/RBS	0.0	—	—	1.209	1.177
	2.0	—	—	1.095	1.094
	4.2	—	—	1.059	1.061
	6.0	—	—	1.045	1.047
	8.0	—	—	1.036	1.041
	10.0	—	—	1.030	1.032
Attic w/white roof	0.0	—	—	1.540	1.211
	2.0	—	—	1.170	1.096
	4.2	—	—	1.095	1.058
	6.0	—	—	1.070	1.044
	8.0	—	—	1.054	1.034
	10.0	—	—	1.045	1.028
Attic w/ IRCC	0.0	1.366	1.257	1.327	1.248
	2.0	1.148	1.141	1.129	1.132
	4.2	1.088	1.092	1.077	1.084
	6.0	1.066	1.071	1.057	1.065
	8.0	1.052	1.057	1.045	1.052
	10.0	1.043	10.48	1.037	1.043
Conditioned space	0.0	1.042	1.029	1.000	1.000
	2.0	1.016	1.011	1.000	1.000
	4.2	1.010	1.007	1.000	1.000
	6.0	1.007	1.005	1.000	1.000
	8.0	1.006	1.004	1.000	1.000
	10.0	1.005	1.003	1.000	1.000

TABLE 13-2C5.2.1C
DUCT MULTIPLIERS SOUTH FLORIDA

Supply duct location	Duct R-value	Return Duct Location					
		Unconditioned		Attic w/RBS		Attic w/white roof	
		WDM	SDM	WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.765	1.296	1.694	1.299	1.734	1.302
	2.0	1.244	1.150	1.220	1.144	1.229	1.144
	4.2	1.135	1.095	1.123	1.090	1.128	1.090
	6.0	1.099	1.073	1.091	1.069	1.094	1.069
	8.0	1.076	1.058	1.070	1.055	1.073	1.055
	10.0	1.063	1.049	1.058	1.046	1.060	1.046
Attic w/RBS	0.0	1.349	1.178	1.289	1.153	—	—
	2.0	1.154	1.094	1.134	1.085	—	—
	4.2	1.095	1.062	1.083	1.057	—	—
	6.0	1.072	1.048	1.063	1.044	—	—
	8.0	1.057	1.039	1.050	1.036	—	—
	10.0	1.048	1.032	1.042	1.030	—	—
Attic w/white roof	0.0	1.860	1.205	—	—	1.800	1.180
	2.0	1.273	1.095	—	—	1.252	1.086
	4.2	1.151	1.059	—	—	1.139	1.054
	6.0	1.111	1.045	—	—	1.102	1.041
	8.0	1.085	1.035	—	—	1.078	1.032
	10.0	1.070	1.029	—	—	1.064	1.027
Attic w/ IRCC	0.0	1.531	1.249	—	—	—	—
	2.0	1.207	1.128	—	—	—	—
	4.2	1.122	1.083	—	—	—	—
	6.0	1.091	1.064	—	—	—	—
	8.0	1.071	1.052	—	—	—	—
	10.0	1.059	1.043	—	—	—	—
Conditioned space	0.0	1.060	1.025	1.043	1.017	1.060	1.011
	2.0	1.020	1.009	1.017	1.007	1.020	1.004
	4.2	1.012	1.005	1.010	1.004	1.012	1.002
	6.0	1.009	1.004	1.008	1.003	1.009	1.002
	8.0	1.007	1.003	1.006	1.003	1.007	1.001
	10.0	1.006	1.003	1.005	1.002	1.006	1.001

(continued)

TABLE 13-2C5.2.1C - continued
DUCT MULTIPLIERS SOUTH FLORIDA

Supply duct location	Duct R-value	Return Duct Location			
		Attic w/ IRCC		Conditioned Space	
		WDM	SDM	WDM	SDM
Unconditioned space	0.0	1.708	1.305	1.671	1.286
	2.0	1.224	1.146	1.209	1.139
	4.2	1.125	1.091	1.116	1.087
	6.0	1.092	1.070	1.085	1.067
	8.0	1.071	1.055	1.066	1.053
	10.0	1.059	1.046	1.054	1.044
Attic w/RBS	0.0	—	—	1.262	1.150
	2.0	—	—	1.118	1.081
	4.2	—	—	1.073	1.053
	6.0	—	—	1.056	1.041
	8.0	—	—	1.044	1.033
	10.0	—	—	1.037	1.028
Attic w/white roof	0.0	—	—	1.702	1.178
	2.0	—	—	1.216	1.082
	4.2	—	—	1.120	1.051
	6.0	—	—	1.088	1.038
	8.0	—	—	1.068	1.030
	10.0	—	—	1.056	1.025
Attic w/ IRCC	0.0	1.471	1.224	1.149	1.217
	2.0	1.187	1.119	1.162	1.111
	4.2	1.110	1.078	1.096	1.072
	6.0	1.083	1.061	1.072	1.056
	8.0	1.065	1.049	1.056	1.045
	10.0	1.054	1.041	1.046	1.037
Conditioned space	0.0	1.054	1.024	1.000	1.000
	2.0	1.020	1.009	1.000	1.000
	4.2	1.012	1.006	1.000	1.000
	6.0	1.009	1.004	1.000	1.000
	8.0	1.007	1.003	1.000	1.000
	10.0	1.006	1.003	1.000	1.000

13-2C6.2.2.1 Waste heat recovery unit. Credit may be claimed for installation of a waste heat recovery unit (HRU) on either an air conditioner or a heat pump where the heat recovery unit meets all the criteria for this section. Credit multipliers shall be determined from Table 6A-23 on Form 600A based on the type of system to which the HRU is attached.

1. To obtain credits under the code, a storage water heater which meets the minimum performance criteria of Section 13-612.AB shall be used in conjunction with the HRU. This water heater shall provide service hot water to the water circuit with the most fixtures in the residence and shall be sized as follows.
   a. Two bedroom and up, single-family 50 gallon (189 L) tank minimum.
   b. Two bedroom and up, multiple-family, and one bedroom single-family 40 gallon (151 L) tank minimum.
   c. One bedroom multiple-family 30 gallon (114 L) tank minimum.
2. To obtain credit, a heat recovery unit shall be tested by an independent testing laboratory under the standard rating conditions specified in Florida Standard FL-1 (see Appendix 13-E) and shall have a minimum net useful heat exchange effect of 50 percent. A copy of Form 600D (see Appendix 13-D) shall be prominently displayed on the heat recovery unit, with test results clearly visible for inspection through a transparent, weatherproof envelope. An ARDM-certified refrigerant desuperheater seal affixed to the unit, clearly visible for inspection, may be substituted for the 600D form. This seal indicates that the unit meets the criteria of this section.
3. Multiple HRUs on multiple air conditioners are allowed. If more than one air-conditioning system is installed in a residence and only one HRU is installed, the HRU shall be attached to the system serving the daytime primary living areas (family room, living room, kitchen, dining room and adjacent bedrooms and bathrooms) to obtain credit. If the HRU is installed in a residence which has only one water heater, the entire HRU credit may be claimed. If more than one water heater is installed in the residence, credit may be claimed based on the gallon capacity of the water heater to which it is coupled and the total capacity of the water heaters in the residence by entering a calculation for each water heating system as follows:

$$\text{Total \# Bedrooms} \times \frac{\text{Gallons with HRU}}{\text{Total Gallons}} \times \text{HWCM} \times \text{HWM} = \text{Hot Water Points, System \#1}$$

$$\text{Total \# Bedrooms} \times \frac{\text{Gallons without HRU}}{\text{Total Gallons}} \times 1 \times \text{HWM} = \text{Hot Water Points, System \#2}$$

Equals = Total Hot Water Points

13-2C6.2.2.2 Dedicated heat pump. Credit may be claimed for installation for installation of a dedicated heat pump, either as an add-on to a conventional water heater or as a separate integral system. The credit multiplier shall be determined from Table 6A-23 on Form 600A based on the EF of the system installed.

13-2C6.2.2.3 Integrated heat pumps. Credit may be claimed for installation of an integrated heat pump, either as an add-on to a conventional water heater or as a separate integral system. The credit multiplier shall be determined from Table 6A-23 on Form 600A based on the combined cooling performance factor (CCPF) and the combined heating performance factor (CHPF) of the system installed. An equivalent dedicated heat pump EF shall be calculated according to Equation 13-2C6.2.2.3 where the various terms are defined in ASHRAE 137 and

TABLE 13-2C6.2.1
GAS INSTANTANEOUS (TANKLESS) WATER HEATER MULTIPLIERS

CLIMATE ZONE 123	HOT WATER MULTIPLIERS (HWM)													
EF	.60-.61	.62-.63	.64-.65	.66-.67	.68-.69	.70-.71	.72-.73	.74-.75	.76-.77	.78-.79	.80-.81	.82-.83	.84-.85	0.86 & Up
Natural Gas HWM	1599	1547	1498	1453	1412	1375	1341	1309	1279	1252	1226	1202	1179	1157
Propane Gas HWM	2171	2101	2035	1973	1920	1869	1821	1776	1735	1696	1660	1626	1594	1564
CLIMATE ZONE 456														
EF	.60-.61	.62-.63	.64-.65	.66-.67	.68-.69	.70-.71	.72-.73	.74-.75	.76-.77	.78-.79	.80-.81	.82-.83	.84-.85	0.86 & Up
Natural Gas HWM	1549	1499	1452	1408	1367	1328	1293	1261	1231	1205	1183	1164	1148	1137
Propane Gas HWM	1895	1834	1776	1722	1676	1631	1588	1549	1513	1478	1446	1417	1389	1362
CLIMATE ZONE 789														
EF	.60-.61	.62-.63	.64-.65	.66-.67	.68-.69	.70-.71	.72-.73	.74-.75	.76-.77	.78-.79	.80-.81	.82-.83	.84-.85	0.86 & Up
Natural Gas HWM	1324	1281	1241	1203	1167	1134	1103	1073	1046	1020	997	975	956	938
Propane Gas HWM	1686	1631	1581	1533	1492	1452	1415	1380	1348	1318	1290	1264	1239	1216

the DOE waiver granted to NORDYNE and published in the Federal Register Vol. 61, No. 55, Wednesday, March 20, 1996, pages 11395-11400.

$$EF = \frac{\frac{q_w}{EF_{sep}}}{\frac{q_o\,(95).\,CLH + q_{wos}}{CCPF} + \frac{DHR.\,HLH.\,C + q_{whs}}{CHPF} - \frac{q_c\,(95).\,CLH}{SEER} - \frac{DHR.\,HLH.\,C}{HSPF}}$$

13-2C6.2.2.4 Solar water heater. Credit may be claimed for installation of a solar water heater, either as an add-on to a conventional water heater or as a separate system (with tank). The credit multiplier for an add-on solar system (without tank) shall be determined from Table 6A-23 on Form 600A based on the EF of the system installed.

APPENDIX 13-D

Effective March 1, 2009

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

SUBCHAPTER 13-4 – Commercial Building Compliance Methods

Form 400B-08
Building Prescriptive Envelope Method

All
Climate Zones

Project Name:	Buildings that may comply by this form: shell buildings (preliminary), renovation, change of occupancy type permitted before 1979, limited or special use building, building system changeouts).
Address:	Building Classification:
City, Zip Code:	Building Permit No.:
Builder:	Permitting Office:
Owner:	Jurisdiction No.:

BUILDING ENVELOPE INFORMATION

ENVELOPE COMPONENT						
	U-factor	Absorptance				
Roof:						
Wall:						
Floor:						
Fenestration	Max. *U*-factor Fixed/operable	Max. SHGC All orientation				
Vertical glazing type, % of wall:						
Skylight type, % of roof:						

SYSTEMS INFORMATION

SYSTEM	Type (describe system)			Size (capacity)	Sizing calc.	Efficiency	Rating
Air-conditioning system							
Heating system							
Ventilation						CFM	
Ducts	Location:			Fan Power:		*R*-value	
Piping	Fluid design operating temp:			Size of pipe:	-------	Inches	
Hot water					-------	EF	
Electric power	Drawings	Y	N	Operations manual available upon completion:	Y	N	
Motors	Open or enclosed			Poles & speed		Horsepower:	
Lighting	Space type:			Lighting power density			

PRESCRIPTIVE MEASURES

Components	Section	Requirements	Check
Operations Manual	13-102.1, 13-410, 13-413	Operations manual provided to owner.	
Windows & Doors	13-406.AB.1.1	Glazed swinging entrance & revolving doors: max. 1.0 cfm/ft^2; all other products: 0.4 cfm/ft^2.	
Joints/Cracks	13-406.AB.1.2	To be caulked, gasketed, weatherstripped or otherwise sealed.	
Dropped Ceiling Cavity	13-406.AB.1.4	Vented: seal & insulated ceiling. Unvented seal & insulate roof & side walls.	
Reheat	13-407.B	Electric resistance reheat prohibited.	
HVAC Efficiency	13-407, 13-408	Minimum efficiencies: Cooling Tables 13-407.AB.3.2.1A-D; 13-407.AB.3.2.1G through 13-407.AB.3.2.2-J; Heating Tables 13-407.AB.3.2.1B, 13-407.AB.3.2.1D, 13-408.AB.3.2.1E-F.	
HVAC Controls	13-407.AB.2	Zone controls prevent reheat (exceptions); separate thermostatic control per zone; combined HAC control 5°F deadband (exceptions).	
Ventilation	13-409.AB.3	Motorized dampers reqd. except gravity dampers OK in: 1) exhaust systems and 2) systems with design outside air intake or exhaust capacity ≤300 cfm.	
HVAC Ducts	13-410.AB	Air ducts, fittings, mechanical equipment & plenum chambers shall be mechanically attached, sealed, insulated & installed per Sec. 13-410.AB. Fan power limitations.	
Balancing	13-410.AB.4	HVAC distribution system(s) tested & balanced. Report in construction documents.	
Piping Insulation	13-411.AB	In accordance with Table 13-411.AB.2.	
Water Heaters	13-412.AB	Performance requirements in accordance with Table 13-412.AB.3. Heat trap required.	
Swimming Pools	13-412.AB.2.6	Cover on heated pools; Time switch (exceptions); Readily accessible on/off switch.	
Hot Water Pipe Insulation	13-412.AB.4	Table 13-411.AB.2 for circulating systems, first 8' outlet pipe from storage tank, between inlet pipe and heat trap.	
Water Fixtures	13-412.AB.2.5.2	Shower heat water flow restricted to 2.5 gpm at 80 psi. Public lavatory fixture max. Flow 0.5 gpm; if self-closing valve 0.25 gallon circulating, 0.5 gallon noncirculating.	
Lighting Controls	13-415.AB	Automatic control required for interior lighting in buildings >5,000 s.f.; Space control; Exterior photo sensor; Tandem wiring where 1-3 linear fluorescent lamps >30W.	

If required by Florida law, I hereby certify that the system design is in compliance with the Florida Energy Code. Registration number
ARCHITECT: _____
ELECTRICAL SYSTEM DESIGNER: _____
LIGHTING SYSTEM DESIGNER: _____
MECHANICAL SYSTEM DESIGNER: _____
PLUMBING SYSTEM DESIGNER: _____

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.
PREPARED BY: _____ DATE: _____
I hereby certify that this building is in compliance with the Florida Energy Code:
OWNER AGENT: _____ DATE: _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.
BUILDING OFFICIAL: _____
DATE: _____

BUILDING ENVELOPE REQUIREMENTS	
Building Element	Mandatory Requirements
Roof: Absorptance *U*-factor	 ≤ 0.22 ≤ 0.027
Wall: Absorptance *U*-factor	 ≤ 0.3 ≤ 0.089
Raised Floor Insulation: *U*-factor	 ≤ 0.052
Windows: *U*-factor Window Area SHGC 0-40% WW Ratio SHGC 40-50% WW Ratio Overhang Projection Factor (PF)	 ≤ 0.45 ≤ 50% window to wall area ratio 0.61 North 0.25 all others 0.44 North 0.25 all others 0.5 (projection half the distance of window height)
Skylights: SHGC Skylight *U*-factor Maximum percent of roof area	 ≤ 0.19 ≤1.36 5 percent
Opaque Door *U*-factor Swinging Non-swinging	 ≤ 0.70 ≤ 1.45
BUILDING SYSTEM REQUIREMENTS	
SHELL BUILDINGS:	Lighting and HVAC must be sufficiently efficient to meet Method A criteria for the entire space at time of build-out.

OTHER BUILDING TYPES: Replacement systems*			
HVAC Equipment			
Air conditioner (0-65 KBtuh)	13.0 SEER	Gas furnace (0-225 KBtuh)	80% AFUE
Air conditioner (> 65-135 KBtuh)	10.3 EER	Gas furnace (>225 KBtuh)	80% E_c
Air conditioner (>135-240 KBtuh)	9.7 EER		
Air conditioner (> 240-760 KBtuh)	9.5 EER, 9.7 IPLV	Heat pump (0 – 65 KBtuh)	13.0 SEER/ 7.7 HSPF
Air conditioner (> 760 KBtuh)	9.2 EER, 9.4 IPLV	Heat pump (> 65 – 135 KBtuh)	9.9 EER/3.2 COP
		Heat pump (>135-240 KBtuh)	9.1 EER/3.1 COP
		Heat pump (> 240 KBtuh)	8.8 EER, 9.0 IPLV/3.1 COP
Service Hot Water		**Lighting**	
Gas storage ≤ 75,00 Btu/h, ≥ 20 gallons	0.67-0.0019V EF		LPD for space type on Table 13-415.B.1.
Gas storage > 75,000 Btu/h	80% E_t		
Gas instantaneous	80% E_t		
Electric storage ≤ 12 kW	0.97 – 0.0032xV EF		
Pipe insulation (d < 1.5", d≥1.5")	0.5", 1.0"		

*Other types of replacement equipment shall meet the code minimum for that type of equipment in the applicable table of Section 13-407, 13-408 and 13-412.

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 600A-08 — **Alternate Residential Points System Method** — **NORTH 1 2 3**

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	**CLIMATE ZONE:** 1 ☐ 2 ☐ 3 ☐
OWNER:		**PERMIT NO.:** ☐☐☐☐☐☐☐☐	**JURISDICTION NO.:** ☐☐☐☐☐☐

		Please Type	CK
1.	**New construction or addition**	1. _____	
2.	**Single-family detached or Multiple-family attached**	2. _____	
3.	**If Multiple-family–No. of units covered by this submission**	3. _____	
4.	**Is this a worst case? (yes/no)**	4. _____	
5.	**Conditioned floor area (sq. ft.)**	5. _____ sq. ft.	
6.	**Predominant eave overhang (ft.)**	6. _____ ft.	
7.	**Glass type[1] and area: (Label required by 13-104.4.5 if not default)**	Description Area	
	a. *U*-factor: (or Single- or Double-Pane DEFAULT)	7a. _____ _____ sq. ft.	
	b. SHGC: (or Clear or Tint DEFAULT)	7b. _____ _____ sq. ft.	
8.	**Floor type and insulation:**		
	a. Slab-on-grade (*R*-value + perimeter)	8a. R =_____ , _____ l. ft.	
	b. Wood, raised (*R*-value + sq. ft.)	8b. R =_____ , _____ sq. ft.	
	c. Concrete, raised (*R*-value)	8c. R =_____ , _____ sq. ft.	
9.	**Net wall type, area and insulation:**		
	a. Exterior: 1. Concrete block (Insulation *R*-value)	9a-1 R = _____ , _____ sq. ft.	
	2. Wood frame (Insulation *R*-value)	9a-2 R = _____ , _____ sq. ft.	
	3. Steel frame (Insulation *R*-value)	9a-3 R = _____ , _____ sq. ft.	
	4. Log (Insulation *R*-value)	9a-4 R = _____ , _____ sq. ft.	
	5. Other: _____		
	b. Adjacent: 1. Concrete block (Insulation *R*-value)	9b-1 R = _____ , _____ sq. ft.	
	2. Wood frame (Insulation *R*-value)	9b-2 R = _____ , _____ sq. ft.	
	3. Steel frame (Insulation *R*-value)	9b-3 R = _____ , _____ sq. ft.	
	4. Log (Insulation *R*-value)	9b-4 R = _____ , _____ sq. ft.	
10.	**Ceiling type, area and insulation:**		
	a. Under attic (Insulation *R*-value)	10a. _____ _____ sq. ft.	
	b. Single assembly (Insulation *R*-value)	10b. _____ _____ sq. ft.	
	c. Radiant barrier, IRCC or white roof installed?	10c. _____	
11.	**Air distribution system:**		
	a. Ducts (Insulation + Location)	11a. R = _____ , _____ (cond./uncond.)	
	b. Air Handler (Location)	11b. R = _____ , _____ (cond./uncond.)	
12.	**Cooling system:** (Types: central-split, central-single pkg., room unit, PTAC, gas, none)	12a. Type: _____	
		12b. SEER/EER/COP: _____	
		12c. Capacity: _____	
13.	**Heating system:** (Types: heat pump, elec. strip, nat. gas, LP gas, gas h.p., room or PTAC, none)	13a. Type: _____	
		13b. HSPF/COP/AFUE: _____	
		13c. Capacity: _____	
14.	**Hot water system:** (Types: elec., natural gas, solar, LP gas, none)	14a. Type: _____	
		14b. EF: _____	
15.	**Hot water credits**		
	a. Heat Recovery (HR)	15a. _____	
	b. Dedicated Heat Pump (DHP)	15b. _____	
	c. Solar	15c. _____	
16.	**HVAC Credits** (Use: CF-ceiling fan, CV-cross vent, PT-programmable thermostat, HF-whole house fan, MZ-Multizone)	16. _____	
17.	**COMPLIANCE STATUS:** (PASS if As-Built Pts. are less than Base Pts.)	17. _____	
	a. Total As-Built points b. Total Base points	17a._____17b. _____	

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ **DATE:** _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:** _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

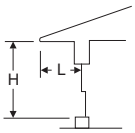
DATE: _____

[1] Predominant glass type. For actual glass type and areas, see summer and winter glass output on Pages 2 and 4.

SUMMER CALCULATIONS

CLIMATE ZONES 1 2 3

GLASS	ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE SUMMER POINT MULTIPLIER CLEAR	SINGLE-PANE SUMMER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE SUMMER POINT MULTIPLIER CLEAR	DOUBLE-PANE SUMMER POINT MULTIPLIER TINT[2]	X SUMMER OH FACTOR (from 6A-1)	= AS-BUILT GLASS SUMMER PTS
	N			21.73	17.28	19.20	14.84		
	NE			33.55	27.37	29.56	23.48		
	E			47.92	39.62	42.06	33.89		
	SE			48.65	40.24	42.75	34.47		
	S			40.81	33.55	35.87	28.73		
	SW			45.75	37.77	40.16	32.30		
	W			43.84	36.13	38.52	30.93		
	NW			29.42	23.83	25.97	20.48		
	H[1]			84.46	68.97	74.77	59.51		



OVERHANG RATIO = OH LENGTH / OH HEIGHT

GLASS	.18 X	COND FLOOR AREA	X WEIGHTED GLASS MULTIPLIER	= BASE GLASS SUBTOTAL
	.18		18.59	

AS-BUILT GLASS SUBTOTAL

	COMPONENT DESCRIPTION	AREA	X BASE SUMMER POINT. MULT	BASE SUMMER POINTS	COMPONENT DESCRIPTION	AREA	X SUMMER POINT MULT. (6A-2 THRU 6A-6)	= AS-BUILT SUMMER POINTS
WALL	EXTERIOR		1.5					
	ADJACENT		.6					
DOORS	EXTERIOR		6.1					
	ADJACENT		2.4					
CEILING	UNDER ATTIC OR SINGLE ASSEM-BLY		1.73					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		-41.2					
	RAISED (AREA)		-.98					
	FOR SLAB-ON-GRADE USE PERIMIETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			10.21				10.21	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE SUMMER POINTS

TOTAL COMPONENT AS-BUILT SUMMER POINTS

	Base Cooling System Multiplier	X Total Base Summer Points	= BASE COOLING POINTS
COOLING SYSTEM	.325		

TOTAL AS-BUILT SUM. PTS.	X As-Built DM (6A-8)	X As-Built DSM (6A-20)	X As Built AHU (6A-7)	X As Built CSM (6A-9)	X As Built CCM (6A-19)	= AS-BUILT COOLING POINTS
		1.15 or 1.0				

	Number of bedrooms	X Base Hot Water Multiplier	= BASE HOT WATER POINTS
HOT WATER SYSTEM		2635	

AS-BUILT HOT WATER SYS-TEM DESC.	Number of bedrooms	X As-Built HWM (6A-22)	X As Built HWCM (6A-23)	= AS-BUILT HOT WATER POINTS

[1] H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 of APPENDIX G-C of the *FBC, Residential.* TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3] MUST MEET CRITERIA OF APPENDIX G-C4.2.1.5 of the *FBC, Residential.*

SUMMER POINT MULTIPLIERS (SPM)

CLIMATE ZONES 1 2 3 *

6A-1 SUMMER OVERHANG FACTORS (SOF) FOR SINGLE-AND DOUBLE-PANE GLASS

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	0.993	0.971	0.930	0.888	0.842	0.803	0.766	0.736	0.681	0.634	0.593
Northeast	1.00	0.996	0.967	0.907	0.845	0.775	0.717	0.662	0.619	0.545	0.487	0.441
East	1.00	0.994	0.963	0.898	0.827	0.745	0.675	0.609	0.558	0.470	0.405	0.357
Southeast	1.00	0.998	0.952	0.864	0.777	0.689	0.623	0.566	0.525	0.459	0.413	0.379
South	1.00	0.989	0.931	0.835	0.751	0.675	0.620	0.575	0.543	0.493	0.458	0.432
Southwest	1.00	0.998	0.953	0.866	0.779	0.691	0.623	0.565	0.522	0.453	0.404	0.368
West	1.00	0.994	0.963	0.899	0.828	0.748	0.681	0.617	0.569	0.485	0.422	0.375
Northwest	1.00	0.996	0.968	0.913	0.858	0.797	0.748	0.702	0.667	0.605	0.556	0.516
OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-2 WALL SUMMER POINT MULTIPLIERS (SPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	*R*-VALUE	WOOD FR	*R*-VALUE	BLOCK		6 INCH	8 INCH
									0-6.9	2.4	0-2.9	1.0			
R-VALUE	EXT	ADJ	EXT	ADJ	*R*-VALUE	EXT	ADJ	EXT	7-10.9	.6	3-6.9	.6	*R*-VALUE	EXT	EXT
0-6.9	5.5	2.2	7.6	2.8	0-2.9	2.2	1.1	2.2	11-18.9	.4	7-9.9	.4	0-2.9	1.5	1.0
7-10.9	2.1	.8	3.5	1.3	3-4.9	1.3	.8	.8	19-25.9	.2	10 & UP	.2	3-6.9	1.0	.7
11-12.9	1.7	.7	2.7	1.0	5-6.9	1.0	.7	.5	26 & UP	.1			7 & UP	.8	.6
13-18.9	1.5	.6	2.5	0.9	7-10.9	.7	.5	.3							
19-25.9	.9	.4	2.2	0.8	11-18.9	.4	.4	0							
26 & UP	.6	.2	1.2	0.4	19-25.9	.2	.2								
					26 & UP	.1	.1								

6A-3 DOOR SUMMER POINT MULTIPLIERS (SPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	6.1	2.4
INSULATED	4.1	1.6

6A-4 CEILING SUMMER POINT MULTIPLIERS (SPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
R-VALUE	SPM	*R*-VALUE	SPM		CEILING TYPE	
19-21.9	2.34	10-10.9	8.49	*R*-VALUE	EXPOSED	DROPPED
22-25.9	2.11	11-12.9	7.97	10-13.9	9.13	8.47
26-29.9	1.89	13-18.9	7.14	14-20.9	6.80	6.45
30-37.9	1.73	19-25.9	5.64	21 & UP	4.92	4.63
38 & UP	1.52	26-29.9	4.75			
RBS Credit	0.700	30 & UP	4.40			
IRCC Credit	0.849					
White Roof Credit	0.550					

6A-5 FLOOR SUMMER POINT MULTIPLIERS (SPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	SPM	*R*-VALUE	SPM	*R*-VALUE	SPM	SPM	SPM
0-2.9	-41.2	0-2.9	-.8	0-6.9	2.80	-4.7	2.2
3-4.9	-37.2	3-4.9	-1.3	7-10.9	1.34	-2.3	.8
5-6.9	-36.2	5-6.9	-1.3	11-18.9	1.06	-1.9	.7
7 & UP	-35.7	7 & UP	-1.3	19 & UP	.77	-1.5	.4

6A-6 INFILTRATION & INTERNAL GAINS (SPM)

Air Infiltration	3.44
Internal Gains	+6.77
Infiltration/Internal Gains (Combined)	10.21

6A-7 AIR HANDLER MULTIPLIERS (SPM)

Located in garage	1.00
Located in conditioned area	0.91
Located on exterior of building	1.02
Located in attic	1.11

6A-8 DUCT MULTIPLIERS (DM)

SUPPLY DUCTS IN:	DUCT *R*-VALUE	RETURN DUCTS IN:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.118	1.111	1.112	1.089	1.107
	6.0	1.090	1.084	1.085	1.066	1.081
	8.0	1.071	1.066	1.067	1.051	1.064
Attic/Radiant Barrier (RBS)	4.2	1.072	1.066	—	—	1.061
	6.0	1.056	1.051	—	—	1.047
	8.0	1.045	1.041	—	—	1.037
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.099	—	1.092	—	1.084
	6.0	1.076	—	1.071	—	1.065
	8.0	1.061	—	1.057	—	1.052
Attic/Cool Roof	4.2	1.068	—	—	1.096	1.057
	6.0	1.051	—	—	1.071	1.043
	8.0	1.040	—	—	1.055	1.034
Conditioned Space	4.2	1.006	1.005	1.007	1.008	1.000
	6.0	1.005	1.004	1.005	1.006	1.000
	8.0	1.004	1.003	1.004	1.005	1.000

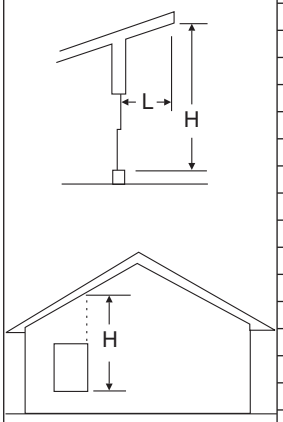
6A-9 COOLING SYSTEM MULTIPLIERS (CSM)

SYSTEM TYPE		COOLING SYSTEM MULTIPLIERS (CSM)										
Central Units (SEER)	Rating		7.5-7.9	8.0-8.4	8.5-8.8	8.9-9.4	9.5-9.9	10.0-10.4	10.5-10.9	11.0-11.4	11.5-11.9	12.0-12.4
	CSM		.45	.43	.40	.38	.36	.34	.32	.31	.30	.28
PTAC & Room Units (EER)	Rating	12.5-12.9	13.0-13.4	13.5-13.9	14.0-14.4	14.5-14.9	15.0-15.4	15.5-15.9	16.0-16.4	16.5-16.9	17.0-17.4	17.5 & UP
	CSM	.27	.26	.25	.24	.24	.23	.22	.21	.21	.20	.19

WINTER CALCULATIONS

CLIMATE ZONES 1 2 3

GLASS



ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE WINTER POINT MULTIPLIER CLEAR	SINGLE-PANE WINTER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE WINTER POINT MULTIPLIER CLEAR	DOUBLE-PANE WINTER POINT MULTIPLIER TINT[2]	X WINTER OH FACTOR (from 6A-10)	= AS-BUILT GLASS WINTER PTS
N			33.22	34.06	24.58	25.37		
NE			32.04	33.05	23.57	24.53		
E			26.41	28.18	18.79	20.51		
SE			21.82	24.24	14.71	17.06		
S			20.24	22.87	13.30	15.87		
SW			24.09	26.20	16.74	18.79		
W			28.84	30.32	20.73	22.15		
NW			32.93	33.82	24.30	25.14		
[1]H			29.19	31.47	19.86	22.11		

GLASS	.18 X COND. FLOOR AREA	X WEIGHTED GLASS MULTIPLIER	= BASE GLASS SUBTOTAL
	.18	20.17	

AS-BUILT GLASS SUBTOTAL

	COMPONENT DESCRIPTION	AREA X	BASE WINTER POINT. MULT.	= BASE WINTER POINTS	COMPONENT DESCRIPTION	AREA	WINTER POINT MULT. (6A-11 THRU 6A-15)	AS-BUILT WINTER POINTS
WALL	EXTERIOR		3.4					
	ADJACENT		3.3					
DOORS	EXTERIOR		12.3					
	ADJACENT		11.5					
CEILING	UNDER ATTIC OR SINGLE ASSEM-BLY		2.05					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		18.8					
	RAISED (AREA)		1.38					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			-0.58				-0.58	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE WINTER POINTS

TOTAL COMPONENT AS-BUILT WINTER POINTS

HEATING SYSTEM	Base Heating System Multiplier X	Total Base Winter Points	= BASE HEATING POINTS
	.554		

TOTAL AS-BUILT WIN. PTS. X	As-Built DM (6A-17) X	As-Built DSM (6A-20) X	As Built AHU (6A-16) X	As Built HSM (6A-18) X	As Built HCM (6A-21) =	AS-BUILT HEATING POINTS
		1.17 or 1.0				

TOTAL	BASE COOLING POINTS (From P. 2) +	BASE HEATING POINTS +	BASE HOT WATER POINTS (From P. 2) ×	0.85 =	TOTAL BASE POINTS (Enter on P. 1)

AS-BUILT COOLING POINTS (From P. 2) +	AS-BUILT HEATING POINTS +	AS-BUILT HOT WATER POINTS (From P. 2) =	TOTAL AS-BUILT POINTS (Enter on P. 1)

[1]H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 of APPENDIX G-C of the *FBC, Residential.* TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3]MUST MEET CRITERIA OF APPENDIX G-C4.2.1.5 of the *FBC, Residential.*

WINTER POINT MULTIPLIERS (WPM)

CLIMATE ZONES 1 2 3 *

6A-10 WINTER OVERHANG FACTORS (WOF)

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	1.000	1.001	1.003	1.005	1.009	1.011	1.014	1.016	1.021	1.024	1.027
Northeast	1.00	0.998	1.001	1.008	1.015	1.023	1.029	1.035	1.040	1.049	1.056	1.061
East	1.00	1.007	1.018	1.040	1.069	1.109	1.150	1.198	1.242	1.338	1.429	1.507
Southeast	1.00	1.014	1.043	1.111	1.202	1.332	1.472	1.635	1.787	2.113	2.412	2.650
South	1.00	0.994	1.032	1.142	1.308	1.563	1.845	2.175	2.471	3.042	3.450	3.661
Southwest	1.00	1.006	1.025	1.070	1.131	1.217	1.308	1.413	1.508	1.708	1.888	2.031
West	1.00	1.002	1.010	1.027	1.049	1.077	1.102	1.128	1.149	1.187	1.217	1.238
Northwest	1.00	0.999	1.000	1.004	1.008	1.012	1.016	1.019	1.022	1.028	1.032	1.036
OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-11 WALL WINTER POINT MULTIPLIERS (WPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	*R*-VALUE	WOOD FR	*R*-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	*R*-VALUE	EXT	ADJ	EXT	0-6.9	12.6	0-2.9	7.9	*R*-VALUE	EXT	EXT
0-6.9	11.1	10.4	15.1	13.1	0-2.9	11.2	6.8	11.2	7-10.9	4.2	3-6.9	5.7	0-2.9	4.5	3.0
7-10.9	4.4	4.4	7.3	6.6	3-4.9	7.3	5.1	5.6	11-18.9	3.5	7-9.9	3.8	3-6.9	2.8	2.2
11-12.9	3.7	3.6	5.7	5.2	5-6.9	5.7	4.2	4.3	19-25.9	2.2	10 & UP	3.0	7 & UP	2.1	1.7
13-18.9	3.4	3.3	5.2	4.9	7-10.9	4.6	3.5	3.3	26 & UP	1.4					
19-25.9	2.2	2.2	4.6	4.4	11-18.9	3.0	2.6	2.2							
26 & Up	1.5	1.5	2.7	2.6	19-25.9	1.9	1.7								
					26 & UP	1.3	1.2								

6A-12 DOOR WINTER POINT MULTIPLIERS (WPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	12.3	11.5
INSULATED	8.4	8.0

6A-13 CEILING WINTER POINT MULTIPLIERS (WPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
					CEILING TYPE	
R-VALUE	WPM	*R*-VALUE	WPM	*R*-VALUE	EXPOSED	DROPPED
19-21.9	2.70	10-10.9	2.87	10-13.9	3.16	2.91
22-25.9	2.45	11-12.9	2.70	14-20.9	2.31	2.14
26-29.9	2.22	13-18.9	2.40	21 & UP	1.47	1.47
30-37.9	2.05	19-25.9	1.86			
38 & UP	1.81	26-29.9	1.54			
RBS Credit	0.850	30 & UP	1.43			
IRCC Credit	0.912					
White Roof Credit	1.044					

6A-14 FLOOR WINTER POINT MULTIPLIERS (WPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	WPM	*R*-VALUE	WPM	*R*-VALUE	WPM	WPM	WPM
0-2.9	18.8	0-2.9	9.9	0-6.9	5.77	3.5	10.4
3-4.9	9.3	3-4.9	5.1	7-10.9	2.20	1.6	4.4
5-6.9	7.6	5-6.9	3.6	11-18.9	1.55	1.2	3.6
7 & UP	7.0	7 & UP	2.9	19 & UP	0.88	.8	2.2

6A-15 INFILTRATION & INTERNAL GAINS (WPM)

Air Infiltration	2.13
Internal Gains	-2.72
Infiltration/Internal Gains (Combined)	-0.58

6A-16 AIR HANDLER MULTIPLIERS (WPM)

Located in garage	1.00
Located in conditioned area	0.93
Located on exterior of building	1.07
Located in attic	1.10

6A-17 DUCT MULTIPLIERS (DM)

SUPPLY DUCTS IN:	DUCT *R*-VALUE	RETURN DUCTS IN:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.093	1.086	1.088	1.089	1.081
	6.0	1.069	1.064	1.065	1.066	1.060
	8.0	1.053	1.049	1.051	1.051	1.046
Attic/Radiant Barrier (RBS)	4.2	1.067	1.059	—	—	1.052
	6.0	1.051	1.045	—	—	1.040
	8.0	1.040	1.036	—	—	1.032
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.096	—	1.088	—	1.077
	6.0	1.072	—	1.066	—	1.057
	8.0	1.056	—	1.052	—	1.045
Attic/Cool Roof	4.2	1.104	—	—	1.096	1.083
	6.0	1.076	—	—	1.071	1.061
	8.0	1.059	—	—	1.055	1.048
Conditioned Space	4.2	1.008	1.007	1.010	1.008	1.000
	6.0	1.006	1.005	1.007	1.006	1.000
	8.0	1.005	1.004	1.006	1.005	1.000

6A-18 HEATING SYSTEM MULTIPLIERS (HSM) All Climate Zones

SYSTEM TYPE		HEATING SYSTEM MULTIPLIERS (HSM)							
Central Heat Pump Units	HSPF	7.4-7.6	7.7-7.8	7.9-8.3	8.4-8.8	8.9-9.3	9.4-9.8	9.9-10.3	10.4-10.8
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
PTHP	COP	2.50-1.69	2.70-2.89	2.90-3.09	3.10-3.29	3.30-3.49	3.50-3.69	3.70-3.89	3.90-4.19
	HSM	.40	.37	.34	.32	.30	.29	.27	.26
Gas Heating	AFUE	.76-.77	.78	.79-.82	.83-.85	.86-.89	.90-.92	.93-.95	.96-.98
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
Electric Strip	1.0								

ADDITIONAL TABLES

CLIMATE ZONES 1 2 3

6A-19 COOLING CREDIT MULTIPLIERS

SYSTEM TYPE	Cooling credit multipliers (CCM)
Ceiling Fans	.95*
Cross Ventilation	.95*
Whole House Fan	.95*
Multizone	.95
Programmable Thermostat	.95

*Credit may be taken for only one system type concurrently.

6A-20 AIR DISTRIBUTION SYSTEM CREDIT MULTIPLIERS

TYPE CREDIT	Prescriptive requirements	Multiplier
Air-tight Duct Credit[1]	Appx G-C5.2.2.1.1	1.00
Factory-sealed AHU Credit[2]	Appx G-C5.2.2.1.2	0.95

[1]Duct Sealing Multiplier (DSM) shall be 1.15 (summer) or 1.17 (winter) unless Air-tight Duct Credit is demonstrated by test report.
[2]Multiply Factory-sealed AHU credit by summer (Table 6A-7) or winter (Table 6A-16) AHU multiplier. Insert total in the "As-Built AHU" box on page 2 or 4.

6A-21 HEATING CREDIT MULTIPLIERS (HCM)

SYSTEM TYPE		HEATING CREDIT MULTIPLIERS (HCM)
Programmable Thermostat	HCM	.95
Multizone	HCM	.95

6A-22 HOT WATER MULTIPLIERS (HWM)

SYSTEM TYPE									
Electric Resistance	EF	.80-.81	.82-.83	.84-.85	.86-.87	.88-.90	.91-.93	.94-.96	.97 &Up
	HWM	3020	2946	2876	2809	2746	2655	2571	2491
Gas Water Heating	EF	.54	.55	.56	.57	.58	.59	.60	.61
	HWM	3020	2946	2876	2809	2746	2655	2571	2491
	EF	.62-.63	.64-.65	.66-.70	.71-.75	.76-.80	.81-.83	.84-.86	.87 & Up
	HWM	2346	2217	2101	1738	1456	1196	1055	933

6A-23 HOT WATER CREDIT MULTIPLIERS (HWCM)

SYSTEM TYPE		HOT WATER CREDIT MULTIPLIERS (HWCM)				
Heat Recovery Unit	With	Air Conditioner		Heat Pump		
	HWCM	.84		.78		
Add-on Dedicated Heat Pump (without tank)	EF	2.0-2.49	2.5-2.99	3.0-3.49	3.5 & Up	
	HWCM	.44	.35	.29	.25	
Add-on Solar Water Heater (without tank)	EF	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0 & Up
	HWCM	.84	.42	.28	.21	.17

NOTE: An HWM must be used in conjunction with all HWCM. See Table 6A-22. EF Means Energy Factor.

6A-24 INFILTRATION REDUCTION COMPLIANCE CHECKLIST

COMPONENTS	SECTION	REQUIREMENTS FOR EACH PRACTICE	CHECK
Exterior Windows & Doors	N1106.AB.1.1	Max: 3 cfm/sq. ft. window area; .5cfm/sq. ft. door area.	
Exterior & Adjacent Walls	N1106.AB.1.2.1	Caulk, gasket, weatherstrip or seal between: windows/doors & frames, surrounding wall; foundation & wall sole or sill plate; joints between exterior wall panels at corners; CFM utility penetrations; between wall panels & top/bottom plates; between walls & floor. EXCEPTION: Frame walls where a continous infiltration barrier is installed that extends from, and is sealed to, the foundation to the top plate.	
Floors	N1106.AB.1.2.2	Penetrations/openings >1/8″ sealed unless backed by truss or joint members. EXCEPTION: Frame floors where a continuous infiltration barrier is installed that is sealed to the perimeter, penetrations and seams.	
Ceilings	N1106.AB.1.2.3	Seal: Between walls & ceilings: penetrations of ceiling plane of top floor; around shafts, chases, soffits, chimneys, cabinets sealed to continuous air barrier; gaps in gyp board & top plate; attic access. EXCEPTION: Frame ceilings where a continuous infiltration barrier is installed that is sealed at the perimeter, at penetrations and seams.	
Recessed Lighting Fixtures	N1106.AB.1.2.4	Type IC rated with no penetrations, sealed; or Type IC or non-IC rated, installed inside a sealed box with 1/2″ clearance & 3″ from insulation; or Type IC rated with <2.0 cfm from conditioned space, tested.	
Multiple Story Houses	N1106.AB.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Additional Infiltration reqts	N1106.AB.1.3	Exhaust fans vented to outdoors, dampers; combustion space heaters comply with NFPA, have combustion air.	

6A-25 OTHER PRESCRIPTIVE MEASURES (must be met or exceeded by all residences.)

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Water Heaters	N1112.AB.3	Comply with efficiency requirements in Table N1112.AB.3. Switch or clearly marked circuit breaker (electric) or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.AB.2.3	Spas & heated pools must have covers (except solar heated). Noncommercial pools must have a pump timer. Gas spa & pool heaters must have a minimum thermal efficiency of 78%.	
Shower Heads	N1112.AB.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 psig.	
Air Distribution Systems	N1110.AB	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated, and installed in accordance with the criteria of Section N1110. Ducts in unconditioned attics: R-6 minimum insulation.	
HVAC Controls	N1107.AB.2	Separate readily accessible manual or automatic thermostat for each system.	
Insulation	N1104.AB.1 N1102.B.1.1	Ceilings–Min. R-19. Common walls–Frame R-11 or CBS R-3 both sides. Common ceiling & floors R-11.	

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 600A-08 **Alternate Residential Points System Method** **CENTRAL 4 5 6**

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	**CLIMATE ZONE:** 4 ☐ 5 ☐ 6 ☐
OWNER:		**PERMIT NO.:** ☐☐☐☐☐☐☐☐	**JURISDICTION NO.:** ☐☐☐☐☐☐

	Please Type	CK
1. New construction or addition	1. _____	
2. Single-family detached or Multiple-family attached	2. _____	
3. If Multiple-family–No. of units covered by this submission	3. _____	
4. Is this a worst case? (yes/no)	4. _____	
5. Conditioned floor area (sq. ft.)	5. _____ sq. ft.	
6. Predominant eave overhang (ft.)	6. _____ ft.	
7. Glass type[1] and area: (Label required by 13-104.4.5 if not default)	Description Area	
a. *U*-factor: (or Single- or Double-Pane DEFAULT)	7a. _____ _____ sq. ft.	
b. SHGC: (or Clear or Tint DEFAULT)	7b. _____ _____ sq. ft.	
8. Floor type and insulation:		
a. Slab-on-grade (*R*-value + perimeter)	8a. R =_____ , _____ l. ft.	
b. Wood, raised (*R*-value + sq. ft.)	8b. R =_____ , _____ sq. ft.	
c. Concrete, raised (*R*-value)	8c. R =_____ , _____ sq. ft.	
9. Net Wall type, area and insulation:		
a. Exterior: 1. Concrete block (Insulation *R*-value)	9a-1 R = _____ , _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9a-2 R = _____ , _____ sq. ft.	
3. Steel frame (Insulation *R*-value)	9a-3 R = _____ , _____ sq. ft.	
4. Log (Insulation *R*-value)	9a-4 R = _____ , _____ sq. ft.	
5. Other:_____		
b. Adjacent: 1. Concrete block (Insulation *R*-value)	9b-1 R = _____ , _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9b-2 R = _____ , _____ sq. ft.	
3. Steel frame (Insulation *R*-value)	9b-3 R = _____ , _____ sq. ft.	
4. Log (Insulation *R*-value)	9b-4 R = _____ , _____ sq. ft.	
10. Ceiling type, area and insulation:		
a. Under attic (Insulation *R*-value)	10a. _____ _____ sq. ft.	
b. Single assembly (Insulation *R*-value)	10b. _____ _____ sq. ft.	
c. Radiant barrier, IRCC or white roof installed?	10c. _____	
11. Air distribution system:		
a. Ducts (Insulation + Location)	11a. R = _____ , _____ (cond./uncond.)	
b. Air Handler (Location)	11b. R = _____ , _____ (cond./uncond.)	
12. Cooling system:	12a. Type: _____	
(Types: central-split, central-single pkg., room unit, PTAC, gas, none)	12b. SEER/EER/COP: _____	
	12c. Capacity: _____	
13. Heating system:	13a. Type: _____	
(Types: heat pump, elec. strip, nat. gas, LP Gas, gas h.p., room or PTAC, none)	13b. HSPF/COP/AFUE: _____	
	13c. Capacity: _____	
14. Hot water system:	14a.Type: _____	
(Types: elec., natural gas, solar, LP gas, none)	14b. EF: _____	
15. Hot water credits	15a. _____	
a. Heat Recovery (HR)	15b. _____	
b. Dedicated Heat Pump (DHP)	15c. _____	
c. Solar		
16. HVAC credits	16. _____	
(Use: CF-Ceiling Fan, CV-cross vent, PT-programmable thermostat, HF-whole house fan, MZ-Multizone)		
17. COMPLIANCE STATUS: (PASS if As-Built Pts. Are less than Base Pts.)	17. _____	
a. Total As-Built Points b. Total Base Points	17a._____17b. _____	

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ **DATE:** _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:** _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

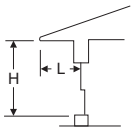
DATE: _____

[1] Predominant glass type. For actual glass type and areas, see summer and winter glass output on Pages 2 and 4.

*

SUMMER CALCULATIONS

CLIMATE ZONES 4 5 6

		ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE SUMMER POINT MULTIPLIER CLEAR	SINGLE-PANE SUMMER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE SUMMER POINT MULTIPLIER CLEAR	DOUBLE-PANE SUMMER POINT MULTIPLIER TINT[2]	X SUMMER OH FACTOR (from 6A-1)	= AS-BUILT GLASS SUMMER PTS
GLASS	 OVERHANG RATIO = OH LENGTH / OH HEIGHT	N			30.19	24.46	26.25	20.63		
		NE			47.10	38.88	40.99	32.90		
		E			63.97	53.27	55.69	45.16		
		SE			61.07	50.80	53.20	43.09		
		S			48.22	39.84	41.92	33.69		
		SW			56.99	47.31	49.60	40.08		
		W			57.68	47.90	50.22	40.60		
		NW			40.72	33.43	35.45	28.29		
		[1]H			109.69	89.83	96.56	77.00		

	.18 X	COND. FLOOR AREA X	WEIGHTED GLASS MULTIPLIER	= BASE GLASS SUBTOTAL	AS-BUILT GLASS SUBTOTAL
GLASS	.18		24.35		

	COMPONENT DESCRIPTION	AREA X	BASE SUMMER POINT MULT	= BASE SUMMER POINTS	COMPONENT DESCRIPTION	AREA	SUMMER POINT MULT. (6A-2 THRU 6A-6)	= AS-BUILT SUMMER POINTS
WALL	EXTERIOR		1.7					
	ADJACENT		.6					
DOORS	EXTERIOR		4.8					
	ADJACENT		1.6					
CEILING	UNDER ATTIC OR SINGLE ASSEM-BLY		2.13					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		-31.9					
	RAISED (AREA)		-1.71					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			14.31				14.31	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE SUMMER POINTS		TOTAL COMPONENT AS-BUILT SUMMER POINTS	

	Base Cooling System Multiplier X	Total Base Summer Points	= BASE COOLING POINTS	TOTAL AS-BUILT SUM. PTS. X	As-Built DM (6A-8) X	As-Built DSM (6A-20) X	As-Built AHU (6A-7) X	As-Built CSM (6A-9) X	As-Built CCM (6A-19) =	AS-BUILT COOLING POINTS
COOLING SYSTEM	.325					1.15 or 1.0				

	Number of Bedrooms X	Base Hot Water Multiplier	= BASE HOT WATER POINTS	AS-BUILT HOT WATER SYS-TEM DESC.	Number of Bedrooms X	As-Built HWM (6A-22) X	As-Built HWCM (6A-23) =	AS-BUILT HOT WATER POINTS
HOT WATER SYSTEM		2460						

[1] H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 of APPENDIX G-C of the *FBC, Residential.* TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3] MUST MEET CRITERIA OF APPENDIX G-C4.2.1.5 of the *FBC, Residential.*

SUMMER POINT MULTIPLIERS (SPM)

CLIMATE ZONES 4 5 6

6A-1 SUMMER OVERHANG FACTORS (SOF) FOR SINGLE AND DOUBLE-PANE GLASS

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	0.992	0.971	0.931	0.891	0.848	0.811	0.776	0.748	0.695	0.651	0.611
Northeast	1.00	0.995	0.966	0.908	0.846	0.777	0.719	0.665	0.623	0.549	0.491	0.445
East	1.00	0.993	0.964	0.903	0.835	0.755	0.687	0.622	0.571	0.482	0.414	0.463
Southeast	1.00	0.999	0.956	0.871	0.786	0.700	0.635	0.580	0.540	0.478	0.436	0.407
South	1.00	0.988	0.935	0.849	0.776	0.708	0.659	0.618	0.588	0.539	0.503	0.475
Southwest	1.00	0.997	0.956	0.874	0.793	0.709	0.645	0.588	0.547	0.479	0.431	0.396
West	1.00	0.994	0.964	0.902	0.834	0.757	0.691	0.630	0.582	0.500	0.438	0.391
Northwest	1.00	0.995	0.966	0.911	0.857	0.798	0.751	0.708	0.674	0.616	0.570	0.532
OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-2 WALL SUMMER POINT MULTIPLIERS (SPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	*R*-VALUE	WOOD FR	*R*-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	*R*-VALUE	EXT	ADJ	EXT	0-6.9	2.9	0-2.9	1.0	*R*-VALUE	EXT	EXT
0-6.9	6.4	2.2	8.9	2.9	0-2.9	2.5	.9	2.5	7-10.9	.6	3-6.9	.6	0-2.9	1.7	1.0
7-10.9	2.3	.8	4.1	1.3	3-4.9	1.4	.7	.7	11-18.9	.4	7-9.9	.4	3-6.9	1.1	.8
11-12.9	1.9	.7	3.0	1.0	5-6.9	1.0	.6	.3	19-25.9	.2	10 & UP	.2	7 & UP	.8	.7
13-18.9	1.7	.6	2.8	0.9	7-10.9	.8	.4	.1	26 & UP	.1					
19-25.9	1.0	.3	2.4	0.8	11-18.9	.4	.3	0							
26 & UP	.6	.2	1.3	0.4	19-25.9	.2	.2								
					26 & Up	.1	.1								

6A-3 DOOR SUMMER POINT MULTIPLIERS (SPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	7.2	2.4
INSULATED	4.8	1.6

6A-4 CEILING SUMMER POINT MULTIPLIERS (SPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
R-VALUE	SPM	R-VALUE	SPM		CEILING TYPE	
19-21.9	2.82	10-10.9	10.27	*R*-VALUE	EXPOSED	DROPPED
22-25.9	2.55	11-12.9	9.73	10-13.9	11.13	10.40
26-29.9	2.28	13-18.9	8.72	14-20.9	8.42	7.99
30-37.9	2.13	19-25.9	6.90	21 & UP	5.99	5.76
38 & UP	1.84	26-29.9	5.82			
RBS Credit	0.700	30 & Up	5.40			
IRCC Credit	0.864					
White Roof Credit	0.550					

6A-5 FLOOR SUMMER POINT MULTIPLIERS (SPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	SPM	*R*-VALUE	SPM	*R*-VALUE	SPM	SPM	SPM
0-2.9	-31.9	0-2.9	-1.0	0-6.9	4.50	-5.8	5.3
3-4.9	-31.8	3-4.9	-1.7	7-10.9	2.28	-2.8	2.1
5-6.9	-31.7	5-6.9	-1.7	11-18.9	1.83	-2.2	1.8
7 & UP	-31.6	7 & UP	-1.7	19 & UP	1.36	-1.8	1.0

6A-6 INFILTRATION & INTERNAL GAINS (SPM)

Air Infiltration	5.17
Internal Gains	+9.14
Infiltration/Internal Gains (Combined)	14.31

6A-7 AIR HANDLER MULTIPLIERS (SPM)

Located in garage	1.00
Located in conditioned area	0.90
Located on exterior of building	1.02
Located in attic	1.10

6A-8 DUCT MULTIPLIERS (DM).

SUPPLY DUCTS IN:	DUCT *R*-VALUE	RETURN DUCTS In:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.113	1.107	1.108	1.107	1.103
	6.0	1.087	1.081	1.083	1.081	1.079
	8.0	1.069	1.064	1.065	1.064	1.062
Attic/Radiant Barrier (RBS)	4.2	1.072	1.066	—	—	1.061
	6.0	1.056	1.051	—	—	1.047
	8.0	1.045	1.041	—	—	1.038
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.098	—	1.092	—	1.084
	6.0	1.076	—	1.071	—	1.065
	8.0	1.060	—	1.057	—	1.052
Attic/Cool Roof	4.2	1.069	—	—	1.063	1.058
	6.0	1.052	—	—	1.047	1.044
	8.0	1.041	—	—	1.037	1.034
Conditioned Space	4.2	1.006	1.005	1.007	1.003	1.000
	6.0	1.005	1.004	1.005	1.002	1.000
	8.0	1.004	1.003	1.004	1.002	1.000

6A-9 COOLING SYSTEM MULTIPLIERS (CSM)

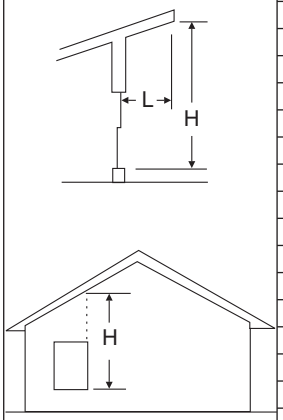
SYSTEM TYPE		COOLING SYSTEM MULTIPLIERS (CSM)										
Central Units (SEER)	Rating		7.5-7.9	8.0-8.4	8.5-8.8	8.9-9.4	9.5-9.9	10.0-10.4	10.5-10.9	11.0-11.4	11.5-11.9	12.0-12.4
	CSM		.45	.43	.40	.38	.36	.34	.32	.31	.30	.28
PTAC & Room Units (EER)	Rating	12.5-12.9	13.0-13.4	13.5-13.9	14.0-14.4	14.5-14.9	15.0-15.4	15.5-15.9	16.0-16.4	16.5-16.9	17.0-17.4	17.5 & UP
	CSM	.27	.26	.25	.24	.24	.23	.22	.21	.21	.20	.19

*

WINTER CALCULATIONS

CLIMATE ZONES 4 5 6

GLASS



ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE WINTER POINT MULTIPLIER CLEAR	SINGLE-PANE WINTER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE WINTER POINT MULTIPLIER CLEAR	DOUBLE-PANE WINTER POINT MULTIPLIER TINT[2] X	WINTER OH FACTOR (from 6A-10)	= AS-BUILT GLASS WINTER PTS
N			15.07	15.38	11.00	11.29		
NE			14.70	15.07	10.70	11.04		
E			12.37	13.04	8.82	9.46		
SE			10.59	11.49	7.31	8.18		
S			9.90	10.88	6.74	7.70		
SW			11.59	12.36	8.12	8.86		
W			13.25	13.80	9.55	10.07		
NW			14.97	15.30	10.91	11.21		
[1]H			14.78	15.61	10.20	11.01		

GLASS	.18 X	COND. FLOOR AREA	X	WEIGHTED GLASS MULTIPLIER	= BASE GLASS SUBTOTAL	AS-BUILT GLASS SUBTOTAL
	.18			9.11		

	COMPONENT DESCRIPTION	AREA	BASE WINTER POINT MULT.	BASE WINTER POINTS	COMPONENT DESCRIPTION	AREA X	WINTER POINT MULT. (6A-11 THRU 6A-15)	= AS-BUILT WINTER POINTS
WALL	EXTERIOR		1.8					
	ADJACENT		1.6					
DOORS	EXTERIOR		5.1					
	ADJACENT		4.0					
CEILING	UNDER ATTIC OR SINGLE ASSEM-BLY		0.64					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		2.5					
	RAISED (AREA)		.39					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			-0.28				-0.28	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE WINTER POINTS		TOTAL COMPONENT AS-BUILT WINTER POINTS	

HEATING SYSTEM	Base Heating System Multiplier	X	Total Base Winter Points	=	BASE HEATING POINTS
	.554				

TOTAL AS-BUILT WIN. PTS.	X	As-Built DM (6A-17)	X	As-Built DSM (6A-20)	X	As Built AHU (6A-16)	X	As Built HSM (6A-18)	X	As Built HCM (6A-21)	=	AS-BUILT HEATING POINTS
				1.16 or 1.0								

TOTAL	BASE COOLING POINTS (From P. 2)	+	BASE HEATING POINTS	+	BASE HOT WATER POINTS (From P. 2)	X	0.85	=	TOTAL BASE POINTS (Enter on P. 1)

AS-BUILT COOLING POINTS (From P. 2)	+	AS-BUILT HEATING POINTS	+	AS-BUILT HOT WATER POINTS (From P. 2)	=	TOTAL AS-BUILT POINTS (Enter on P. 1)

[1]H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 of APPENDIX G-C of the *FBC, Residential.* TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3]MUST MEET CRITERIA OF APPENDIX G-C4.2.1.5 of the *FBC, Residential.*

WINTER POINT MULTIPLIERS (WPM)

CLIMATE ZONES 4 5 6

6A-10 WINTER OVERHANG FACTORS (WOF)

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	0.998	0.996	0.995	0.995	0.994	0.993	0.992	0.990	0.988	1.986	0.984
Northeast	1.00	1.000	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.001	1.000
East	1.00	1.005	1.010	1.020	1.034	1.055	1.078	1.106	1.133	1.198	1.264	1.320
Southeast	1.00	1.010	1.025	1.058	1.102	1.167	1.238	1.324	1.407	1.596	1.783	1.939
South	1.00	0.994	1.011	1.062	1.040	1.262	1.400	1.562	1.709	1.992	2.192	2.291
Southwest	1.00	1.002	1.013	1.038	1.071	1.118	1.168	1.225	1.278	1.388	1.490	1.573
West	1.00	0.999	1.003	1.013	1.025	1.040	1.053	1.067	1.077	1.095	1.107	1.116
Northwest	1.00	0.999	0.998	0.997	0.997	0.996	0.995	0.994	0.993	0.992	0.990	0.989
OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-11 WALL WINTER POINT MULTIPLIERS (WPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	*R*-VALUE	WOOD FR	*R*-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	*R*-VALUE	EXT	ADJ	EXT	0-6.9	7.0	0-2.9	3.7	*R*-VALUE	EXT	EXT
0-6.9	6.8	5.3	9.4	6.7	0-2.9	6.0	3.1	6.0	7-10.9	2.1	3-6.9	2.6	0-2.9	2.2	1.2
7-10.9	2.5	2.1	4.4	3.3	3-4.9	3.8	2.3	2.8	11-18.9	1.7	7-9.9	1.8	3-6.9	1.2	.9
11-12.9	2.0	1.8	3.3	2.6	5-6.9	2.9	1.9	2.0	19-25.9	1.0	10 & UP	1.3	7 & UP	.9	.7
13-18.9	1.8	1.6	3.0	2.4	7-10.9	2.3	1.5	1.5	26 & UP	.6					
19-25.9	1.1	1.0	2.6	2.2	11-18.9	1.5	1.1	.8							
26 & UP	.7	.7	1.4	1.2	19-25.9	.8	.7								
					26 &UP	.5	.5								

6A-12 DOOR WINTER POINT MULTIPLIERS (WPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	7.6	5.9
INSULATED	5.1	4.0

6A-13 CEILING WINTER POINT MULTIPLIERS (WPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
R-VALUE	WPM	*R*-VALUE	WPM		CEILING TYPE	
19-21.9	.87	10-10.9	1.02	*R*-VALUE	EXPOSED	DROPPED
22-25.9	.78	11-12.9	.96	10-13.9	1.16	1.05
26-29.9	.69	13-18.9	.84	14-20.9	.83	.76
30-37.9	.64	19-25.9	.62	21 & UP	.54	.50
38 & UP	.55	26-29.9	.50			
RBS Credit	0.850	30 & UP	.46			
IRCC Credit	0.905					
White Roof Credit	1.044					

6A-14 FLOOR WINTER POINT MULTIPLIERS (WPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	WPM	*R*-VALUE	WPM	*R*-VALUE	WPM	WPM	WPM
0-2.9	2.5	0-2.9	4.0	0-6.9	2.49	1.8	5.3
3-4.9	-1.7	3-4.9	1.8	7-10.9	0.78	.7	2.1
5-6.9	-2.4	5-6.9	1.1	11-18.9	0.47	.5	1.8
7 & UP	-2.7	7 & UP	.8	19 & UP	0.14	.3	1.0

6A-15 INFILTRATION & INTERNAL GAINS (WPM)

Air Infiltration	0.87
Internal Gains	-1.15
Infiltration/Internal Gains (Combined)	-0.28

6A-16 AIR HANDLER MULTIPLIERS (WPM)

Located in garage	1.00
Located in conditioned area	0.92
Located on exterior of building	1.09
Located in attic	1.11

6A-17 DUCT MULTIPLIERS (DM)

SUPPLY DUCTS IN:	DUCT R-VALUE	RETURN DUCTS In:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.107	1.098	1.100	1.102	1.092
	6.0	1.078	1.072	1.074	1.075	1.068
	8.0	1.061	1.056	1.057	1.058	1.052
Attic/Radiant Barrier (RBS)	4.2	1.076	1.067	—	—	1.059
	6.0	1.058	1.051	—	—	1.045
	8.0	1.046	1.041	—	—	1.036
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.097	—	1.088	—	1.077
	6.0	1.073	—	1.066	—	1.057
	8.0	1.057	—	1.052	—	1.045
Attic/Cool Roof	4.2	1.120	—	—	1.110	1.095
	6.0	1.088	—	—	1.081	1.070
	8.0	1.068	—	—	1.063	1.054
Conditioned Space	4.2	1.009	1.008	1.010	1.009	1.000
	6.0	1.007	1.006	1.007	1.007	1.000
	8.0	1.005	1.005	1.006	1.005	1.000

6A-18 HEATING SYSTEM MULTIPLIERS (HSM) All Climate Zones

SYSTEM TYPE		HEATING SYSTEM MULTIPLIERS (HSM)							
Central Heat Pump Units	HSPF	7.4-7.6	7.7-7.8	7.9-8.3	8.4-8.8	8.9-9.3	9.4-9.8	9.9-10.3	10.4-10.8
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
PTHP	COP	2.50-1.69	2.70-2.89	2.90-3.09	3.10-3.29	3.30-3.49	3.50-3.69	3.70-3.89	3.90-4.19
	HSM	.40	.37	.34	.32	.30	.29	.27	.26
Gas Heating	AFUE	.76-.77	.78	.79-.82	.83-.85	.86-.89	.90-.92	.93-.95	.96-.98
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
Electric Strip	1.0								

*

ADDITIONAL TABLES

CLIMATE ZONES 4 5 6

6A-19 COOLING CREDIT MULTIPLIERS

SYSTEM TYPE	Cooling credit multipliers (CCM)
Ceiling Fans	.95*
Cross Ventilation	.95*
Whole House Fan	.95*
Multizone	.95
Programmable Thermostat	.95

*Credit may be taken for only one system type concurrently.

6A-20 AIR DISTRIBUTION SYSTEM CREDIT MULTIPLIERS

TYPE CREDIT	Prescriptive requirements	Multiplier
Air-tight Duct Credit[1]	Appx G-C5.2.2.1.1	1.00
Factory-sealed AHU Credit[2]	Appx G-C5.2.2.1.2	0.95

[1]Duct Sealing Multiplier (DSM) shall be 1.15 (summer) or 1.16 (winter) unless Air-tight Duct Credit is demonstrated by test report.
[2]Multiply Factory-sealed AHU Credit by summer (Table 6A-7) or winter (Table 6A-16) AHU multiplier. Insert total in the "As Built AHU" box on page 2 or 4.

6A-21 HEATING CREDIT MULTIPLIERS (HCM)

SYSTEM TYPE		HEATING CREDIT MULTIPLIERS (HCM)
Programmable Thermostat	HCM	.95
Multizone	HCM	.95

6A-22 HOT WATER MULTIPLIERS (HWM)

SYSTEM TYPE									
Electric Resistance	EF	.80-.81	.82-.83	.84-.85	.86-.87	.88-.90	.91-.93	.94-.96	.97 &Up
	HWM	2820	2752	2685	2624	2564	2479	2400	2326
Gas Water Heating	EF	.54	.55	.56	.57	.58	.59	.60	.61
	HWM	2820	2752	2685	2624	2564	2479	2400	2326
	EF	.62-.63	.64-.65	.66-.70	.71-.75	.76-.80	.81-.83	.84-.86	.87 & Up
	HWM	2191	2070	1962	1623	1359	1117	985	871

6A-23 HOT WATER CREDIT MULTIPLIERS (HWCM)

SYSTEM TYPE		HOT WATER CREDIT MULTIPLIERS (HWCM)				
Heat Recovery Unit	With	Air Conditioner		Heat Pump		
	HWCM	.84		.78		
Add-on Dedicated Heat Pump (without tank)	EF	2.0-2.49	2.5-2.99	3.0-3.49	3.5 & Up	
	HWCM	.44	.35	.29	.25	
Add-on Solar Water Heater (without tank)	EF	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0 & Up
	HWCM	.84	.42	.28	.21	.17

NOTE: An HWM must be used in conjunction with all HWCM. See Table 6A-22. EF Means Energy Factor.

6A-24 INFILTRATION REDUCTION COMPLIANCE CHECKLIST

COMPONENTS	SECTION	REQUIREMENTS FOR EACH PRACTICE	CHECK
Exterior Windows & Doors	N1106.AB.1.1	Max: 3 cfm/sq. ft. window area; .5cfm/sq. ft. door area.	
Exterior & Adjacent Walls	N1106.AB.1.2.1	Caulk, gasket, weatherstrip or seal between: windows/doors & frames, surrounding wall; foundation & wall sole or sill plate; joints between exterior wall panels at corners; utility penetrations; between wall panels & top/bottom plates; between walls & floor. EXCEPTION: Frame walls where a continous infiltration barrier is installed that extends from, and is sealed to, the foundation to the top plate.	
Floors	N1106.AB.1.2.2	Penetrations/openings >1/8″ sealed unless backed by truss or joint members. EXCEPTION: Frame floors where a continuous infiltration barrier is installed that is sealed to the perimeter, penetrations and seams.	
Ceilings	N1106.AB.1.2.3	Seal: Between walls & ceilings: penetrations of ceiling plane of top floor; around shafts, chases, soffits, chimneys, cabinets sealed to continuous air barrier; gaps in gyp board & top plate; attic access. EXCEPTION: Frame ceilings where a continuous infiltration barrier is installed that is sealed at the perimeter, at penetrations and seams.	
Recessed Lighting Fixtures	N1106.AB.1.2.4	Type IC rated with no penetrations, sealed; or Type IC or non-IC rated, installed inside a sealed box with 1/2″ clearance & 3″ from insulation; or Type IC rated with <2.0 cfm from conditioned space, tested.	
Multiple Story Houses	N1106.AB.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Additional Infiltration reqts	N1106.AB.1.3	Exhaust fans vented to outdoors, dampers; combustion space heaters comply with NFPA, have combustion air.	

6A-25 OTHER PRESCRIPTIVE MEASURES (must be met or exceeded by all residences.)

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Water Heaters	N1112.AB.3	Comply with efficiency requirements in Table N1112.AB.3. Switch or clearly marked circuit breaker (electric) or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.AB.2.3	Spas & heated pools must have covers (except solar heated). Non-commercial pools must have a pump timer. Gas spa & pool heaters must have a minimum thermal efficiency of 78%.	
Shower Heads	N1112.AB.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 PSIG.	
Air Distribution Systems	N1110.AB	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated, and installed in accordance with the criteria of Section N1110. Ducts in unconditioned attics: R-6 minimum insulation.	
HVAC Controls	N1104.AB.1 N1102.B.1.1	Separate readily accessible manual or automatic thermostat for each system.	

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 600A-08 **Alternate Residential Points System Method** **SOUTH 7 8 9**

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	**CLIMATE ZONE:** 7 ☐ 8 ☐ 9 ☐
OWNER:		**PERMIT NO.:** ☐☐☐☐☐☐☐☐	**JURISDICTION NO.:** ☐☐☐☐☐☐

	Please Type	CK
1. New construction or addition	1. _____	
2. Single-family detached or Multiple-family attached	2. _____	
3. If Multiple-family–No. of units covered by this submission	3. _____	
4. Is this a worst case? (yes/no)	4. _____	
5. Conditioned floor area (sq. ft.)	5. _____ sq. ft.	
6. Predominant eave overhang (ft.)	6. _____ ft.	
7. Glass type[1] and area: (Label required by 13-104.4.5 if not default)	Description Area	
a. *U*-factor: (or Single- or Double-Pane DEFAULT)	7a. _____ _____ sq. ft.	
b. SHGC: (or Clear or Tint DEFAULT)	7b. _____ _____ sq. ft.	
8. Floor type and insulation:		
a. Slab-on-grade (*R*-value + perimeter)	8a. R =_____ , _____ l. ft.	
b. Wood, raised (*R*-value + sq. ft.)	8b. R =_____ , _____ sq. ft.	
c. Concrete, raised (*R*-value)	8c. R =_____ , _____ sq. ft.	
9. Net Wall type, area and insulation:		
a. Exterior: 1. Concrete block (Insulation *R*-value)	9a-1 R = _____ , _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9a-2 R = _____ , _____ sq. ft.	
3. Steel frame (Insulation *R*-value)	9a-3 R = _____ , _____ sq. ft.	
4. Log (Insulation *R*-value)	9a-4 R = _____ , _____ sq. ft.	
5. Other:_____		
b. Adjacent: 1. Concrete block (Insulation *R*-value)	9b-1 R = _____ , _____ sq. ft.	
2. Wood frame (Insulation *R*-value)	9b-2 R = _____ , _____ sq. ft.	
3. Steel frame (Insulation *R*-value)	9b-3 R = _____ , _____ sq. ft.	
4. Log (Insulation *R*-value)	9b-4 R = _____ , _____ sq. ft.	
10. Ceiling type, area and insulation:		
a. Under attic (Insulation *R*-value)	10a. _____ _____ sq. ft.	
b. Single assembly (Insulation *R*-value)	10b. _____ _____ sq. ft.	
c. Radiant barrier, IRCC or white roof installed?	10c. _____	
11. Air distribution system:		
a. Ducts (Insulation + Location)	11a. R = _____ , _____ (cond./uncond.)	
b. Air Handler (Location)	11b. R = _____ , _____ (cond./uncond.)	
12. Cooling system:	12a. Type: _____	
(Types: central-split, central-single pkg., room unit, PTAC, gas, none)	12b. SEER/EER/COP: _____	
	12c. Capacity: _____	
13. Heating system:	13a. Type: _____	
(Types: heat pump, elec. strip, nat. gas, LP Gas, gas h.p., room or PTAC, none)	13b. HSPF/COP/AFUE: _____	
	13c. Capacity: _____	
14. Hot water system:	14a.Type: _____	
(Types: elec., natural gas, solar, LP gas, none)	14b. EF: _____	
15. Hot water credits	15a. _____	
a. Heat Recovery (HR)	15b. _____	
b. Dedicated Heat Pump (DHP)	15c. _____	
c. Solar		
16. HVAC credits	16. _____	
(Use: CF-Ceiling Fan, CV-cross vent, PT-programmable thermostat, HF-whole house fan, MZ-Multizone)		
17. COMPLIANCE STATUS: (PASS if As-Built Pts. Are less than Base Pts.)	17. _____	
a. Total As-Built Points b. Total Base Points	17a._____17b. _____	

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ **DATE:** _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ **DATE:** _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

DATE: _____

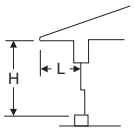
[1] Predominant glass type. For actual glass type and areas, see summer and winter glass output on Pages 2 and 4.

*

SUMMER CALCULATIONS

CLIMATE ZONES 7 8 9

GLASS	ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE SUMMER POINT MULTIPLIER CLEAR	SINGLE-PANE SUMMER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE SUMMER POINT MULTIPLIER CLEAR	DOUBLE-PANE SUMMER POINT MULTIPLIER TINT[2]	X SUMMER OH FACTOR (from 6A-1)	= AS-BUILT GLASS SUMMER PTS
	N			36.46	29.33	31.93	24.93		
	NE			55.61	45.70	48.54	38.79		
	E			78.71	65.40	68.60	55.50		
	SE			79.81	66.34	69.60	56.34		
	S			66.93	55.34	58.45	47.06		
	SW			73.41	60.87	64.05	51.71		
	W			70.53	58.39	61.59	49.65		
	NW			48.42	39.52	42.35	33.62		
	H[1]			133.72	109.20	118.14	93.98		



OVERHANG RATIO = OH LENGTH / OH HEIGHT

GLASS	.18 X	COND. FLOOR AREA X	WEIGHTED GLASS MULTIPLIER	= BASE GLASS SUBTOTAL	AS-BUILT GLASS SUBTOTAL
	.18		30.53		

	COMPONENT DESCRIPTION	AREA X	BASE SUMMER POINT MULT	= BASE SUMMER POINTS	COMPONENT DESCRIPTION	AREA	SUMMER POINT MULT. (6A-2 THRU 6A-6)	= AS-BUILT SUMMER POINTS
WALL	EXTERIOR		2.4					
	ADJACENT		.9					
DOORS	EXTERIOR		6.4					
	ADJACENT		2.6					
CEILING	UNDER ATTIC OR SINGLE ASSEMBLY		2.8					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		-20.0					
	RAISED (AREA)		1.96					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			18.79				18.79	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE SUMMER POINTS		TOTAL COMPONENT AS-BUILT SUMMER POINTS	

	Base Cooling System Multiplier X	Total Base Summer Points	= BASE COOLING POINTS	TOTAL AS-BUILT SUM. PTS. X	As-Built DM (6A-8) X	As-Built DSM (6A-20) X	As-Built AHU (6A-7) X	As-Built CSM (6A-9) X	As-Built CCM (6A-19) =	AS-BUILT COOLING POINTS
COOLING SYSTEM	.325					1.16 or 1.0				

	Number of Bedrooms X	Base Hot Water Multiplier	= BASE HOT WATER POINTS	AS-BUILT HOT WATER SYSTEM DESC.	Number of Bedrooms X	As-Built HWM (6A-22) X	As-Built HWCM (6A-23) =	AS-BUILT HOT WATER POINTS
HOT WATER SYSTEM		2273						

[1] H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 of APPENDIX G-C of the *FBC, Residential.* TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3] MUST MEET CRITERIA OF APPENDIX G-C4.2.1.5 of the *FBC, Residential.*

SUMMER POINT MULTIPLIERS (SPM)

CLIMATE ZONES 7 8 9

*

6A-1 SUMMER OVERHANG FACTORS (SOF) FOR SINGLE AND DOUBLE-PANE GLASS

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	0.993	0.971	0.932	0.891	0.847	0.810	0.774	0.745	0.692	0.646	0.606
Northeast	1.00	0.995	0.966	0.909	0.849	0.782	0.726	0.673	0.633	0.561	0.504	0.459
East	1.00	0.993	0.964	0.904	0.837	0.759	0.691	0.625	0.574	0.484	0.415	0.462
Southeast	1.00	0.999	0.960	0.881	0.799	0.713	0.645	0.585	0.542	0.471	0.422	0.386
South	1.00	0.995	0.945	0.854	0.770	0.689	0.630	0.581	0.546	0.592	0.455	0.428
Southwest	1.00	0.997	0.958	0.882	0.805	0.723	0.657	0.599	0.555	0.482	0.427	0.386
West	1.00	0.994	0.965	0.905	0.840	0.767	0.704	0.645	0.599	0.518	0.455	0.404
Northwest	1.00	0.995	0.967	0.914	0.861	0.805	0.760	0.718	0.686	0.629	0.583	0.545
OH Length	0.0'	1.0'	1.5'	2.0'	3.0'	3.5'	4.5'	5.5'	6.5'	9.5'	14.0'	20.0'

6A-2 WALL SUMMER POINT MULTIPLIERS (SPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	*R*-VALUE	WOOD FR	*R*-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	*R*-VALUE	EXT	ADJ	EXT	0-6.9	4.6	0-2.9	2.3	*R*-VALUE	EXT	EXT
0-6.9	8.5	3.4	11.6	4.4	0-2.9	4.2	1.9	4.2	7-10.9	1.3	3-6.9	1.6	0-2.9	2.8	1.9
7-10.9	3.2	1.3	5.5	2.1	3-4.9	2.7	1.3	1.7	11-18.9	1.1	7-9.9	.9	3-6.9	1.9	1.4
11-12.9	2.7	1.0	4.2	1.6	5-6.9	2.0	1.1	1.2	19-25.9	.6	10 & UP	.7	7-10.9	1.5	1.2
13-18.9	2.4	.9	3.9	1.5	7-10.9	1.6	.8	.7	26 & UP	.3			11-12.9	2.0	1.6
19-25.9	1.6	.6	3.4	1.3	11-18.9	1.0	.6	.3					13-18.9	2.4	1.8
26 & UP	1.0	.3	1.9	.7	19-25.9	.5	.3						19-25.9	1.6	1.4
					26 & Up	.3	.2						26 & UP	1.0	1.0

6A-3 DOOR SUMMER POINT MULTIPLIERS (SPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	9.4	3.8
INSULATED	6.4	2.6

6A-4 CEILING SUMMER POINT MULTIPLIERS (SPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
R-VALUE	SPM	R-VALUE	SPM		CEILING TYPE	
19-21.9	3.72	10-10.9	13.67	*R*-VALUE	EXPOSED	DROPPED
22-25.9	3.36	11-12.9	12.90	10-13.9	14.73	13.67
26-29.9	3.02	13-18.9	11.59	14-20.9	10.96	10.46
30-37.9	2.77	19-25.9	9.24	21 & UP	7.86	7.54
38 & UP	2.43	26-29.9	7.85			
RBS Credit	0.700	30 & Up	7.27			
IRCC Credit	0.865					
White Roof Credit	0.550					

6A-5 FLOOR SUMMER POINT MULTIPLIERS (SPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	SPM	*R*-VALUE	SPM	*R*-VALUE	SPM	SPM	SPM
0-2.9	-20.0	0-2.9	.8	0-6.9	5.02	-4.2	3.4
3-4.9	-17.4	3-4.9	-.3	7-10.9	2.58	-.9	1.3
5-6.9	-16.6	5-6.9	-.4	11-18.9	2.08	-.6	1.0
7 & UP	-16.0	7 & UP	-.5	19 & UP	1.58	-.4	.6

6A-6 INFILTRATION & INTERNAL GAINS (SPM)

Air Infiltration	7.43
Internal Gains	+11.36
Infiltration/Internal Gains (Combined)	18.79

6A-7 AIR HANDLER MULTIPLIERS (SPM)

Located in garage	1.00
Located in conditioned area	0.90
Located on exterior of building	1.03
Located in attic	1.08

6A-8 DUCT MULTIPLIERS (DM)

SUPPLY DUCTS IN:	DUCT *R*-VALUE	RETURN DUCTS In:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.095	1.090	1.091	1.090	1.087
	6.0	1.073	1.069	1.070	1.069	1.067
	8.0	1.058	1.055	1.055	1.055	1.053
Attic/Radiant Barrier (RBS)	4.2	1.062	1.057	—	—	1.053
	6.0	1.048	1.044	—	—	1.041
	8.0	1.039	1.036	—	—	1.033
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.083	—	1.078	—	1.072
	6.0	1.064	—	1.061	—	1.056
	8.0	1.052	—	1.049	—	1.045
Attic/Cool Roof	4.2	1.059	—	—	1.054	1.051
	6.0	1.045	—	—	1.041	1.038
	8.0	1.035	—	—	1.032	1.030
Conditioned Space	4.2	1.005	1.004	1.006	1.002	1.000
	6.0	1.004	1.003	1.004	1.002	1.000
	8.0	1.003	1.003	1.003	1.001	1.000

6A-9 COOLING SYSTEM MULTIPLIERS (CSM)

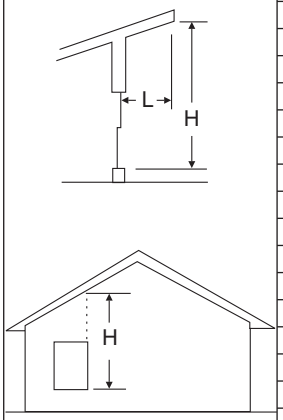
SYSTEM TYPE		COOLING SYSTEM MULTIPLIERS (CSM)										
Central Units (SEER)	Rating		7.5-7.9	8.0-8.4	8.5-8.8	8.9-9.4	9.5-9.9	10.0-10.4	10.5-10.9	11.0-11.4	11.5-11.9	12.0-12.4
	CSM		.45	.43	.40	.38	.36	.34	.32	.31	.30	.28
PTAC & Room Units (EER)	Rating	12.5-12.9	13.0-13.4	13.5-13.9	14.0-14.4	14.5-14.9	15.0-15.4	15.5-15.9	16.0-16.4	16.5-16.9	17.0-17.4	17.5 & UP
	CSM	.27	.26	.25	.24	.24	.23	.22	.21	.21	.20	.19

*

WINTER CALCULATIONS

CLIMATE ZONES 7 8 9

GLASS



ORIENTATION	OVERHANG LENGTH OH (FEET)	GLASS AREA (SQ. FT.) X	SINGLE-PANE WINTER POINT MULTIPLIER CLEAR	SINGLE-PANE WINTER POINT MULTIPLIER TINT[2]	OR DOUBLE-PANE WINTER POINT MULTIPLIER CLEAR	DOUBLE-PANE WINTER POINT MULTIPLIER TINT[2] X	WINTER OH FACTOR (from 6A-10) =	AS-BUILT GLASS WINTER PTS
N			6.03	6.11	4.38	4.45		
NE			5.84	5.96	4.18	4.28		
E			4.77	5.05	3.30	3.56		
SE			4.22	4.57	2.87	3.20		
S			4.49	4.79	3.12	3.40		
SW			5.06	5.25	3.63	3.83		
W			5.49	5.65	3.98	4.12		
NW			6.00	6.09	4.35	4.43		
[1]H			6.39	6.61	4.48	4.70		

GLASS	.18 X	COND. FLOOR AREA X	WEIGHTED GLASS MULTIPLIER =	BASE GLASS SUBTOTAL
	.18		3.60	

AS-BUILT GLASS SUBTOTAL

	COMPONENT DESCRIPTION	AREA	BASE WINTER POINT MULT.	BASE WINTER POINTS	COMPONENT DESCRIPTION	AREA X	WINTER POINT MULT. (6A-11 THRU 6A-15) =	AS-BUILT WINTER POINTS
WALL	EXTERIOR		.6					
	ADJACENT		.5					
DOORS	EXTERIOR		1.8					
	ADJACENT		1.3					
CEILING	UNDER ATTIC OR SINGLE ASSEM-BLY		.1					
					RBS/IRCC/white roof[3]		x___	
	BASE CEILING AREA EQUALS FLOOR AREA DIRECTLY UNDER CEILING, AS-BUILT CEILING AREA EQUALS ACTUAL CEILING SQUARE FOOTAGE.							
FLOOR	SLAB (PERIMETER)		-2.1					
	RAISED (AREA)		.09					
	FOR SLAB-ON-GRADE USE PERIMETER LENGTH AROUND CONDITIONED FLOOR. FOR RAISED FLOORS USE AREA OVER UNCONDITIONED SPACE.							
INFILTRATION & INTERNAL GAINS			-0.06				-0.06	
	USE TOTAL FLOOR AREA OF CONDITIONED SPACE.							

TOTAL COMPONENT BASE WINTER POINTS		TOTAL COMPONENT AS-BUILT WINTER POINTS	

	Base Heating System Multiplier X	Total Base Winter Points =	BASE HEATING POINTS	TOTAL AS-BUILT WIN. PTS. X	As-Built DM (6A-17) X	As-Built DSM (6A-20) X	As Built AHU (6A-16) X	As Built HSM (6A-18) X	As Built HCM (6A-21) =	AS-BUILT HEATING POINTS
HEATING SYSTEM	.554					1.14 or 1.0				

TOTAL	BASE COOLING POINTS (From P. 2) +	BASE HEATING POINTS +	BASE HOT WATER POINTS (From P. 2) X	0.85 =	TOTAL BASE POINTS (Enter on P. 1)	AS-BUILT COOLING POINTS (From P. 2) +	AS-BUILT HEATING POINTS +	AS-BUILT HOT WATER POINTS (From P. 2) =	TOTAL AS-BUILT POINTS (Enter on P. 1)

[1]H = HORIZONTAL GLASS (SKYLIGHTS)

[2] FOR GLASS WITH KNOWN SHGC, SEE SECTION 2.1.1 of APPENDIX G-C of the *FBC, Residential.* TINT MULTIPLIERS MAY BE USED FOR GLASS WITH SOLAR SCREENS, FILM, OR TINT.

[3]MUST MEET CRITERIA OF APPENDIX G-C4.2.1.5 of the *FBC, Residential.*

WINTER POINT MULTIPLIERS (WPM)

CLIMATE ZONES 7 8 9 *

6A-10 WINTER OVERHANG FACTORS (WOF)

SELECT BY OR

OH Ratio	.00-.11	.12-.17	.18-.26	.27-.35	.36-.46	.47-.57	.58-.70	.71-.83	.84-1.18	1.19-1.72	1.73-2.73	2.74 & up
North	1.00	0.998	0.995	0.991	0.986	0.982	0.977	0.973	0.969	0.962	0.955	0.984
Northeast	1.00	0.999	0.999	0.998	0.997	0.996	0.994	0.993	0.991	0.985	0.978	0.969
East	1.00	1.009	1.015	1.023	1.032	1.044	1.057	1.073	1.090	1.136	1.203	1.291
Southeast	1.00	1.017	1.027	1.046	1.067	1.097	1.130	1.171	1.215	1.333	1.485	1.647
South	1.00	0.994	1.001	1.024	1.060	1.115	1.174	1.238	1.290	1.376	1.425	1.443
Southwest	1.00	0.999	1.003	1.012	1.024	1.041	1.059	1.078	1.096	1.132	1.164	1.191
West	1.00	0.998	0.998	0.999	1.001	1.005	1.011	1.018	1.023	1.030	1.032	1.032
Northwest	1.00	0.997	0.995	0.992	0.989	0.985	0.982	0.978	0.974	0.967	0.959	0.952
OH Length	**0.0'**	**1.0'**	**1.5'**	**2.0'**	**3.0'**	**3.5'**	**4.5'**	**5.5'**	**6.5'**	**9.5'**	**14.0'**	**20.0'**

6A-11 WALL WINTER POINT MULTIPLIERS (WPM)

FRAME					CONCRETE BLOCK (NORMAL WT)				FACE BRICK				LOG		
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.	*R*-VALUE	WOOD FR	*R*-VALUE	BLOCK		6 INCH	8 INCH
R-VALUE	EXT	ADJ	EXT	ADJ	*R*-VALUE	EXT	ADJ	EXT	0-6.9	2.4	0-2.9	.9			
0-6.9	2.5	1.7	3.4	2.2	0-2.9	1.9	.7	1.9	7-10.9	.6	3-6.9	.6	*R*-VALUE	EXT	EXT
7-10.9	.8	.6	1.5	1.0	3-4.9	1.2	.5	.6	11-18.9	.5	7-9.9	.4	0-2.9	.6	.2
11-12.9	.6	.5	1.1	0.8	5-6.9	.9	.4	.3	19-25.9	.2	10 & UP	.2	3-6.9	.3	.1
13-18.9	.6	.5	1.0	0.7	7-10.9	.7	.4	.2	26 & UP	.1			7 & UP	.2	.1
19-25.9	.3	.3	0.9	0.6	11-18.9	.4	.2	.0							
26 & UP	.2	.2	0.4	0.3	19-25.9	.2	.1								
					26 &UP	.1	.0								

6A-12 DOOR WINTER POINT MULTIPLIERS (WPM)

DOOR TYPE	EXTERIOR	ADJACENT
WOOD	2.8	1.9
INSULATED	1.8	1.3

6A-13 CEILING WINTER POINT MULTIPLIERS (WPM)

UNDER ATTIC		SINGLE ASSEMBLY		CONCRETE DECK ROOF		
R-VALUE	WPM	*R*-VALUE	WPM		CEILING TYPE	
19-21.9	.14	10-10.9	.16	*R*-VALUE	EXPOSED	DROPPED
22-25.9	.12	11-12.9	.15	10-13.9	0.18	0.16
26-29.9	.11	13-18.9	.14	14-20.9	0.13	0.12
30-37.9	.10	19-25.9	.11	21 & UP	0.09	0.08
38 & UP	.08	26-29.9	.09			
RBS Credit	0.850	30 & UP	.08			
IRCC Credit	0.899					
White Roof Credit	1.044					

6A-14 FLOOR WINTER POINT MULTIPLIERS (WPM)

SLAB-ON-GRADE EDGE INSULATION		RAISED CONCRETE		RAISED WOOD			
					POST OR PIER CONSTRUCTION	STEM WALL w/UNDER FLOOR INSULATION	ADJACENT
R-VALUE	WPM	*R*-VALUE	WPM	*R*-VALUE	WPM	WPM	WPM
0-2.9	-2.1	0-2.9	1.0	0-6.9	0.99	0.3	1.7
3-4.9	-2.6	3-4.9	.3	7-10.9	0.24	0	.6
5-6.9	-2.7	5-6.9	.1	11-18.9	0.12	0	.5
7 & UP	-2.7	7 & UP	0	19 & UP	-0.01	-.1	.3

6A-15 INFILTRATION & INTERNAL GAINS (WPM)

Air Infiltration	0.87
Internal Gains	-1.15
Infiltration/Internal Gains (Combined)	-0.28

6A-16 AIR HANDLER MULTIPLIERS (WPM)

Located in garage	1.00
Located in conditioned area	0.92
Located on exterior of building	1.09
Located in attic	1.11

6A-17 DUCT MULTIPLIERS (DM)

SUPPLY DUCTS IN:	DUCT R-VALUE	RETURN DUCTS In:				
		Unconditioned space	Attic/ RBS	Attic/ IRCC	Attic/ Cool roof	Conditioned space
Unconditioned Space	4.2	1.135	1.123	1.125	1.128	1.116
	6.0	1.099	1.091	1.092	1.094	1.085
	8.0	1.076	1.070	1.071	1.073	1.066
Attic/Radiant Barrier (RBS)	4.2	1.095	1.083	—	—	1.073
	6.0	1.072	1.063	—	—	1.056
	8.0	1.057	1.050	—	—	1.044
Attic/Interior Radiation Control Coatings (IRCC)	4.2	1.122	—	1.110	—	1.096
	6.0	1.091	—	1.083	—	1.072
	8.0	1.071	—	1.0565	—	1.056
Attic/Cool Roof	4.2	1.151	—	—	1.139	1.120
	6.0	1.111	—	—	1.102	1.088
	8.0	1.085	—	—	1.078	1.068
Conditioned Space	4.2	1.012	1.010	1.012	1.012	1.000
	6.0	1.009	1.008	1.009	1.009	1.000
	8.0	1.007	1.006	1.007	1.007	1.000

6A-18 HEATING SYSTEM MULTIPLIERS (HSM) All Climate Zones

SYSTEM TYPE		HEATING SYSTEM MULTIPLIERS (HSM)							
Central Heat Pump Units	HSPF	7.4-7.6	7.7-7.8	7.9-8.3	8.4-8.8	8.9-9.3	9.4-9.8	9.9-10.3	10.4-10.8
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
PTHP	COP	2.50-1.69	2.70-2.89	2.90-3.09	3.10-3.29	3.30-3.49	3.50-3.69	3.70-3.89	3.90-4.19
	HSM	.40	.37	.34	.32	.30	.29	.27	.26
Gas Heating	AFUE	.76-.77	.78	.79-.82	.83-.85	.86-.89	.90-.92	.93-.95	.96-.98
	HSM	.46	.44	.43	.41	.38	.36	.34	.33
Electric Strip	1.0								

*

ADDITIONAL TABLES

6A-19 COOLING CREDIT MULTIPLIERS

SYSTEM TYPE	Cooling credit multipliers (CCM)
Ceiling Fans	.95*
Cross Ventilation	.95*
Whole House Fan	.95*
Multizone	.95
Programmable Thermostat	.95

*Credit may be taken for only one system type concurrently.

6A-20 AIR DISTRIBUTION SYSTEM CREDIT MULTIPLIERS

TYPE CREDIT	Prescriptive requirements	Multiplier
Air-tight Duct Credit[1]	Appx G-C5.2.2.1.1	1.00
Factory-sealed AHU Credit[2]	Appx G-C5.2.2.1.2	0.95

[1]Duct Sealing Multiplier (DSM) shall be 1.15 (summer) or 1.16 (winter) unless Air-tight Duct Credit is demonstrated by test report.
[2]Multiply Factory-sealed AHU Credit by summer (Table 6A-7) or winter (Table 6A-16) AHU multiplier. Insert total in the "As Built AHU" box on page 2 or 4.

6A-21 HEATING CREDIT MULTIPLIERS (HCM)

SYSTEM TYPE		HEATING CREDIT MULTIPLIERS (HCM)
Programmable Thermostat	HCM	.95
Multizone	HCM	.95

6A-22 HOT WATER MULTIPLIERS (HWM)

SYSTEM TYPE									
Electric Resistance	EF	.80-.81	.82-.83	.84-.85	.86-.87	.88-.90	.91-.93	.94-.96	.97 &Up
	HWM	2606	2543	2482	2424	2369	2290	2218	2149
Gas Water Heating	EF	.54	.55	.56	.57	.58	.59	.60	.61
	HWM	2606	2543	2482	2424	2369	2290	2218	2149
	EF	.62-.63	.64-.65	.66-.70	.71-.75	.76-.80	.81-.83	.84-.86	.87 & Up
	HWM	2024	1912	1813	1500	1256	1032	910	805

6A-23 HOT WATER CREDIT MULTIPLIERS (HWCM)

SYSTEM TYPE		HOT WATER CREDIT MULTIPLIERS (HWCM)				
Heat Recovery Unit	With	Air Conditioner		Heat Pump		
	HWCM	.84		.78		
Add-on Dedicated Heat Pump (without tank)	EF	2.0-2.49	2.5-2.99	3.0-3.49	3.5 & Up	
	HWCM	.44	.35	.29	.25	
Add-on Solar Water Heater (without tank)	EF	1.0-1.9	2.0-2.9	3.0-3.9	4.0-4.9	5.0 & Up
	HWCM	.84	.42	.28	.21	.17

NOTE: An HWM must be used in conjunction with all HWCM. See Table 6A-22. EF Means Energy Factor.

6A-24 INFILTRATION REDUCTION COMPLIANCE CHECKLIST

COMPONENTS	SECTION	REQUIREMENTS FOR EACH PRACTICE	CHECK
Exterior Windows & Doors	N1106.AB.1.1	Max: 3 cfm/sq. ft. window area; .5cfm/sq. ft. door area.	
Exterior & Adjacent Walls	N1106.AB.1.2.1	Caulk, gasket, weatherstrip or seal between: windows/doors & frames, surrounding wall; foundation & wall sole or sill plate; joints between exterior wall panels at corners; utility penetrations; between wall panels & top/bottom plates; between walls & floor. EXCEPTION: Frame walls where a continous infiltration barrier is installed that extends from, and is sealed to, the foundation to the top plate.	
Floors	N1106.AB.1.2.2	Penetrations/openings >1/8″ sealed unless backed by truss or joint members. EXCEPTION: Frame floors where a continuous infiltration barrier is installed that is sealed to the perimeter, penetrations and seams.	
Ceilings	N1106.AB.1.2.3	Seal: Between walls & ceilings: penetrations of ceiling plane of top floor; around shafts, chases, soffits, chimneys, cabinets sealed to continuous air barrier; gaps in gyp board & top plate; attic access. EXCEPTION: Frame ceilings where a continuous infiltration barrier is installed that is sealed at the perimeter, at penetrations and seams.	
Recessed Lighting Fixtures	N1106.AB.1.2.4	Type IC rated with no penetrations, sealed; or Type IC or non-IC rated, installed inside a sealed box with 1/2″ clearance & 3″ from insulation; or Type IC rated with <2.0 cfm from conditioned space, tested.	
Multiple Story Houses	N1106.AB.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Additional Infiltration reqts	N1106.AB.1.3	Exhaust fans vented to outdoors, dampers; combustion space heaters comply with NFPA, have combustion air.	

6A-25 OTHER PRESCRIPTIVE MEASURES (must be met or exceeded by all residences.)

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Water Heaters	N1112.AB.3	Comply with efficiency requirements in Table N1112.AB.3. Switch or clearly marked circuit breaker (electric) or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.AB.2.3	Spas & heated pools must have covers (except solar heated). Non-commercial pools must have a pump timer. Gas spa & pool heaters must have a minimum thermal efficiency of 78%.	
Shower Heads	N1112.AB.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 PSIG.	
Air Distribution Systems	N1110.AB	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated, and installed in accordance with the criteria of Section N1110. Ducts in unconditioned attics: R-6 minimum insulation.	
HVAC Controls	N1107.AB.2	Separate readily accessible manual or automatic thermostat for each system.	
Insulation	N1104.AB.1 N1102.B.1.1	Ceilings–Min. R-19. Common walls–Frame R-11 or CBS R-3 both sides. Common ceiling & floors R-11.	

Effective March 1, 2009

FLORIDA ENERGY EFFICIENCY CODE FOR BUILDING CONSTRUCTION

FORM 1100B-08 **Residential Component Prescriptive Method B** **ALL CLIMATE ZONES**

Compliance with Method B of Chapter 11 of the *Florida Building Code, Residential*, or Subchapter 13-6 of the *Florida Building Code, Building*, may be demonstrated by the use of Form 1100B for single-and multiple-family residences of three stories or less in height, additions to existing residential buildings, renovations to existing residential buildings, new heating, cooling, and water heating systems in existing buildings, and site-added components of manufactured homes and manufactured buildings.To comply, a building must meet or exceed all of the energy efficiency requirements on Table 11B-1 and all applicable mandatory requirements summarized in Table 11B-2 of this form. If a building does not comply with this method, it may still comply under Method A of Chapter 11 or Subchapter 13-6 of the applicable code.

PROJECT NAME: AND ADDRESS:		**BUILDER:**	
		PERMITTING OFFICE:	
OWNER:		**PERMIT NO.:**	**JURISDICTION NO.:**

1. New construction including additions which incorporate any of the following features cannot comply using this method: skylights or other nonvertical roof glass, glass areas in excess of 16 percent of conditioned floor area, and electric resistance heat (See Notes to Table 11B-1 on page 2).
2. Fill in all the applicable spaces of the "To Be Installed" column on "Table 11B-1 with the information requested. All "To Be Installed" values must be equal to or more efficient than the required levels.
3. Complete page 1 based on the "To Be Installed" column information.
4. Read "Minimum Requirements for All Packages", Table 11B-2 and check each box to indicate your intent to comply with all applicable items.
5. Read, sign and date the "Prepared By" certification statement at the bottom of page 1. The owner or owner's agent must also sign and date the form.

	Please Print	CK
1. New construction, addition, or existing building	**1.** _____	_____
2. Single-family detached or multiple-family attached	**2.** _____	_____
3. If multiple-family–No. of units covered by this submission	**3.** _____	_____
4. Is this a worst case? (yes/no)	**4.** _____	_____
5. Conditioned floor area (sq. ft.)	**5.** _____	_____
6. Glass type and area:		
a. U-factor	**6a.** _____	_____
b. SHGC	**6b.** _____	_____
c. Glass area	**6c.** _____ sq. ft.	_____
7. Percentage of glass to floor area	**7.** _____ **%**	_____
8. Floor type, area or perimeter, and insulation:		
a. Slab-on-grade (*R*-value)	**8a. R =** _____ _____ lin. ft.	_____
b. Wood, raised (*R*-value)	**8b. R =** _____ _____ sq. ft.	_____
c. Wood, common (*R*-value)	**8c. R =** _____ _____ sq. ft.	_____
d. Concrete, raised (*R*-value)	**8d. R =** _____ _____ sq. ft.	_____
e. Concrete, common (*R*-value)	**8e. R =** _____ _____ sq. ft.	_____
9. Wall type, area and insulation:		
a. Exterior: 1. Masonry (Insulation R-value)	**9a-1. R =** _____ _____ sq. ft.	_____
2. Wood frame (Insulation *R*-value)	**9a-2. R =** _____ _____ sq. ft.	_____
b. Adjacent: 1. Masonry (Insulation *R*-value)	**9b-1. R =** _____ _____ sq. ft.	_____
2. Wood frame (Insulation *R*-value)	**9b-2. R =** _____ _____ sq. ft.	_____
10. Ceiling type, area and insulation:		
a. Under attic (Insulation *R*-value)	**10a. R =** _____ sq. ft. _____	_____
b. Single assembly (Insulation *R*-value)	**10b. R =** _____ _____ sq. ft.	_____
11. Air distribution system: Duct insulation, location	**11a. R =** _____ _____	_____
Test report required if duct in unconditioned space	**11b.Test report attached?** Yes No	
12. Cooling system:	**12a. Type:** _____	_____
(Types: central, room unit, package terminal A.C., gas, none)	**12b. SEER/EER:** _____	_____
	12c. Capacity: _____	_____
13. Heating system:	**13a. Type:** _____	_____
(Types: heat pump, elec. strip, nat. gas, LP-Gas, gas h.p., room or PTAC, none)	**13b. HSPF/COP/AFUE:** _____	_____
	13c. Capacity: _____	_____
14. Programmable thermostat installed on HVAC systems:	**14. Yes No**	
15. Hot water system:	**15a. Type:** _____	_____
(Types: elec., nat. gas, LP-gas, solar, heat rec., ded. heat pump, other, none)	**15b. EF:** _____	_____

I hereby certify that the plans and specifications covered by the calculation are in compliance with the Florida Energy Code.

PREPARED BY: _____ DATE: _____

I hereby certify that this building is in compliance with the Florida Energy Code:

OWNER AGENT: _____ DATE: _____

Review of plans and specifications covered by this calculation indicates compliance with the Florida Energy Code. Before construction is completed, this building will be inspected for compliance in accordance with Section 553.908, F.S.

BUILDING OFFICIAL: _____

DATE: _____

* **TABLE 11B-1** **MINIMUM REQUIREMENTS (See Note 1)** **All Climate Zones**

BUILDING COMPONENT	PERFORMANCE CRITERIA	INSTALLED VALUES:
Windows (see Note 2):	U-Factor = 0.65 SHGC = 0.35 % of CFA < = 16%	U-Factor = SHGC = % of CFA =
Exterior door type	Wood or insulated	Type:
Walls – Ext. and Adj. (see Note 3): Frame Mass (see Note 3) Interior of wall: Exterior of wall:	 R-13 R-6 R-4	 R-Value = R-Value = R-Value =
Electric resistance heat (See Note 10)	Not allowed	
Ceilings (see Notes 3 & 4)	R=30	R-Value =
Floors: Slab-on-grade Over unconditioned spaces (see Note 3)	No requirement R-13	R-Value =
Hot water systems (storage type) Electric (see Note 5): Gas fired (see Note 6):	 40 gal: EF = 0.92 50 gal: EF = 0.90 40 gal: EF = 0.59 50 gal: EF = 0.58	 Gallons = EF = Gallons = EF =
Air conditioning systems (see Note 7)	SEER = 13.0	SEER =
Heat pump systems (see Note 8)	SEER = 13.0 HSPF = 7.7	SEER = HSPF =
Gas furnaces	AFUE = 78%	AFUE =
Oil furnaces	AFUE = 78%	AFUE =
Programmable thermostat (see Note 10)	Must be installed on all HVAC systems.	Installed? Yes No
Ductwork: (see Note 9) Unconditioned space[9] Conditioned space Unvented attic assembly per R806.4 with insulation at the roof plane	 R-6, TESTED NA R-4.2	Location: Unconditioned space R-Value = Test report: Conditioned space R-Value = (No test report required)
Air Handler location: Unconditioned attic[9] or garage Conditioned space or Unvented attic assembly per R806.4 with insulation at the roof plane	 Requires test report No duct test required	 Location: Test report:

(1) Each component present in the As-Built home must meet or exceed each of the applicable performance criteria in order to comply with this code using this method; otherwise Method A compliance must be used.

** (2) Windows and doors qualifying as glazed fenestration areas must comply with both the maximum *U*-Factor and the maximum SHGC (Solar Heat Gain Coefficient) criteria and have a maximum total window area equal to or less than 16% of the conditioned floor area (CFA), otherwise Method A must be used for compliance. **Exceptions:** 1. Additions of 600 square feet (56 m^2) or less may have maximum glass to CFA of 50 percent. 2. Renovations with new windows under ≥ 2 foot overhang whose lower edge does not extend further than 8 feet from the overhang may have tinted glazing or double-pane clear glazing. Replacement skylights installed in renovations shall be double paned or single paned with a diffuser.

(3) *R*-Values are for insulation material only as applied in accordance with manufacturers' installation instructions. For mass walls, the "interior of wall" requirement (R-6) must be met except if at least 50% of the R-4 insulation value required for the "exterior of wall" is installed exterior of, or integral to, the wall.

(4) Attic knee walls shall be insulated to same level as ceilings and shall have a positive means of maintaining insulation in place. Such means may include rigid insulation board or air barrier sheet materials adequately fastened to the attic sides of knee wall framing materials.

(5) For other electric storage volumes, minimum EF = 0.97 - (0.00132 * volume).

(6) For other natural gas storage volumes, minimum EF = 0.67 - (0.0019 * volume).

(7) For all conventional units with capacities greater than 30,000 Btu/hr. For Small-Duct, High-Velocity units, Space Constrained units, and units with capacities less than 30,000 Btu/hr see Table 13-607.AB.3.2 of the *Florida Building Code, Building*, or Table N1107.AB.3.2 of the *Florida Building Code, Residential.*

(8) For all conventional units with capacities greater than 30,000 Btu/hr. For Small-Duct, High-Velocity units, Space Constrained units, and units with capacities less than 30,000 Btu/hr see Table 13-607.AB.3.2B of the *Florida Building Code, Building*, or Table N1107.AB.3.2B of the *Florida Building Code, Residential.*

(9) All ducts and air handlers shall be either located in conditioned space or tested by a Class 1 BERS rater to be "substantially" leak free. "Substantially leak free" shall mean distribution system air leakage to outdoors no greater than 3 cfm per 100 square feet of conditioned floor area at a pressure differential of 25 Pascal (0.10 in. w.c.) across the

** entire air distribution system, including the manufacturer's air handler enclosure. **Exception:** New or replacement ducts installed onto an existing air distribution system as part of an addition or renovation. Such ducts shall either be insulated to R-6 or be installed in conditioned space.

** 10) The prohibition on electric resistance heat and the requirement for programmable thermostats do not apply to additions, renovations, and new heating systems installed in existing buildings.

TABLE 11B-2 MINIMUM REQUIREMENTS FOR ALL PACKAGES

COMPONENTS	SECTION	REQUIREMENTS	CHECK
Exterior Joints & Cracks	N1106.AB.1.2	To be caulked, gasketed, weather-stripped or otherwise sealed.	
Exterior Windows & Doors	N1106.AB.1.1	Max .3 cfm/sq.ft. window area; .5 cfm/sq.ft. door area.	
Sole & Top Plates	N1106.AB.1.2.1	Sole plates and penetrations through top plates of exterior walls must be sealed.	
Recessed Lighting	N1106.AB.1.2.4	Type IC rated with no penetrations (two alternatives allowed).	
Multistory Houses	N1106.AB.1.2.5	Air barrier on perimeter of floor cavity between floors.	
Exhaust Fans	N1106.AB.1.3	Exhaust fans vented to unconditioned space shall have dampers, except for combustion devices with integral exhaust ductwork.	
Water Heaters	N1112.AB.3	Comply with efficiency requirements in Table N1112.AB.3. Switch or clearly marked circuit breaker electric or cutoff (gas) must be provided. External or built-in heat trap required for vertical pipe risers.	
Swimming Pools & Spas	N1112.AB.2.3.4	Spas & heated pools must have covers (except solar heated). Noncommercial pools must have a pump timer. Gas spa & pool heaters must have minimum thermal efficiency of 78%. Heat pump pool heaters shall have a minimum COP of 4.0.	
Hot Water Pipes	N1112.AB.5	Insulation is required for hot water circulating systems (including heat recovery units).	
Shower Heads	N1112.AB.2.4	Water flow must be restricted to no more than 2.5 gallons per minute at 80 psig.	
HVAC Duct Construction, Insulation & Installation	N1110.AB	All ducts, fittings, mechanical equipment and plenum chambers shall be mechanically attached, sealed, insulated and installed in accordance with the criteria of Section N1110.AB. Ducts in attics must be insulated to a minimum of R-6.	
HVAC Controls	N1107.AB.2	Separate readily accessible manual or automatic thermostat for each system.	

FORM 1100D-08

DESUPERHEATER, HEAT RECOVERY UNIT (HRU) WATER HEATER EFFICIENCY CERTIFICATION

TESTS CONDUCTED IN ACCORDANCE WITH FLORIDA STANDARD FL-1

Laboratory:_____ Date of Test: _____

Report Approved By: _____ Report No: _____

Manufacturer: _____ Model No:_____

Construction Type: _____

Recommended for use with refrigeration system capacities of _____ tons.

Design Pressure: Water side _____ psig

Refrigerant side _____ psig

Test results at Standard Conditions:
Test refrigerant designation: _____
Tested at system capacity: _____ **Tons**
Total system hot gas superheat: _____ **Btu/h**
Total useful heat exchange effect:_ _____ **Btu/h**
Water pump input: _____ **Watts**

NET SUPERHEAT RECOVERY: _____ %

ENERGY PERFORMANCE LEVEL (EPL) DISPLAY CARD

ESTIMATED ENERGY PERFORMANCE INDEX* =
The lower the Energy Performance Index, the more efficient the home.

1.	New Home or addition	_____
2.	Single family or multiple family	_____
3.	Number of units, (if multi-family)	_____
4.	Number of bedrooms	_____
5.	Is this a worst case? (yes or no)	_____
6.	Conditioned floor area	_____ sq. ft.
7.	Glass type & area	
	a. U-Factor: _____	_____ sq. ft.
	(Or single or double Default)	_____ sq. ft.
	b. SHGC: _____	_____ sq. ft.
	(Or clear or tint Default)	_____ sq. ft.
8.	Floor types, Insulation level	
	a. Slab-on-grade, edge insulation	R=_____
	b. Wood, raised	R=_____
	c. Concrete, raised	R=_____
9.	Wall types, Insulation level	
	Exterior	
	a. Wood frame	R=_____
	b. Metal frame	R=_____
	c. Concrete block	R=_____
	d. Log	R=_____
	e. Other _____	R=_____
	Adjacent	
	a. Wood frame	R=_____
	b. Metal frame	R=_____
	c. Concrete block	R=_____
	d. Log	R=_____
	e. Other _____	R=_____
10.	Ceiling types, Insulation level	
	a. Under attic	R=_____
	b. Single assembly	R=_____
	c. Knee walls/skylight walls	R=_____
	d. Radiant barrier installed	R=_____
11.	Ducts, Location & Insulation Level	
	a. Supply ducts: _____	R=_____
	b. Return ducts: _____	R=_____
12.	Cooling systems	Capacity: _____
	a. Split system	SEER:_____
	b. Single package	SEER:_____
	c. Ground/water source	COP:_____
	d. Room unit	EER:_____
	e. PTAC	EER:_____
	f. Gas-driven	COP:_____
13.	Heating Systems	Capacity:_____
	a. Split system heat pump	HSPF:_____
	b. Single package heat pump	HSPF:_____
	c. Electric resistance	COP:_____
	d. Gas furnace, natural gas	AFUE:_____
	e. Gas furnace, LPG	AFUE:_____
	f. Gas-driven heat pump	Recov. EFF.: _____
14.	Water heating systems	
	a. Electric resistance	EF:_____
	b. Gas fired, natural gas	EF:_____
	c. Gas fired, LPG	EF:_____
	d. Solar System with tank	EF:_____
	e. Dedicated heat pump with tank	EF:_____
	f. Heat recovery unit	HeatRec%
	g. Other: _____	_____
15.	HVAC credits claimed (Alternate Point System Method only)	
	a. Ceiling fans	_____
	b. Cross ventilation	_____
	c. Whole house fan	_____
	d. Multizone cooling credit	_____
	e. Multizone heating credit	_____
	f. Programmable thermostat	_____

I certify that this home has complied with the Florida Energy Efficiency Code For Building through the above energy saving features which will be installed (or exceeded) in this home before final inspection. Otherwise, a new EPL Display Card will be completed based on installed Code compliant features.

Builder Signature: _____ **Date:** _____

Address of New Home: _____ **City/FL Zip** _____

**NOTE: The home's estimated Energy Performance Index is available through the EnergyGauge USA FLA/RES computer program. This is not a Building Energy Rating. If your index is below 100, your home may qualify for energy efficiency mortgage (EEM) incentives if you obtain a Florida Energy Gauge Rating. Contact the EnergyGauge Hotline at (321)638-1492 or see the EnergyGauge web site at www.energygauge.com for information and a list of certified Raters. For information about Florida's Energy Efficiency Code For Building Construction, contact the Department of Community Affairs at (850)487-1824.*

**Label required by Section 13-104.4.5 of the *Florida Building Code, Building*, or Section B2.1.1 of Appendix G of the *Florida Building Code, Residential*, if not DEFAULT.

APPENDIX 13-E
FLORIDA STANDARD NO. 1 (FL-1)
FLORIDA REGULATORY MODIFICATIONS TO AIR-CONDITIONING & REFRIGERATION INSTITUTE (ARI) STANDARD 470-80
Effective April 1, 1986

The following regulatory modifications made to the Air-Conditioning and Refrigeration Institute (ARI) Standard 470-80 shall constitute Florida Standard FL-1 and shall be accounted for in results testing performed on heat recovery units for which credit is claimed under Chapter 6 of the *Florida Energy Code for Building Construction.* All other criteria and conditions of ARI Standard 470-80 remain in effect. Testing to the Florida regulatory modifications shall not constitute testing to ARI Standard 470-80. ARI Standard 470-80 is hereby incorporated by reference.

SECTION 1
PURPOSE

1.1.1 This standard is ~~suggested as a guide for~~ to be used by the industry, including manufacturers, distributors, contractors, consulting engineers, and users of desuperheater/water heaters.

SECTION 2
SCOPE

2.1 Scope. This standard applies to desuperheater/water heaters ~~supplied as separate components, as defined in Section 3.1~~ for residential potable water heating.

~~2.2 Exclusion. This standard does not apply to desupereater/water heaters supplied as components of factory assembled refrigeration or air conditioning units.~~

SECTION 3
DEFINITIONS

3.1 Desuperheater/water heater. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such heat transfer relationship that the refrigerant vapor is desuper-heated and the water is heated. A water circulating pump may be included as part of the assembly.

3.2 Total useful heat exchange effect.

3.3 ~~Total Heat Exchange Effect. The total heat removed from the refrigerant in the heat exchanger. This is the sum of the useful heat exchange effect and the heat loss through the external surfaces of the heat exchanger to the ambient air.~~ Total system hot gas superheat. The total heat removal required to completely desuperheat the refrigerant discharge vapor. This value is the product of the mass flow of refrigerant and the difference in enthalpy between the refrigerant vapor entering the desuperheater and the vapor at saturation leaving the desuperheater.

SECTION 4
STANDARD EQUIPMENT AND ACCESSORIES

4.1 The following items shall be required as standard equipment:

6. Installation manual, including owners' operating and maintenance instructions.

SECTION 5
TESTING AND RATING REQUIREMENTS

5.1.1 Published ratings shall state all the pertinent operating conditions and shall include the following:

d. Total useful heat exchanger effect, Btuh(W)

i. Fouling factor (water side)
Net useful heat exchange effect expressed as percent of total hot gas superheat.

j. Total system hot gas superheat.

j. [j. becomes k.]

k. [k. Becomes l.]

Note 1: If a water circulating pump is included as part of the desuperheater assembly, as value of 2545 Btu/h (746 W) per rated horsepower shall be deducted from the useful heat exchange effect (d) to arrive at actual net useful heat exchange effect, Btu/h (W). If the pump motor is rated in watts (s), such value shall be used to determine Btu/h to be deducted. For systems with no water circulating pump, the net useful heat exchange effect is equal to the total useful heat exchange effect.

5.1.2 Published ratings may also include a nominal refrigerating system capacity. The nominal system capacity in tons shall be based ~~upon a total heat transfer effect in the desuperheater/water heater of 2000 Btuh (588 W) per ton of total system capacity at the 75 F(23.9°C) entering water temperature, air cooled conditions shown in Table 1.~~ on a refrigerant 22 mass flow rate of 180 pounds per hour (.02268 Kg/s) per ton, and shall be given for at least one of the standard rating groups shown in Table 1. It shall be identified as to air cooled or water cooled rating.

5.2 Standard ratings. Published ratings shall include the standard rating, given for at least one of the standard rating groups shown in Table 1 and properly identified as the standard rating. ~~Standard ratings shall include an allowance for fouling of the water side surface of 0.002 sq ft · hr · F/Btu (0.0036 m² · °C/W) for steel tubes or 0.001 sq ft · hr · F/Btu (0.00018m² · °C/W) for non ferrous tubes. Regrigerant side fouling is assumed to be 0.0000.~~ Standards ratings shall be cleaned ratings per 5.4.1.

5.3 Application ratings. Application ratings. Application ratings give performance data under operating conditions other than those shown in Table 1. A~~t least on set of application rat-~~

* ~~ings shall use the fouling factor as shown in 5.2.~~ Application ratings shall contain all information shown in Section 5.1.1, and such ratings shall be subject to the tolerances of this standard. The publication of application ratings is optional.

5.3.1 Published application ratings may also include ratings with other fouling factors or means for determining ratings with other fouling factors. If a manufacturer elects to publish application ratings with other fouling factors, these ratings shall be determined in accordance with methods described in Section 5.4.2 and 5.4.3 below. Fouling factors shall be specified.

5.3.2 Reserved. ~~The manufacturer shall provide published information as to the maximum recommended flow rate to minimize erosion.~~

SECTION 7
MARKING

7.1 Each desuperheater/water heater shall have the following minimum information shown in a conspicuous place:

e. Water pump h.p. (watts), volts, amps

SECTION 8
~~Voluntary~~ CONFORMANCE

8.1 Conformance. ~~While conformance with this standard is completely voluntary,~~ All equipment represented as being in accordance with this standard shall conform to all of the provisions thereof.

Table 1. **STANDARD RATING CONDITIONS**

APPENDIX A. METHOD OF TESTING DESUPERHEATER/WATER HEATERS

SECTION A2
SCOPE

A2.1 Scope. This appendix applies to desuperheater/water heaters ~~supplied as a separate component.~~ for residential potable water heating.

SECTION A3
DEFINITIONS

A3.1 Desuperheater/water heater. A factory-made assembly of elements by which the flows of refrigerant vapor and water are maintained in such a heat transfer relationship that the refrigerant vapor is desuperheated and the water is heated. A water circulating pump may be included as part of the assembly.

A3.2 Useful heat exchanger effect. The useful heat transferred shall be the product of the mass flow of water, the specific heat and the temperature difference between water ~~entering and leaving water~~ entering and leaving the desuperheater assembly.

A3.3 Total heat exchange effect. The total heat removed from the refrigerant in the heat exchanger. This is the sum of the useful heat exchange effect and the heat loss through the external surfaces of the heat exchanger to the ambient air. *

A3.4 Total system hot gas superheat. The total heat removal required to completely desuperheat the refrigerant discharge vapor. This value is the product of the mass flow of the refrigerant and the difference in enthalpy between the refrigerant vapor entering the desuperheater and the vapor at saturation leaving the desuperheater.

SECTION A4
EXPRESSION OF TEST RESULTS

A4.1.1 Test results shall be expressed in the following terms:

j. Refrigerant designation - R22

k. Useful heat exchange effect, percent of total system hot gas superheat, %.

l. Total system hot gas superheat, Btu/h.

SECTION A5
TEST METHODS

A5.1.1 Test shall consist of measurement of the following at specified conditions:

i. Water pump, watts

j. Total system hot gas superheat, Btu/h

A5.1.2 A5.1.2 The total useful heat transfer effect shall be determined by:

a. Multiplying the mass flow rate of water by the specific heat and temperature difference between entering and leaving water (total useful heat transfer effect) ~~and adding to this the heat lost by the refrigerant vapor though the external surfaces of the heat exchanger (see A5.1.6)~~.

b. Multiplying the mass flow rate of refrigerant by the enthalpy difference between entering and leaving refrigerant and adding to this the heat effect of the pump if included as part of the assembly (see NOTE 1, para. 5.1.1).

A5.1.6 Reserved. ~~The heat lost through the external surfaces of the heat exchanger to the ambient air shall be determined by:~~

~~$Q = \frac{A - t_m}{R}$~~

~~Where:~~

~~Q = heat loss though external surfaces, Btuh (W)~~

~~A = external surface area, sq ft (m^2)~~

~~t_m = log mean temperature difference, F(°C) calculated between entering and leaving refrigerant temperature and the average ambient air temperature)~~

~~$R = \frac{x + 1, \text{ hr ft}^2 \text{ F/Btu } (m^2 \cdot °C/W)}{k - hs}$~~

~~Where:~~

~~x = insulation thickness, ft (m)~~

~~k = thermal conductivity of insulation, Btu/hr ft F (W/m · °C)~~

CHAPTER 14
EXTERIOR WALLS

SECTION 1401
GENERAL

1401.1 Scope. The provisions of this chapter shall establish the minimum requirements for exterior walls, exterior wall coverings, exterior wall openings, exterior windows and doors, architectural trim, balconies and similar projections, and bay and oriel windows.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 1403.7 and 1408.

SECTION 1402
DEFINITIONS

1402.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

ADHERED MASONRY VENEER. Veneer secured and supported through the adhesion of an approved bonding material applied to an approved backing.

ANCHORED MASONRY VENEER. Veneer secured with approved mechanical fasteners to an approved backing.

BACKING. The wall or surface to which the veneer is secured.

EXTERIOR WALL. A wall, bearing or nonbearing, that is used as an enclosing wall for a building, other than a fire wall, and that has a slope of 60 degrees (1.05 rad) or greater with the horizontal plane.

EXTERIOR WALL COVERING. A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation or for aesthetics, including but not limited to, veneers, siding, exterior insulation and finish systems, architectural trim and embellishments such as cornices, soffits, facias, gutters and leaders.

EXTERIOR WALL ENVELOPE. A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

FIBER CEMENT SIDING. A manufactured, fiber-reinforcing product made with an inorganic hydraulic or calcium silicate binder formed by chemical reaction and reinforced with organic or inorganic nonasbestos fibers, or both. Additives that enhance manufacturing or product performance are permitted. Fiber cement siding products have either smooth or textured faces and are intended for exterior wall and related applications.

METAL COMPOSITE MATERIAL (MCM). A factory-manufactured panel consisting of metal skins bonded to both faces of a plastic core.

METAL COMPOSITE MATERIAL (MCM) SYSTEM. An exterior wall finish system fabricated using MCM in a specific assembly including joints, seams, attachments, substrate, framing and other details as appropriate to a particular design.

VENEER. A facing attached to a wall for the purpose of providing ornamentation, protection or insulation, but not counted as adding strength to the wall.

VINYL SIDING. A shaped material, made principally from rigid polyvinyl chloride (PVC), that is used as an exterior wall covering.

WATER-RESISTIVE BARRIER. A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.

SECTION 1403
PERFORMANCE REQUIREMENTS

1403.1 General. The provisions of this section shall apply to exterior walls, wall coverings and components thereof.

1403.2 Weather protection. Exterior walls shall provide the building with a weather-resistant exterior wall envelope. The exterior wall envelope shall include flashing, as described in Section 1405.3. The exterior wall envelope shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer, as described in Section 1404.2 and a means for draining water that enters the assembly to the exterior. All exterior finishes shall be applied in accordance with the manufacturer's specifications or installation instructions. Protection against condensation in the exterior wall assembly shall be provided in accordance with Chapter 13 of the *Florida Building Code, Building*.

Exceptions:

1. A weather-resistant exterior wall envelope shall not be required over concrete or nonporous masonry walls designed in accordance with Chapters 19 and 21, respectively.
2. Compliance with the requirements for a means of drainage, and the requirements of Sections 1405.2 and 1405.3, shall not be required for an exterior wall envelope that has been demonstrated through testing to resist wind-driven rain, including joints, penetrations and intersections with dissimilar materials, in accordance with ASTM E 331 under the following conditions:

   2.1. Exterior wall envelope test assemblies shall include at least one opening, one control joint, one wall/eave interface and one wall sill. All tested openings and penetrations shall be representative of the intended end-use configuration.

2.2. Exterior wall envelope test assemblies shall be at least 4 feet by 8 feet (1219 mm by 2438 mm) in size.

2.3. Exterior wall envelope assemblies shall be tested at a minimum differential pressure of 6.24 pounds per square foot (psf) (0.297 kN/m^2).

2.4. Exterior wall envelope assemblies shall be subjected to a minimum test exposure duration of 2 hours.

The exterior wall envelope design shall be considered to resist wind-driven rain where the results of testing indicate that water did not penetrate control joints in the exterior wall envelope, joints at the perimeter of openings or intersections of terminations with dissimilar materials.

1403.3 Structural. Exterior walls, and the associated openings, shall be designed and constructed to resist safely the superimposed loads required by Chapter 16.

1403.4 Fire resistance. Exterior walls shall be fire-resistance rated as required by other sections of this code with opening protection as required by Chapter 7.

1403.5 Flood resistance. This code specifically defers to the authority granted to local government by Title 44 CFR, Sections 59 and 60. This code is not intended to supplant or supercede local ordinances adopted pursuant to that authority, nor are local floodplain management ordinances to be deemed amendments to the code.

1403.6 Flood resistance for high-velocity wave action areas. Reserved.

1403.7 In order to provide for inspection for termite infestation, clearance between exterior wall coverings and final earth grade on the exterior of a building shall not be less than 6 inches (152 mm).

Exceptions:

1. Paint or decorative cementitious finish less than $^5/_8$ inch (17.1 mm) thick adhered directly to the masonry foundation sidewall.
2. Access or vehicle ramps which rise to the interior finish floor elevation for the width of such ramps only.
3. A 4-inch (102 mm) inspection space above patio and garage slabs and entry areas.
4. If the patio has been soil treated for termites, the finish elevation may match the building interior finish floor elevations on masonry construction only.
5. Masonry veneers.

1403.8 Drained wall assembly over mass wall assembly. Where wood frame or other types of drained wall assemblies are constructed above mass wall assemblies, flashing or other approved drainage system shall be installed as required by Section 1405.3.

SECTION 1404
MATERIALS

1404.1 General. Materials used for the construction of exterior walls shall comply with the provisions of this section. Materials not prescribed herein shall be permitted, provided that any such alternative has been approved.

1404.2 Water-resistive barrier. Exterior walls of frame construction receiving a veneer shall be provided with a water-resistive barrier. The water-resistive barrier shall be a minimum of one layer of No. 15 asphalt felt, complying with ASTM D 226 for Type 1 felt or other approved materials, shall be attached to the sheathing, with flashing as described in Section 1405.3, in such a manner as to provide a continuous water-resistive barrier behind the exterior wall veneer.

1404.2.1 Where cement plaster (stucco) is to be applied to lath over frame construction, measures shall be taken to prevent bonding between the cement plaster and the water resistive barrier. A bond break shall be provided between the water resistive barrier and the cement plaster (stucco) consisting of one of the following:

1. Two layers of an approved water-resistant barrier or
2. One layer of an approved water-resistant barrier over an approved plastic house wrap, or
3. Other approved methods or materials applied in accordance with the manufacturer's installation instructions.

1404.3 Wood. Exterior walls of wood construction shall be designed and constructed in accordance with Chapter 23.

1404.3.1 Basic hardboard. Basic hardboard shall conform to the requirements of AHA A135.4.

1404.3.2 Hardboard siding. Hardboard siding shall conform to the requirements of AHA A135.6 and, where used structurally, shall be so identified by the label of an approved agency.

1404.4 Masonry. Exterior walls of masonry construction shall be designed and constructed in accordance with this section and Chapter 21. Masonry units, mortar and metal accessories used in anchored and adhered veneer shall meet the physical requirements of Chapter 21. The backing of anchored and adhered veneer shall be of concrete, masonry, steel framing or wood framing.

1404.5 Metal. Exterior walls of formed steel construction, structural steel or lightweight metal alloys shall be designed in accordance with Chapters 22 and 20, respectively.

1404.5.1 Aluminum siding. Aluminum siding shall conform to the requirements of AAMA 1402.

1404.5.2 Cold-rolled copper. Copper shall conform to the requirements of ASTM B 370.

1404.5.3 Lead-coated copper. Lead-coated copper shall conform to the requirements of ASTM B 101.

1404.6 Concrete. Exterior walls of concrete construction shall be designed and constructed in accordance with Chapter 19.

CHAPTER 15
ROOF ASSEMBLIES AND ROOFTOP STRUCTURES

SECTION 1501
GENERAL

1501.1 Scope. The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Section 1503.6 and Sections 1512 through 1525.

SECTION 1502
DEFINITIONS

1502.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

AGGREGATE. In roofing, crushed stone, crushed slag or water-worn gravel used for surfacing for roof coverings.

BALLAST. In roofing, ballast comes in the form of large stones or paver systems or light-weight interlocking paver systems and is used to provide uplift resistance for roofing systems that are not adhered or mechanically attached to the roof deck.

BUILT-UP ROOF COVERING. Two or more layers of felt cemented together and surfaced with a cap sheet, mineral aggregate, smooth coating or similar surfacing material.

INTERLAYMENT. A layer of felt or nonbituminous saturated felt not less than 18 inches (457 mm) wide, shingled between each course of a wood-shake roof covering.

MECHANICAL EQUIPMENT SCREEN. A partially enclosed rooftop structure used to aesthetically conceal heating, ventilating and air conditioning (HVAC) electrical or mechanical equipment from view.

METAL ROOF PANEL. An interlocking metal sheet having a minimum installed weather exposure of 3 square feet (0.279 m^2) per sheet.

METAL ROOF SHINGLE. An interlocking metal sheet having an installed weather exposure less than 3 square feet (0.279 m^2) per sheet.

MODIFIED BITUMEN ROOF COVERING. One or more layers of polymer-modified asphalt sheets. The sheet materials shall be fully adhered or mechanically attached to the substrate or held in place with an approved ballast layer.

PENTHOUSE. An enclosed, unoccupied structure above the roof of a building, other than a tank, tower, spire, dome cupola or bulkhead, occupying not more than one-third of the roof area.

POSITIVE ROOF DRAINAGE. The drainage condition in which consideration has been made for all loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation.

REROOFING. The process of recovering or replacing an existing roof covering. See "Roof recover" and "Roof replacement."

ROOF ASSEMBLY. A system designed to provide weather protection and resistance to design loads. The system consists of a roof covering and roof deck or a single component serving as both the roof covering and the roof deck. A roof assembly includes the roof deck, vapor retarder, substrate or thermal barrier, insulation, vapor retarder and roof covering.

ROOF COVERING. The covering applied to the roof deck for weather resistance, fire classification or appearance.

ROOF COVERING SYSTEM. See "Roof assembly."

ROOF DECK. The flat or sloped surface not including its supporting members or vertical supports.

ROOF RECOVER. The process of installing an additional roof covering over a prepared existing roof covering without removing the existing roof covering.

ROOF REPAIR. Reconstruction or renewal of any part of an existing roof for the purposes of its maintenance.

ROOF REPLACEMENT. The process of removing the existing roof covering, repairing any damaged substrate and installing a new roof covering.

ROOF SECTION. A separation or division of a roof area by existing joints, parapet walls, flashing (excluding valleys), difference of elevation (excluding hips and ridges), roof type or legal description; not including the roof area required for a proper tie-off with an existing system.

ROOF VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, attics, cathedral ceilings or other enclosed spaces over which a roof assembly is installed.

ROOFTOP STRUCTURE. An enclosed structure on or above the roof of any part of a building.

SCUPPER. An opening in a wall or parapet that allows water to drain from a roof.

SINGLE-PLY MEMBRANE. A roofing membrane that is field applied using one layer of membrane material (either homogeneous or composite) rather than multiple layers.

UNDERLAYMENT. One or more layers of felt, sheathing paper, nonbituminous saturated felt or other approved material over which a steep-slope roof covering is applied.

SECTION 1503
WEATHER PROTECTION

1503.1 General. Roof decks shall be covered with approved roof coverings secured to the building or structure in accordance with the provisions of this chapter. Roof coverings shall be designed and installed in accordance with this code and the

approved manufacturer's instructions such that the roof covering shall serve to protect the building or structure.

1503.2 Flashing. Flashing shall be installed in such a manner so as to prevent moisture entering the wall and roof through joints in copings, through moisture-permeable materials and at intersections with parapet walls and other penetrations through the roof plane.

1503.2.1 Locations. Flashing shall be installed at wall and roof intersections, at gutters, wherever there is a change in roof slope or direction, and around roof openings.

Exception: Flashing is not required at hip and ridge junctions.

Where flashing is of metal, the metal shall be corrosion resistant with a thickness not less than provided in Table 1503.2.

TABLE 1503.2
METAL FLASHING MATERIAL

MATERIAL	MINIMUM THICKNESS (INCHES)	GAGE	WEIGHT (LBS PER SQ FT)
Copper			1 (16 oz)
Aluminum	0.024		
Stainless Steel		28	
Galvanized Steel	0.0179	26 (zinc coated G90)	
Aluminum Zinc Coated Steel	0.0179	26 (AZ50 Alum Zinc)	
Zinc Alloy	0.027		
Lead			2.5 (40 oz)
Painted Terne	----		1.25 (20 oz)

1503.3 Coping. Parapet walls shall be properly coped or sealed with noncombustible, weatherproof materials of a width no less than the thickness of the parapet wall. Metal coping shall comply with ANSI/SPRI ES-1 or RAS 111.

1503.4 Roof drainage. Unless roofs are sloped to drain over roof edges, design and installation of roof drainage systems shall comply with the *Florida Building Code, Plumbing* Chapter 11.

1503.4.1 Gutters. Gutters and leaders placed on the outside of buildings, other than Group R-3, private garages and buildings of Type V construction, shall be of noncombustible material or a minimum of Schedule 40 plastic pipe.

1503.4.2 Scupper. Where required for roof drainage, a scupper shall be placed level with the roof surface in a wall or parapet. The scupper shall be located as determined by the slope and the contributing area of the roof. The exterior facing or lining of a scupper, if metal, shall be the same as flashing material required by Sections 1503 through 1510 for the particular type of covering specified for the building. For other type materials, follow manufacturer's specifications.

1503.4.3 Overflow scuppers. When other means of drainage of overflow water is not provided, overflow scuppers shall be placed in walls or parapets not less than 2 inches (51 mm) nor more than 4 inches (102 mm) above the finished roof covering and shall be located as close as practical to required vertical leaders or downspouts or wall and parapet scuppers. An overflow scupper shall be sized in accordance with the *Florida Building Code, Plumbing*.

1503.5 Roof ventilation. Attic ventilation shall be provided in accordance with Section 1203.2 and the manufacturer's installation instructions.

1503.6 Protection against decay and termites. Condensate lines and roof downspouts shall discharge at least 1 foot (305 mm) away from the structure sidewall, whether by underground piping, tail extensions, or splash blocks. Gutters with downspouts are required on all buildings with eaves of less than 6 inches (152 mm) horizontal projection except for gable end rakes or on a roof above another roof.

SECTION 1504
PERFORMANCE REQUIREMENTS

1504.1 Wind resistance of roofs. Roof decks and roof coverings shall be designed for wind loads in accordance with Chapter 16 and Sections 1504.2, 1504.3 and 1504.4.

1504.1.1 Wind resistance of asphalt shingles. Asphalt shingles shall be designed for wind speeds in accordance with Section 1507.2.10.

1504.1.2 Reserved.

TABLE 1504.1.2
RESERVED

1504.2 Wind resistance of clay and concrete tile. Clay and concrete tile roof coverings shall be connected to the roof deck in accordance with Chapter 16.

1504.3 Wind resistance of nonballasted roofs. Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for cladding in Chapter 16.

1504.3.1 Other roof systems. Roof systems with built-up, modified bitumen, fully adhered or mechanically attached single-ply through fastened metal panel roof systems, and other types of membrane roof coverings shall also be tested in accordance with FM 4450, FM 4470, UL 580 or UL 1897.

1504.3.2 Metal panel roof systems. Metal panel roof systems through fastened or standing seam shall be tested in accordance with UL 580 or ASTM E 1592 or TAS 125.

Exception: Metal roofs constructed of cold-formed steel, where the roof deck acts as the roof covering and provides both weather protection and support for structural loads, shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2209.1.

1504.4 Ballasted low-slope roof systems. Ballasted low-slope (roof slope < 2:12) single-ply roof system coverings shall be designed in accordance with ANSI/SPRI RP-4.

1504.5 Edge securement for low-slope roofs. Low-slope membrane roof systems metal edge securement, except gutters, shall be designed and installed for wind loads in accor-

dance with Chapter 16 and tested for resistance in accordance with ANSI/SPRI ES-1 or RAS 111 except the basic wind speed shall be determined from Figure 1609.

1504.6 Physical properties. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall demonstrate physical integrity over the working life of the roof based upon 2,000 hours of exposure to accelerated weathering tests conducted in accordance with ASTM G 152, ASTM G 153, ASTM G 155 or ASTM G 154. Those roof coverings that are subject to cyclical flexural response due to wind loads shall not demonstrate any significant loss of tensile strength for unreinforced membranes or breaking strength for reinforced membranes when tested as herein required.

1504.7 Impact resistance. Roof coverings installed on low-slope roofs (roof slope < 2:12) in accordance with Section 1507 shall resist impact damage based on the results of tests conducted in accordance with ASTM D 3746, ASTM D 4272, CGSB 37-GP-52M or the "Resistance to Foot Traffic Test" in Section 5.5 of FM 4470. All structural metal roofing systems having a thickness equal to or greater than 22 gage and all nonstructural metal roof systems having a thickness equal to or greater than 26 gage shall be exempt from the tests listed above.

1504.8 Aggregate. Aggregate shall be permitted as roof surfacing when installed on slopes of 3:12 or less, not less than 400 pounds (182 kg) of roofing gravel or 300 pounds (145 kg) of slag per square shall be applied. A minimum of 50 percent of the total aggregate shall be embedded in the flood coat of bitumen or installed in accordance with its product approval. Aggregate shall be dry and free from dirt and shall be in compliance with the sizing requirements set forth in ASTM D 1863. A building official may request a test to confirm compliance with these requirements.

TABLE 1504.8
RESERVED

1504.9 Margin of safety. A margin of safety of 2:1 shall be applied to all wind uplift resistance test results except when a margin of safety is specified in the test standard.

Exception: Asphalt shingles testing resulting in a miles per hour rating as required in Section 1507.2.10.

SECTION 1505
FIRE CLASSIFICATION

1505.1 General. Roof assemblies shall be divided into the classes defined below. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E 108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D 2898. The minimum roof coverings installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

Exception: Skylights and sloped glazing that comply with Chapter 24 or Section 2610.

TABLE 1505.1[a,b]
MINIMUM ROOF COVERING CLASSIFICATION FOR TYPES OF CONSTRUCTION

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C[c]	B	C[c]	B	B	C[c]

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Unless otherwise required in accordance with the *International* Wildland-Urban Interface Code or due to the location of the building within a fire district in accordance with Appendix D.

b. Nonclassified roof coverings shall be permitted on buildings of Group R-3 and Group U occupancies, where there is a minimum fire-separation distance of 6 feet measured from the leading edge of the roof.

c. Buildings that are not more than two stories in height and having not more than 6,000 square feet of projected roof area and where there is a minimum 10-foot fire-separation distance from the leading edge of the roof to a lot line on all sides of the building, except for street fronts or public ways, shall be permitted to have roofs of No. 1 cedar or redwood shakes and No. 1 shingles.

1505.2 Class A roof assemblies. Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings or structures of all types of construction.

Exception: Class A roof assemblies include those with coverings of brick, masonry, slate, clay or concrete roof tile, exposed concrete roof deck, ferrous or copper shingles or panels.

1505.3 Class B roof assemblies. Class B roof assemblies are those that are effective against moderate fire-test exposure. Class B roof assemblies and roof coverings shall be listed and identified as Class B by an approved testing agency.

Exception: Class B roof assemblies include those with coverings of metal sheets and shingles.

1505.4 Class C roof assemblies. Class C roof assemblies are those that are effective against light fire-test exposure. Class C roof assemblies and roof coverings shall be listed and identified as Class C by an approved testing agency.

1505.5 Nonclassified roofing. Nonclassified roofing is approved material that is not listed as a Class A, B or C roof covering.

1505.6 Fire-retardant-treated wood shingles and shakes. Fire-retardant-treated wood shakes and shingles shall be treated by impregnation with chemicals by the full-cell vacuum-pressure process, in accordance with AWPA C1. Each bundle shall be marked to identify the manufactured unit and the manufacturer, and shall also be labeled to identify the classification of the material in accordance with the testing required in Section 1505.1, the treating company and the quality control agency.

1505.7 Special purpose roofs. Reserved.

SECTION 1506
MATERIALS

1506.1 Scope. The requirements set forth in this section shall apply to the application of roof-covering materials specified herein. Roof coverings shall be applied in accordance with this chapter and the manufacturer's installation instructions. Instal-

lation of roof coverings shall comply with the applicable provisions of Section 1507.

1506.2 Compatibility of materials. Roofs and roof coverings shall be of materials that are compatible with each other and with the building or structure to which the materials are applied.

1506.3 Material specifications and physical characteristics. Roof-covering materials shall conform to the applicable standards listed in this chapter. In the absence of applicable standards or where materials are of questionable suitability, testing by an approved agency shall be required by the building official to determine the character, quality and limitations of application of the materials.

1506.4 Product identification. Roof-covering materials shall be delivered in packages bearing the manufacturer's identifying marks and approved testing agency labels required in accordance with Section 1505. Bulk shipments of materials shall be accompanied with the same information issued in the form of a certificate or on a bill of lading by the manufacturer.

1506.5 Nails. Nails shall be corrosion resistant nails conforming to ASTM F 1667. The corrosion resistance shall meet ASTM A 641, Class 1 or an equal corrosion resistance by coating, electro galvanization, mechanical galvanization, hot dipped galvanization, stainless steel, nonferrous metal and alloys or other suitable corrosion resistant material.

1506.6 Screws. Wood screws shall conform to ANSI/ASME B 18.6.1. Screws shall be corrosion resistant by coating, galvanization, stainless steel, nonferrous metal or other suitable corrosion-resistant material. The corrosion resistance shall be demonstrated through one of the following methods:

1. Corrosion resistance equivalent to ASTM A 641, Class 1, or
2. Corrosion resistance in accordance with TAS 114, Appendix E, or
3. Corrosion resistant coating exhibiting not more than 5 percent red rust after 1,000 hours exposure in accordance with ASTM B 117.

1506.7 Clips. Clips shall be corrosion resistant clips. The corrosion resistance shall meet 0.90 oz per sq ft (0.458 kg/m^2) measured according to ASTM A 90/A 90M, TAS 114 Appendix E or an equal corrosion resistance coating, electro galvanization, mechanical galvanization, hot dipped galvanization, stainless steel, nonferrous metals and alloys or other suitable corrosion resistant material. Stainless steel clips shall conform to ASTM A 167, Type 304.

SECTION 1507
REQUIREMENTS FOR ROOF COVERING

1507.1 Scope. Roof coverings shall be applied in accordance with the applicable provisions of this section and the manufacturer's installation instructions.

1507.2 Asphalt shingles. The installation of asphalt shingles shall comply with the provisions of this section.

1507.2.1 Deck requirements. Asphalt shingles shall be fastened to solidly sheathed decks.

1507.2.2 Slope. Asphalt shingles shall only be used on roof slopes of two units vertical in 12 units horizontal (17-percent slope) or greater. For roof slopes from two units vertical in 12 units horizontal (17-percent slope) up to four units vertical in 12 units horizontal (33-percent slope), double underlayment application is required in accordance with Section 1507.2.8.

1507.2.3 Underlayment. Unless otherwise noted, required underlayment shall conform to ASTM D 226, Type I or Type II, or ASTM D 4869, Type I or Type II, or ASTM D 6757.

1507.2.4 Self-adhering polymer modified bitumen sheet. Self-adhering polymer modified bitumen sheet shall comply with ASTM D 1970.

1507.2.5 Asphalt shingles. Asphalt shingles shall have self-seal strips or be interlocking and comply with ASTM D 225 or ASTM D 3462. Shingles shall also comply with Section1507.2.10. Asphalt shingle packaging shall bear labeling indicating compliance with one of the required classifications as shown in Table 1507.2.10 or a listing by an approved testing agency in accordance with the requirements of Section 1609.5.2.

1507.2.6 Fasteners. Fasteners for asphalt shingles shall be galvanized, stainless steel, aluminum or copper roofing nails, minimum 12 gage [0.105 inch (2.67 mm)] shank with a minimum 0.375 inch-diameter (9.5 mm) head, of a length to penetrate through the roofing materials and a minimum of 0.75 inch (19.1 mm) into the roof sheathing. Where the roof sheathing is less than 0.75 inch (19.1 mm) thick, the nails shall penetrate through the sheathing. Fasteners shall comply with ASTM F 1667.

1507.2.6.1 The nail component of plastic cap nails shall meet the corrosion resistance requirements of 1507.2.6.

1507.2.7 Attachment. Asphalt shingles shall have the minimum number of fasteners required by the manufacturer and Section 1504.1. Asphalt shingles shall be secured to the roof with not less than four fasteners per strip shingle or two fasteners per individual shingle. Where the roof slope exceeds 21 units vertical in 12 units horizontal (21:12), asphalt shingles shall be installed in accordance with the manufacturer's printed installation instructions for steep-slope roof applications.

1507.2.8 Underlayment application. For roof slopes from two units vertical in 12 units horizontal (17-percent slope) and up to four units vertical in 12 units horizontal (33-percent slope), underlayment shall be two layers applied in the following manner. Apply a minimum 19-inch-wide (483 mm) strip of underlayment felt parallel with and starting at the eaves, fastened sufficiently to hold in place. Starting at the eave, apply 36-inch-wide (914 mm) sheets of underlayment overlapping successive sheets 19 inches (483 mm), by fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal. For roof slopes of four units vertical in 12 units horizontal (33-percent slope) or greater, underlayment shall be one layer applied in the following manner. Underlayment shall be applied shingle fashion, parallel to

and starting from the eave and lapped 2 inches (51 mm), fastened sufficiently to hold in place. Distortions in the underlayment shall not interfere with the ability of the shingles to seal.

1507.2.8.1 High wind attachment. Underlayment applied in areas subject to high winds (greater than 110 mph in accordance with Figure 1609) shall be applied with corrosion- resistant fasteners in accordance with the manufacturer's instructions. Fasteners are to be applied along the overlap at a maximum spacing of 36 inches (914 mm) on center.

1507.2.8.2 Ice dam membrane. Reserved.

1507.2.9 Flashings. Flashing for asphalt shingles shall comply with this section. Flashing shall be applied in accordance with this section and the asphalt shingle manufacturer's printed instructions.

1507.2.9.1 Base and counter flashing. Base and counter flashing shall be installed as follows:

1. In accordance with manufacturer's installation instructions, or
2. A continuous metal "L" flashing shall be set in approved flashing cement and set flush to base of wall and over the underlayment. Both horizontal and vertical metal flanges shall be fastened 6 inches (152 mm) on center with approved fasteners. All laps shall be a minimum of 4 inches (102 mm) fully sealed in approved flashing cement. Flashing shall start at the lower portion of roof to insure water-shedding capabilities of all metal laps. The entire edge of the horizontal flange shall be sealed covering all nail penetrations with approved flashing cement and membrane. Shingles will overlap the horizontal flange and shall be set in approved flashing cement.

Base flashing shall be of either corrosion resistant metal with a minimum thickness provided in Table 1503.2 or mineral surface roll roofing weighing a minimum of 77 pounds per 100 square feet (3.76 kg/m^2). Counter flashing shall be corrosion resistant metal with a minimum thickness provided in Table 1503.2.

1507.2.9.2 Valleys. Valley linings shall be installed in accordance with the manufacturer's instructions before applying shingles. Valley linings of the following types shall be permitted:

1. For open valleys lined with metal, the valley lining shall be at least 16 inches (406 mm) wide and of any of the corrosion-resistant metals in Table 1503.2.
2. For open valleys, valley lining of two plies of mineral-surfaced roll roofing complying with ASTM D 6380 Class M or ASTM D 3909 shall be permitted. The bottom layer shall be 18 inches (457 mm) and the top layer a minimum of 36 inches (914 mm) wide.
3. For closed valleys, valley lining of one ply of smooth roll roofing complying with ASTM D 6380 Class S and at least 36 inches (914 mm) wide or types as described in Items 1 or 2 above shall be permitted. Specialty underlayment complying with ASTM D 1970 may be used in lieu of the lining material.

Table 1507.2.9.2 Valley Lining Material. Reserved.

1507.2.9.3 Drip edge. Provide drip edge at eaves and gables of shingle roofs. Overlap to be a minimum of 2 inches (51 mm). Eave drip edges shall extend ½ inch (13 mm) below sheathing and extend back on the roof a minimum of 2 inches (51 mm). Drip edge at eaves shall be permitted to be installed either over or under the underlayment. If installed over the underlayment, there shall be a minimum 4 inches (51 mm) width of roof cement installed over the drip edge flange. Drip edge shall be mechanically fastened a maximum of 12 inches (305 mm) on center. Where the basic wind speed per Figure 1609 is 110 mph (177 km/h) or greater or the mean roof height exceeds 33 feet (10 058 mm), drip edges shall be mechanically fastened a maximum of 4 inches (102 mm) on center.

1507.2.9.4 Crickets or saddles. A cricket or saddle shall be installed on the ridge side of any chimney or penetration greater than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

Exception: Any penetration that allows water to flow around it shall not require a cricket or saddle.

1507.2.10 Wind Resistance of Asphalt Shingles. Asphalt Shingles shall be classified in accordance with ASTM D3161, TAS 107 or ASTM D7158 to resist the basic wind speed per Figure 1609. Shingles classified as ASTM D 3161 Class D or ASTM D 7158 Class G are acceptable for use in the 100-mph wind zone. Shingles classified as ASTM D3161 Class F, TAS107 or ASTM D 7158 Class H are acceptable for use in all wind zones. Asphalt shingle wrappers shall indicate compliance with one of the required classifications as shown in Table 1507.2.10.

TABLE 1507.2.10
WIND RESISTANCE OF ASPHALT SHINGLES

MAXIMUM BASIC WIND SPEED MPH (per Figure 1609)	CLASSIFICATION
100	ASTM D 3161 Class D or ASTM D 7158 Class G or TAS 107
110	ASTM D 3161 Class F or ASTM D 7158 Class G or TAS 107
120	ASTM D 3161 Class F or ASTM D 7158 Class G or TAS 107
130	ASTM D 3161 Class F or ASTM D 7158 Class H or TAS 107
140	ASTM D 3161 Class F or ASTM D 7158 Class H or TAS 107
150	ASTM D 3161 Class F or ASTM D 7158 Class H or TAS 107

1507.3 Clay and concrete tile. The installation of clay and concrete tile shall comply with the provisions of this section.

1507.3.1 Deck requirements. Concrete and clay tile shall be installed only over solid sheathing except where the roof covering is specifically designed and tested in accordance with Section 1609.5.2 to be applied over structural spaced sheathing boards.

1507.3.2 Deck slope. Clay and concrete roof tile shall be installed in accordance with the recommendations of FRSA/RTI 07320.

1507.3.3 Underlayment. Unless otherwise noted, required underlayment shall conform to: ASTM D 226, Type II; ASTM D 2626; ASTM D 1970 or ASTM D 6380 mineral-surfaced roll roofing. Underlayment shall be applied according to the tile manufacturer's installation instructions or the recommendations of the FRSA/TRI 07320.

1507.3.3.1 Slope and underlayment requirements. Refer to FRSA/TRI manual for underlayment and slope requirements for specific roof tile systems.

1507.3.3.2 High-slope roofs. Reserved.

1507.3.4 Clay tile. Clay roof tile shall comply with ASTM C 1167.

1507.3.5 Concrete tile. Concrete roof tile shall comply with ASTM C 1492.

1507.3.6 Fasteners. Tile fasteners shall be corrosion resistant and not less than 11 gage, $^{5}/_{16}$-inch (8.0 mm) head, and of sufficient length to penetrate the deck a minimum of 0.75 inch (19.1 mm) or through the thickness of the deck, whichever is less or in accordance with the FRSA/TRI 07320 manual. Attaching wire for clay or concrete tile shall not be smaller than 0.083 inch (2.1 mm).

1507.3.7 Attachment. Clay and concrete roof tiles shall be fastened in accordance with Section 1609 or in accordance with FRSA/TRI 07320 Installation Manual.

1507.3.8 Application. Tile shall be applied according to the manufacturer's installation instructions or recommendations of the FRSA/TRI 07320.

1507.3.9 Flashing. At the juncture of the roof vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions or the recommendations of the FRSA/TRI 07320 Manual.

1507.4 Metal roof panels. The installation of metal roof panels shall comply with the provisions of this section.

1507.4.1 Deck requirements. Metal roof panel roof coverings shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced supports.

1507.4.2 Deck slope. Minimum slopes for metal roof panels shall comply with the following:

1. The minimum slope for lapped, nonsoldered seam metal roofs without applied lap sealant shall be three units vertical in 12 units horizontal (25-percent slope).
2. The minimum slope for lapped, nonsoldered seam metal roofs with applied lap sealant shall be one-half unit vertical in 12 units horizontal (4-percent slope). Lap sealants shall be applied in accordance with the approved manufacturer's installation instructions.
3. The minimum slope for standing seam of roof systems shall be one-quarter unit vertical in 12 units horizontal (2-percent slope).

1507.4.3 Material standards. Metal-sheet roof covering systems that incorporate supporting structural members shall be designed in accordance with Chapter 22. Metal-sheet roof coverings installed over structural decking shall comply with Table 1507.4.3(1). The materials used for metal-sheet roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses shown in Table 1507.4.3(2).

TABLE 1507.4.3(2)
MINIMUM CORROSION RESISTANCE

55% Aluminum-Zinc Alloy Coated Steel	ASTM A 792 AZ 50
5% Aluminum Alloy-coated steel	ASTM A875 GF60
Aluminum-coated steel	ASTM A463 T2 65
Galvanized Steel	ASTM A 653 G-90
Prepainted Steel	ASTM A 755[a]

a. Paint systems in accordance with ASTM A 755 shall be applied over steel products with corrosion resistant coatings complying with ASTM A 792, ASTM A 875, ASTM A 463, or ASTM A 653.

1507.4.4 Attachment. Metal roof panels shall be secured to the supports in accordance with the approved manufacturer's fasteners. In the absence of manufacturer recommendations, the following fasteners shall be used:

1. Galvanized fasteners shall be used for steel roofs.
2. 300 series stainless-steel fasteners shall be used for copper roofs.

TABLE 1507.4.3(1)
METAL ROOF COVERINGS

ROOF COVERING TYPE	STANDARD	STANDARD APPLICATION RATE/THICKNESS
Aluminum	ASTM B 209	0.024 inch minimum thickness for roll-formed panels and 0.019 inch minimum thickness for press-formed shingles.
Aluminum-zinc coated steel	ASTM A 792	0.013 inch minimum thickness, AZ 50 (coated minimum application rate)
Cold-rolled copper	ASTM B 370	Minimum 16 oz/sq. ft. and 12 oz./sq. ft. high yield copper for metal-sheet roof covering systems: 12 oz/sq. ft. for preformed metal shingle systems.
Copper	ASTM B 370	16 oz./sq. ft. for metal-sheet roof-covering systems; 12 oz./sq. ft. for preformed metal shingle systems.
Galvanized steel	ASTM A 653	0.013 inch minimum thickness, G-90 zinc-coated[a].
Hard lead		2 lbs./sq. ft.
Lead-coated copper	ASTM B 101	
Prepainted steel	ASTM A 755	
Soft lead		3 lbs./sq. ft.
Stainless steel	ASTM A 240	300 Series Alloys
Steel	ASTM A 924/ A 924M	
Terne and terne-coated stainless		Terne coating of 40 lbs. per double base box, field painted where applicable in accordance with manufacturer's installation instructions.
Zinc		0.027 inch minimum thickness; 99.995% electrolytic high grade zinc with alloy additives of copper (0.08% - 0.20%), titanium (0.07% - 0.12%) and aluminum (0.015%).

For SI: 1 ounce per square foot = 0.0026 kg/m^2,
1 pound per square foot = 4.882 kg/m^2,
1 inch = 25.4 mm, 1 pound = 0.454 kg.

a. For Group U buildings, the minimum coating thickness for ASTM A 653 galvanized steel roofing shall be G-60.

3. Aluminum-zinc coated fasteners are acceptable for aluminum-zinc coated roofs.
4. Stainless-steel fasteners are acceptable for all types of metal roofs.

1507.4.5 Underlayment. Underlayment shall be installed as per manufacturer's installation guidelines.

1507.5 Metal roof shingles. The installation of metal roof shingles shall comply with the provisions of this section.

1507.5.1 Deck requirements. Metal roof shingles shall be applied to a solid or closely fitted deck, except where the roof covering is specifically designed to be applied to spaced sheathing.

1507.5.2 Deck slope. Metal roof shingles shall not be installed on roof slopes below three units vertical in 12 units horizontal (25-percent slope).

1507.5.2.1 Underlayment shall be installed as per manufacturer's installation guidelines.

Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 1970 or ASTM D 4869.

1507.5.4 Material standards. Metal roof shingle roof coverings shall comply with Table 1507.4.3(1). The materials used for metal-roof shingle roof coverings shall be naturally corrosion resistant or provided with corrosion resistance in accordance with the standards and minimum thicknesses specified in the standards listed in Table 1507.4.3(2).

1507.5.5 Attachment. Metal roof shingles shall be secured to the roof in accordance with the approved manufacturer's installation instructions.

1507.5.6 Flashing. Roof valley flashing shall be of corrosion-resistant metal of the same material as the roof covering or shall comply with the standards in Table 1507.4.3(1). The valley flashing shall extend at least 8 inches (203 mm) from the centerline each way and shall have a splash diverter rib not less than 0.75 inch (19.1 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm).

1507.6 Mineral-surfaced roll roofing. The installation of mineral-surfaced roll roofing shall comply with this section.

1507.6.1 Deck requirements. Mineral-surfaced roll roofing shall be fastened to solidly sheathed roofs.

1507.6.2 Deck slope. Mineral-surfaced roll roofing shall not be applied on roof slopes below one unit vertical in 12 units horizontal (8-percent slope).

1507.6.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or Type II or ASTM D 1970 or ASTM D 4869.

1507.6.4 Material standards. Mineral-surfaced roll roofing shall conform to ASTM D 6380 Class M or Class WS or ASTM D 3909.

1507.7 Slate shingles. The installation of slate shingles shall comply with the provisions of this section.

1507.7.1 Deck requirements. Slate shingles shall be fastened to solidly sheathed roofs.

1507.7.2 Deck slope. Slate shingles shall only be used on slopes of four units vertical in 12 units horizontal (4:12) or greater.

1507.7.3 Underlayment. Underlayment shall comply with ASTM D 226, Type II or ASTM D 4869, Type II.

1507.7.4 Material standards. Slate shingles shall comply with ASTM C 406.

1507.7.5 Application. Minimum headlap for slate shingles shall be in accordance with Table 1507.7.5. Slate shingles shall be secured to the roof with two fasteners per slate.

TABLE 1507.7.5
SLATE SHINGLE HEADLAP

SLOPE	HEADLAP (inches)
4:12 < slope < 8:12	4
8:12 < slope < 20:12	3
slope ≥ 20:12	2

For SI: 1 inch = 25.4 mm.

1507.7.6 Flashing. Flashing and counter flashing shall be made with sheet metal. Valley flashing shall be a minimum of 16 inches (381 mm) wide.Valley and flashing metal shall be a minimum thickness provided in Table 1503.2 nonferrous metal or stainless steel.

1507.8 Wood shingles. The installation of wood shingles shall comply with the provisions of this section and Table 1507.8.

1507.8.1 Deck requirements. Wood shingles shall be installed on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners.

1507.8.1.1 Solid sheathing required. Reserved.

1507.8.2 Deck slope. Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (25-percent slope) or greater.

1507.8.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869, Type I.

1507.8.4 Material standards. Wood shingles shall be of naturally durable wood and comply with the requirements of Table 1507.8.4.

TABLE 1507.8.4
WOOD SHINGLE MATERIAL REQUIREMENTS

MATERIAL	APPLICABLE MINIMUM GRADES	GRADING RULES
Wood shingles of naturally durable wood	1, 2 or 3	CSSB

CSSB = Cedar Shake and Shingle Bureau

1507.8.5 Attachment. Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 0.75 inch (19.1 mm) into the sheathing. For sheathing less than 0.5 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shingle shall be attached with a minimum of two fasteners.

TABLE 1507.8
WOOD SHINGLE AND SHAKE INSTALLATION

ROOF ITEM	WOOD SHINGLES	WOOD SHAKES
1. Roof slope	Wood shingles shall be installed on slopes of three units vertical in 12 units horizontal (3:12) or greater.	Wood shakes shall be installed on slopes of four units vertical in 12 units horizontal (4:12) or greater.
2. Deck requirement	—	—
Temperate climate	Shingles shall be applied to roofs with solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than $1'' \times 4''$ nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners.	Shakes shall be applied to roofs with solid or spaced sheathing.Where spaced sheathing is used, sheathing boards shall not be less than $1'' \times 4''$ nominal dimensions and shall be spaced on center equal to the weather exposure to coincide with the placement of fasteners. When $1'' \times 4''$ spaced sheathing is installed at 10 inches, boards must be installed between the sheathing boards.
3. Interlayment	No requirements.	Interlayment shall comply with ASTM D 226, Type 1.
4. Underlayment	—	—
Temperate climate	Underlayment shall comply with ASTM D 226, Type 1.	Underlayment shall comply with ASTM D 226, Type 1.
5. Application	—	—
Attachment	Fasteners for wood shingles shall be corrosion resistant with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.	Fasteners for wood shakes shall be corrosion resistant with a minimum penetration of 0.75 inch into the sheathing. For sheathing less than 0.5 inch thick, the fasteners shall extend through the sheathing.
No. of fasteners	Two per shingle.	Two per shake.
Exposure	Weather exposures shall not exceed those set forth in Table 1507.8.6	Weather exposures shall not exceed those set forth in Table 1507.9.7
Method	Shingles shall be laid with a side lap of not less than 1.5 inches between joints in courses, and no two joints in any three adjacent courses shall be in direct alignment. Spacing between shingles shall be 0.25 to 0.375 inch.	Shakes shall be laid with a side lap of not less than 1.5 inches between joints in adjacent courses. Spacing between shakes shall not be less than 0.375 inch or more than 0.625 inch for shakes and tapersawn shakes of naturally durable wood and shall be 0.25 to 0.375 inch for preservative taper sawn shakes.
Flashing	In accordance with Section 1507.8.7.	In accordance with Section 1507.9.8.

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

1507.8.6 Application. Wood shingles shall be laid with a side lap not less than 1.5 inches (38 mm) between joints in adjacent courses, and not be in direct alignment in alternate courses. Spacing between shingles shall be 0.25 to 0.375 inches (6.4 to 9.5 mm). Weather exposure for wood shingles shall not exceed that set in Table 1507.8.6.

TABLE 1507.8.6
WOOD SHINGLE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches)	
			3:12 pitch to < 4:12	4:12 pitch or steeper
Shingles of naturally durable wood	16	No. 1 No. 2 No. 3	3.75 3.5 3	5 4 3.5
	18	No. 1 No. 2 No. 3	4.25 4 3.5	5.5 4.5 4
	24	No. 1 No. 2 No. 3	5.75 5.5 5	7.5 6.5 5.5

For SI: 1 inch = 25.4 mm.

1507.8.7 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall comply with Table 1503.2. The valley flashing shall extend at least 11 inches (279 mm) from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of three units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) layer of underlayment running the full length of the valley, in addition to other required underlayment.

1507.9 Wood shakes. The installation of wood shakes shall comply with the provisions of this section and Table 1507.8.

1507.9.1 Deck requirements. Wood shakes shall only be used on solid or spaced sheathing. Where spaced sheathing is used, sheathing boards shall not be less than 1-inch by 4-inch (25 mm by 102 mm) nominal dimensions and shall be spaced on centers equal to the weather exposure to coincide with the placement of fasteners. Where 1-inch by 4-inch (25 mm by 102 mm) spaced sheathing is installed at 10 inches (254 mm) o.c., additional 1-inch by 4-inch (25 mm by 102 mm) boards shall be installed between the sheathing boards.

1507.9.1.1 Solid sheathing required. Reserved.

1507.9.2 Deck slope. Wood shakes shall only be used on slopes of three units vertical in 12 units horizontal (33-percent slope) or greater.

1507.9.3 Underlayment. Underlayment shall comply with ASTM D 226, Type I or ASTM D 4869, Type I.

1507.9.4 Interlayment. Interlayment shall comply with ASTM D 226, Type I.

1507.9.5 Material standards. Wood shakes shall comply with the requirements of Table 1507.9.5.

TABLE 1507.9.5
WOOD SHAKE MATERIAL REQUIREMENTS

MATERIAL	MINIMUM GRADES	APPLICABLE GRADING RULES
Wood shakes of naturally durable wood	1	CSSB
Taper sawn shakes of naturally durable wood	1 or 2	CSSB
Preservative-treated shakes and shingles of naturally durable wood	1	CSSB
Fire-retardant-treated shakes and shingles of naturally durable wood	1	CSSB
Preservative-treated taper sawn shakes of Southern pine treated in accordance with AWPA U1 (Commodity Specification A, Use Category 3B and Section 5.6)	1 or 2	TFS

CSSB = Cedar Shake and Shingle Bureau.
TFS = Forest Products Laboratory of the Texas Forest Services.

1507.9.6 Attachment. Fasteners or wood shakes shall be corrosion resistant with a minimum penetration of 0.75 inch (19.1 mm) into the sheathing. For sheathing less than 0.5 inch (12.7 mm) in thickness, the fasteners shall extend through the sheathing. Each shake shall be attached with a minimum of two fasteners.

1507.9.7 Application. Wood shakes shall be laid with a side lap not less than 1.5 inches (38 mm) between joints in adjacent courses. Spacing between shakes in the same course shall be 0.375 to 0.625 inches (9.5 to 15.9 mm) for shakes and taper sawn shakes of naturally durable wood and shall be 0.25 to 0.375 inch (6.4 to 9.5 mm) for preservative taper sawn shakes. Weather exposure for wood shakes shall not exceed those set in Table 1507.9.7.

TABLE 1507.9.7
WOOD SHAKE WEATHER EXPOSURE AND ROOF SLOPE

ROOFING MATERIAL	LENGTH (inches)	GRADE	EXPOSURE (inches) 4:12 PITCH OR STEEPER
Shakes of naturally durable wood	18 24	No. 1 No. 1	7.5 10[a]
Preservative-treated taper sawn shakes of Southern yellow pine	18 24	No. 1 No. 1	7.5 10
	18 24	No. 2 No. 2	5.5 7.5
Taper sawn shakes of naturally durable wood	18 24	No. 1 No. 1	7.5 10
	18 24	No. 2 No. 2	5.5 7.5

For SI: 1 inch = 25.4 mm.
a. For 24-inch by 0.375-inch handsplit shakes, the maximum exposure is 7.5 inches.

1507.9.8 Flashing. At the juncture of the roof and vertical surfaces, flashing and counterflashing shall be provided in accordance with the manufacturer's installation instructions, and where of metal, shall comply with Table 1503.2. The valley flashing shall extend at least 11 inches (279 mm)

from the centerline each way and have a splash diverter rib not less than 1 inch (25 mm) high at the flow line formed as part of the flashing. Sections of flashing shall have an end lap of not less than 4 inches (102 mm). For roof slopes of 3 units vertical in 12 units horizontal (25-percent slope) and over, the valley flashing shall have a 36-inch-wide (914 mm) layer of underlayment running the full length of the valley, in addition to other required underlayment.

1507.10 Built-up roofs. The installation of built-up roofs shall comply with the provisions of this section.

1507.10.1 Slope. Built-up roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage, except for coal-tar built-up roofs that shall have a design slope of a minimum one-eighth unit vertical in 12 units horizontal (1-percent slope).

1507.10.2 Material standards. Built-up roof covering materials shall comply with the standards in Table 1507.10.2.

1507.10.3 Red rosin paper. Red rosin paper shall be used when the membrane is applied directly to a wood deck or cementitious fiber decks.

1507.11 Modified bitumen roofing. The installation of modified bitumen roofing shall comply with the provisions of this section.

1507.11.1 Slope. Modified bitumen membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.11.2 Material standards. Modified bitumen roof coverings shall comply with CGSB 37-GP-56M, ASTM D 6162, ASTM D 6163, ASTM D 6164, ASTM D 6222, ASTM D 6223, ASTM D 6298 or ASTM D 6509.

1507.12 Thermoset single-ply roofing. The installation of thermoset single-ply roofing shall comply with the provisions of this section.

1507.12.1 Slope. Thermoset single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.12.2 Material standards. Thermoset single-ply roof coverings shall comply with ASTM D 4637, ASTM D 5019 or CGSB 37-GP-52M.

1507.13 Thermoplastic single-ply roofing. The installation of thermoplastic single-ply roofing shall comply with the provisions of this section.

1507.13.1 Slope. Thermoplastic single-ply membrane roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope).

1507.13.2 Material standards. Thermoplastic single-ply roof coverings shall comply with ASTM D 4434, ASTM D 6754, ASTM D 6878 or CGSB CAN/CGSB 37-54.

1507.14 Sprayed polyurethane foam roofing. The installation of sprayed polyurethane foam roofing shall comply with the provisions of this section.

TABLE 1507.10.2
BUILT-UP ROOFING MATERIAL STANDARDS

MATERIAL STANDARD	STANDARD
Acrylic coatings used in roofing	ASTM D 6083
Aggregate surfacing	ASTM D 1863
Asphalt adhesive used in roofing	ASTM D 3747
Asphalt cements used in roofing	ASTM D 3019; D 2822; D 4586
Asphalt-coated glass fiber base sheet	ASTM D 4601
Asphalt coatings used in roofing	ASTM D1227; D 2823; D 4479; ASTM D 2824
Asphalt glass felt	ASTM D 2178
Asphalt primer used in roofing	ASTM D 41
Asphalt-saturated and asphalt-coated organic felt base sheet	ASTM D 2626
Asphalt-saturated organic felt (perforated)	ASTM D 226
Asphalt used in roofing	ASTM D 312
Coal-tar cements used in roofing	ASTM D 4022; D 5643
Coal-tar saturated organic felt	ASTM D 227
Coal-tar pitch used in roofing	ASTM D 450; Type I or II
Coal-tar primer used in roofing, dampproofing and waterproofing	ASTM D 43
Glass mat, coal tar	ASTM D 4990
Glass mat, venting type	ASTM D 4897
Mineral-surfaced inorganic cap sheet	ASTM D 3909
Thermoplastic fabrics used in roofing	ASTM D 5665, D 5726

1507.14.1 Slope. Sprayed polyurethane foam roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope) for drainage.

1507.14.2 Material standards. Spray-applied polyurethane foam insulation shall comply with ASTM C 1029.

1507.14.3 Application. Foamed-in-place roof insulation shall be installed in accordance with the manufacturer's instructions. A liquid-applied protective coating that complies with Section 1507.15 shall be applied no less than 2 hours nor more than 72 hours following the application of the foam.

1507.14.4 Foam plastics. Foam plastic materials and installation shall comply with Chapter 26.

1507.15 Liquid-applied coatings. The installation of liquid-applied coatings shall comply with the provisions of this section.

1507.15.1 Slope. Liquid-applied roofs shall have a design slope of a minimum of one-fourth unit vertical in 12 units horizontal (2-percent slope).

1507.15.2 Material standards. Liquid-applied roof coatings shall comply with ASTM C 836, ASTM C 957, ASTM D 1227 or ASTM D 3468, ASTM D 6083 or ASTM D 6694.

SECTION 1508
ROOF INSULATION

1508.1 General. The use of above-deck thermal insulation shall be permitted provided such insulation is covered with an approved roof covering and passes the tests of FM 4450 or UL 1256 when tested as an assembly.

Exceptions:

1. Foam plastic roof insulation shall conform to the material and installation requirements of Chapter 26.
2. Where a concrete roof deck is used and the above-deck thermal insulation is covered with an approved roof covering.

1508.1.1 Cellulosic fiberboard. Cellulosic fiberboard roof insulation shall conform to the material and installation requirements of Chapter 23.

1508.2 Material standards. Above-deck thermal insulation board shall comply with the standards in Table 1508.2.

TABLE 1508.2
MATERIAL STANDARDS FOR ROOF INSULATION

Cellular glass board	ASTM C 552
Composite boards	ASTM C 1289, Type III, IV, V or VI
Expanded polystyrene	ASTM C 578
Extruded polystyrene board	ASTM C 578
Perlite board	ASTM C 728
Polyisocyanurate board	ASTM C 1289, Type I or Type II
Wood fiberboard	ASTM C 208

SECTION 1509
ROOFTOP STRUCTURES

1509.1 General. The provisions of this section shall govern the construction of rooftop structures.

1509.2 Penthouses. A penthouse or other projection above the roof in structures of other than Type I construction shall not exceed 28 feet (8534 mm) above the roof where used as an enclosure for tanks or for elevators that run to the roof and in all other cases shall not extend more than 18 feet (5486 mm) above the roof. The aggregate area of penthouses and other rooftop structures shall not exceed one-third the area of the supporting roof. A penthouse, bulkhead or any other similar projection above the roof shall not be used for purposes other than shelter of mechanical equipment or shelter of vertical shaft openings in the roof. Provisions such as louvers, louver blades or flashing shall be made to protect the mechanical equipment and the building interior from the elements. Penthouses or bulkheads used for purposes other than permitted by this section shall conform to the requirements of this code for an additional story. The restrictions of this section shall not prohibit the placing of wood flagpoles or similar structures on the roof of any building.

1509.2.1 Type of construction. Penthouses shall be constructed with walls, floors and roof as required for the building.

Exceptions:

1. On buildings of Type I and II construction, the exterior walls and roofs of penthouses with a fire separation distance of more than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be of at least 1-hour fire-resistance-rated noncombustible construction. Walls and roofs with a fire separation distance of 20 feet (6096 mm) or greater shall be of noncombustible construction. Interior framing and walls shall be of noncombustible construction.
2. On buildings of Type III, IV and V construction, the exterior walls of penthouses with a fire separation distance of more than 5 feet (1524 mm) and less than 20 feet (6096 mm) shall be at least 1-hour fire-resistance-rated construction. Walls with a fire separation distance of 20 feet (6096 mm) or greater from a common property line shall be of Type IV or noncombustible construction. Roofs shall be constructed of materials and fire-resistance rated as required in Table 601. Interior framing and walls shall be Type IV or noncombustible construction.
3. Unprotected noncombustible enclosures housing only mechanical equipment and located with a minimum fire separation distance of 20 feet (6096 mm) shall be permitted.
4. On one-story buildings, combustible unroofed mechanical equipment screens, fences or similar enclosures are permitted where located with a fire separation distance of at least 20 feet (6096 mm) from adjacent property lines and where not exceeding 4 feet (1219 mm) in height above the roof surface.
5. Dormers shall be of the same type of construction as the roof on which they are placed, or of the exterior walls of the building.

1509.3 Tanks. Tanks having a capacity of more than 500 gallons (2 m^3) placed in or on a building shall be supported on masonry, reinforced concrete, steel or Type IV construction provided that, where such supports are located in the building above the lowest story, the support shall be fire-resistance rated as required for Type IA construction.

1509.3.1 Valve. Such tanks shall have in the bottom or on the side near the bottom, a pipe or outlet, fitted with a suitable quick opening valve for discharging the contents in an emergency through an adequate drain.

1523.6.5.2.17 Roof tile adhesive used in adhesive set tiles systems. All roof tile adhesive used in adhesive set tile systems shall comply with the requirements set forth in TAS 110 and TAS 123. Physical properties shall be as follows:

1523.6.5.2.17.1 Tested for compressive strength in compliance with ASTM D 1621 with a minimum strength of 18 psi (121 kPa) parallel to rise, and 12 psi (82.7 kPa) perpendicular to rise.

1523.6.5.2.17.2 Tested for density in compliance with ASTM D 1622 with a minimum density of 1.6 lb/ft^3 (25.6 kg/m^3).

1523.6.5.2.17.3 Tested for tensile strength in compliance with ASTM D 1623 with a minimum requirement of 28 psi (193 kPa) parallel to rise.

1523.6.5.2.17.4 Tested for dimensional stability taken from a free rise sample specimen. Tested in compliance with ASTM D 2126 with a maximum volume change of +0.07 percent volume change at -40ºF (-40ºC) for two weeks; and +6.0 percent volume change at 158ºF (70ºC) and 100 percent RH for two weeks.

1523.6.5.2.17.5 Tested in compliance with ASTM D 2856 from a free rise sample specimen with a minimum requirement for 85 percent.

1523.6.5.2.17.6 Tested for water absorption in compliance with ASTM D 2842 with a maximum requirement of 10 percent.

1523.6.5.2.17.7 Tested in compliance with ASTM E 96 for moisture vapor transmission for a maximum of 3.1 perms.

SECTION 1524
HIGH-VELOCITY HURRICANE ZONES—REQUIRED OWNERS NOTIFICATION FOR ROOFING CONSIDERATIONS

1524.1 Scope. As it pertains to this section, it is the responsibility of the roofing contractor to provide the owner with the required roofing permit, and to explain to the owner the content of this section. The provisions of Chapter 15 of the *Florida Building Code, Building* govern the minimum requirements and standards of the industry for roofing system installations. Additionally, the following items should be addressed as part of the agreement between the owner and the contractor. The owner's initial in the designated space indicates that the item has been explained.

1. **Aesthetics-workmanship:** The workmanship provisions of Chapter 15 (High-Velocity Hurricane Zone) are for the purpose of providing that the roofing system meets the wind resistance and water intrusion performance standards. Aesthetics (appearance) are not a consideration with respect to workmanship provisions. Aesthetic issues such as color or architectural appearance, that are not part of a zoning code, should be addressed as part of the agreement between the owner and the contractor.
2. **Renailing wood decks:** When replacing roofing, the existing wood roof deck may have to be renailed in accordance with the current provisions of Chapter 16 (High-Velocity Hurricane Zones) of the *Florida Building Code, Building*. (The roof deck is usually concealed prior to removing the existing roof system.)
3. **Common roofs:** Common roofs are those which have no visible delineation between neighboring units (i.e., townhouses, condominiums, etc.). In buildings with common roofs, the roofing contractor and/or owner should notify the occupants of adjacent units of roofing work to be performed.
4. **Exposed ceilings:** Exposed, open beam ceilings are where the underside of the roof decking can be viewed from below. The owner may wish to maintain the architectural appearance; therefore, roofing nail penetrations of the underside of the decking may not be acceptable. The owner provides the option of maintaining this appearance.
5. **Ponding water:** The current roof system and/or deck of the building may not drain well and may cause water to pond (accumulate) in low-lying areas of the roof. Ponding can be an indication of structural distress and may require the review of a professional structural engineer. Ponding may shorten the life expectancy and performance of the new roofing system. Ponding conditions may not be evident until the original roofing system is removed. Ponding conditions should be corrected.
6. **Overflow scuppers (wall outlets):** It is required that rainwater flow off so that the roof is not overloaded from a buildup of water. Perimeter/edge walls or other roof extensions may block this discharge if overflow scuppers (wall outlets) are not provided. It may be necessary to install overflow scuppers in accordance with the requirements of: Chapter 15 and 16 herein and the *Florida Building Code, Plumbing.*
7. **Ventilation:** Most roof structures should have some ability to vent natural airflow through the interior of the structural assembly (the building itself). The existing amount of attic ventilation shall not be reduced.

Exception: Attic spaces, designed by a Florida-licensed engineer or registered architect to eliminate the attic venting, venting shall not be required.

_____ _____ _____

Owner's/Agent's Signature Date Contractor's Signature

SECTION 1525
HIGH-VELOCITY HURRICANE ZONES UNIFORM PERMIT APPLICATION

Florida Building Code Edition 2007
High-Velocity Hurricane Zone Uniform Permit Application Form.

INSTRUCTION PAGE

COMPLETE THE NECESSARY SECTIONS OF THE UNIFORM ROOFING PERMIT APPLICATION FORM AND ATTACH THE REQUIRED DOCUMENTS AS NOTED BELOW:

Roof System	Required Sections of the Permit Application Form	Attachments Required See List Below
Low Slope Application	A,B,C	1,2,3,4,5,6,7
Prescriptive BUR-RAS 150	A,B,C	4,5,6,7
Asphaltic Shingles	A,B,D	1,2,4,5,6,7
Concrete or Clay Tile	A,B,D,E	1,2,3,4,5,6,7
Metal Roofs	A,B,D	1,2,3,4,5,6,7
Wood Shingles and Shakes	A,B,D	1,2,4,5,6,7
Other	As Applicable	1,2,3,4,5,6,7

ATTACHMENTS REQUIRED:

1.	Fire Directory Listing Page
2.	From Product Approval: Front Page Specific System Description Specific System Limitations General Limitations Applicable Detail Drawings
3.	Design Calculations per Chapter 16, or If Applicable, RAS 127 or RAS 128
4.	Other Component of Product Approval
5.	Municipal Permit Application
6.	Owners Notification for Roofing Considerations (Reroofing Only)
7.	Any Required Roof Testing/Calculation Documentation

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High-Velocity Hurricane Zone Uniform Permit Application Form.

Section A (General Information)

Master Permit No._____ **Process No.** _____

Contractor's Name _____

Job Address_____

ROOF CATEGORY

☐ **Low Slope** ☐ **Mechanically Fastened Tile** ☐ **Mortar/Adhesive Set Tile**

☐ **Asphaltic Shingles** ☐ **Metal Panel/Shingles** ☐ **Wood Shingles/Shakes**

☐ **Prescriptive BUR-RAS 150**

ROOF TYPE

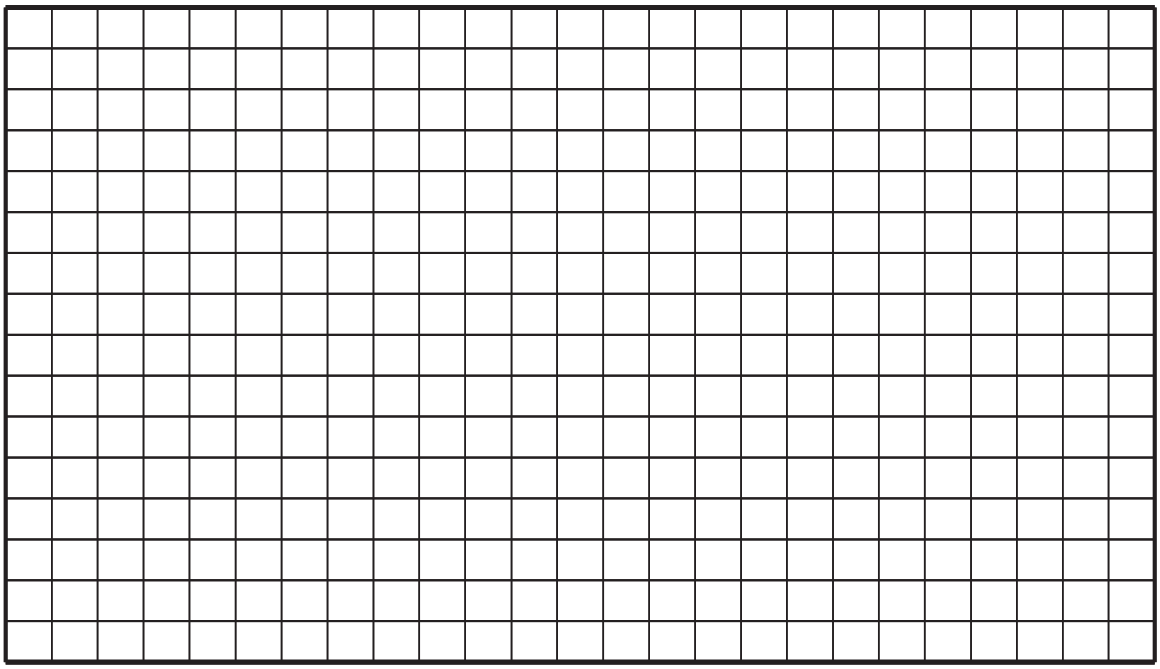
☐ **New Roof** ☐ **Reroofing** ☐ **Recovering** ☐ **Repair** ☐ **Maintenance**

ROOF SYSTEM INFORMATION

Low Slope Roof Area (SF) **Steep Sloped Roof Area (SF)** **Total (SF)**

Section B (Roof Plan)

Sketch Roof Plan: Illustrate all levels and sections, roof drains, scuppers, overflow scuppers and overflow drains. Include dimensions of sections and levels, clearly identify dimensions of elevated pressure zones and location of parapets.



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High-Velocity Hurricane Zone Uniform Permit Application Form.

Section C (Low Slope Application)

Fill in specific roof assembly components and identify manufacturer (If a component is not used, identify as "NA")

System Manufacturer:_____

Product Approval No.:_____

Design Wind Pressures, From RAS 128 or Calculations:

Pmax1:_____ **Pmax2:**_____ **Pmax3:**_____

Max. Design Pressure, from the specific Product Approval system:_____

Deck:

Type:_____

Gauge/Thickness:_____

Slope:_____

Anchor/Base Sheet & No. of Ply(s):_____

Anchor/Base Sheet Fastener/Bonding Material:

_____

Insulation Base Layer: _____

Base Insulation Size and Thickness: _____

Base Insulation Fastener/Bonding Material:

_____

Top Insulation Layer: _____

Top Insulation Size and Thickness: _____

Top Insulation Fastener/Bonding Material:

_____

Base Sheet(s) & No. of Ply(s): _____

Base Sheet Fastener/Bonding Material:

_____

Ply Sheet(s) & No. of Ply(s): _____

Ply Sheet Fastener/Bonding Material:

_____

Top Ply: _____

Top Ply Fastener/Bonding Material:

_____

Surfacing: _____

Fastener Spacing for Anchor/Base Sheet Attachment:

Field: ____" oc @ Lap, # Rows ____ @ ____" oc

Perimeter: ____" oc @ Lap, # Rows ___ @ ____" oc

Corner: ____" oc @ Lap, # Rows ____ @ ____" oc

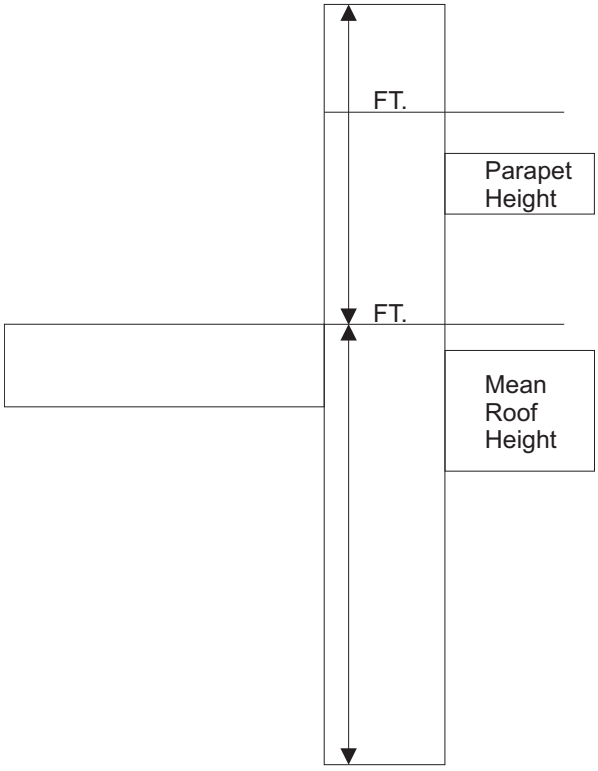
Number of Fasteners Per Insulation Board:

Field _____ **Perimeter** _____ **Corner** _____

Illustrate Components Noted and Details as Applicable:

Woodblocking, Gutter, Edge Termination, Stripping, Flashing, Continuous Cleat, Cant Strip, Base Flashing, Counter-Flashing, Coping, Etc.

Indicate: Mean Roof Height, Parapet Height, Height of Base Flashing, Component Material, Material Thickness, Fastener Type, Fastener Spacing or Submit



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High-Velocity Hurricane Zone Uniform Permit Application Form.

Section D (Steep Sloped Roof System)

Roof System Manufacturer:
_____

Notice of Acceptance Number:
_____

Minimum Design Wind Pressures, If Applicable (From RAS 127 or Calculations):
P1: _____ P2: _____ P3: _____

Steep Sloped Roof System Description

Roof Slope:
_____: 12

Ridge Ventilation?
_____

Mean Roof Height: _____

Deck Type:

Type Underlayment:

Insulation:

Fire Barrier:

Fastener Type & Spacing:

Adhesive Type:

Type Cap Sheet:

Roof Covering:

Type & Size Drip Edge:

Florida Building Code Edition 2007

High-Velocity Hurricane Zone Uniform Permit Application Form.

Section E (Tile Calculations)

For Moment based tile systems, choose either Method 1 or 2. Compare the values for M_r with the values from M_f. If the M_f values are greater than or equal to the M_r values, for each area of the roof, then the tile attachment method is acceptable.

Method 1 "Moment Based Tile Calculations Per RAS 127"

(P_1: _____ × λ _____ =_____) - Mg: _____ = M_{r1} _____ Product Approval M_f _____

(P_2: _____ × λ _____ =_____) - Mg: _____ = M_{r2} _____ Product Approval M_f _____

(P_3: _____ × λ _____ =_____) - Mg: _____ = M_{r3} _____ Product Approval M_f _____

Method 2 "Simplified Tile Calculations Per Table Below"

Required Moment of Resistance (Mr) From Table Below _____ Product Approval M_f _____

M_r required Moment Resistance*					
Mean Roof Height → Roof Slope ↓	**15'**	**20'**	**25'**	**30'**	**40'**
2:12	**34.4**	**36.5**	**38.2**	**39.7**	**42.2**
3:12	**32.2**	**34.4**	**36.0**	**37.4**	**39.8**
4:12	**30.4**	**32.2**	**33.8**	**35.1**	**37.3**
5:12	**28.4**	**30.1**	**31.6**	**32.8**	**34.9**
6:12	**26.4**	**28.0**	**29.4**	**30.5**	**32.4**
7:12	**24.4**	**25.9**	**27.1**	**28.2**	**30.0**

*Must be used in conjunction with a list of moment based tile systems endorsed by the Broward County Board of Rules and Appeals.

For Uplift based tile systems use Method 3. Compared the values for F' with the values for Fr. If the F' values are greater than or equal to the Fr values, for each area of the roof, then the tile attachment method is acceptable.

Method 3 "Moment Based Tile Calculations Per RAS 127"

(P_1: _____ × L _____ =_____ × w: = _____) - W: _____ × cos θ _____ = F_{r1} _____ Product Approval F′ _____

(P_2: _____ × L _____ =_____ × w: = _____) - W: _____ × cos θ _____ = F_{r2} _____ Product Approval F′ _____

(P_3: _____ × L _____ =_____ × w: = _____) - W: _____ × cos θ _____ = F_{r3} _____ Product Approval F′ _____

Where to Obtain Information		
Description	**Symbol**	**Where to find**
Design Pressure	P1 or P2 or P3	RAS 127 Table 1 or by an engineering analysis prepared by PE based on ASCE 7
Mean Roof Height	H	Job Site
Roof Slope	θ	Job Site
Aerodynamic Multiplier	λ	Product Approval
Restoring Moment due to Gravity	M_g	Product Approval
Attachment Resistance	M_f	Product Approval
Required Moment Resistance	M_g	Calculated
Minimum Attachment Resistance	F′	Product Approval
Required Uplift Resistance	Fr	Calculated
Average Tile Weight	W	Product Approval
Tile Dimensions	L = length W = width	Product Approval
All calculations must be submitted to the building official at the time of permit application.		

TABLE 1604.5
OCCUPANCY CATEGORY OF BUILDINGS AND OTHER STRUCTURES

OCCUPANCY CATEGORY	NATURE OF OCCUPANCY
I	Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to: • Agricultural facilities. • Certain temporary facilities. • Minor storage facilities. • Screen enclosures
II	Buildings and other structures except those listed in Occupancy Categories I, III and IV
III	Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to: • Covered structures whose primary occupancy is public assembly with an occupant load greater than 300. • Buildings and other structures with elementary school, secondary school or day care facilities with an occupant load greater than 250. • Buildings and other structures with an occupant load greater than 500 for colleges or adult education facilities. • Health care facilities with an occupant load of 50 or more resident patients, but not having surgery or emergency treatment facilities. • Jails and detention facilities. • Any other occupancy with an occupant load greater than 5,000. • Power-generating stations, water treatment for potable water, waste water treatment facilities and other public utility facilities not included in Occupancy Category IV. • Buildings and other structures not included in Occupancy Category IV containing sufficient quantities of toxic or explosive substances to be dangerous to the public if released.
IV	Buildings and other structures designated as essential facilities, including but not limited to: • Hospitals and other health care facilities having surgery or emergency treatment facilities. • Fire, rescue and police stations and emergency vehicle garages. • Designated hurricane or other emergency shelters. • Designated emergency preparedness, communication, and operation centers and other facilities required for emergency response. • Power-generating stations and other public utility facilities required as emergency backup facilities for Occupancy Category IV structures. • Structures containing highly toxic materials as defined by Section 307 where the quantity of the material exceeds the maximum allowable quantities of Table 307.1.(2). • Aviation control towers, air traffic control centers and emergency aircraft hangars. • Buildings and other structures having critical national defense functions. • Water treatment facilities required to maintain water pressure for fire suppression.

$1.2D + 1.6(L_r \text{ or } R) + (f_1 L \text{ or } 0.8W)$ **(Equation 16-3)**

$1.2D + 1.6W + f_1 L + 0.5(L_r \text{ or } R)$ **(Equation 16-4)**

$1.2D + f_1 L$ **(Equation 16-5)**

$0.9D + 1.6W + 1.6H$ **(Equation 16-6)**

$0.9D + 1.6H$ **(Equation 16-7)**

f_1 = 1 for floors in places of public assembly, for live load in excess of 100 pounds per square foot (4.79 kN/m^2), and for parking garage live load, and

= 0.5 for other live loads

Exception: Where other factored load combinations are specifically required by the provisions of this code, such combinations shall take precedence.

1605.2.2 Other loads. Where F_a is to be considered in the design, the load combinations of Section 2.3.3 of ASCE 7 shall be used.

1605.3 Load combinations using allowable stress design.

1605.3.1 Basic load combinations. Where allowable stress design (working stress design), as permitted by this code, is used, structures and portions thereof shall resist the most critical effects resulting from the following combinations of loads:

$D + F$ **(Equation 16-8)**

$D + H + F + \text{L} + T$ **(Equation 16-9)**

$D + H + F + (L_r \text{ or } R)$ **(Equation 16-10)**

$D + H + F + 0.75(L + T) + 0.75\,(L_r \text{ or } R)$ **(Equation 16-11)**

$D + H + F + (W)$ **(Equation 16-12)**

$D + H + F + 0.75(W) + 0.75L + 0.75\,(L_r \text{ or } R)$ **(Equation 16-13)**

$0.6D + W + H$ **(Equation 16-14)**

$0.6D + H$ **(Equation 16-15)**

Exception: Crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load.

1605.3.1.1 Load reduction.

1. Increases in allowable stress specified in the materials sections of this code or a referenced standard shall not be permitted to be used with load combinations of Sections 1605.3.1. Duration of load increase shall be permitted in accordance with Chapter 23.

   Exception: Increases in allowable stress shall be permitted in accordance with ACI 530/ASCE 5/TMS 402 provided the load reduction shall not be applied (see Section 1605.3.1).

2. Simultaneous use of both one-third increase in allowable stress and the 25 percent reduction in combined loads shall not be permitted.

1605.3.1.2 Other loads. Where F_a is to be considered in design, the load combinations of Section 2.4.2 of ASCE 7 shall be used.

1605.3.2 Alternative basic load combinations. In lieu of the basic load combinations specified in Section 1605.3.1, structures and portions thereof shall be permitted to be designed for the most critical effects resulting from the following combinations. When using these alternative basic load combinations that include wind loads, allowable stresses are permitted to be increased or load combinations reduced where permitted by the material chapter of this code or the referenced standards. For load combinations that include the counteracting effects of dead and wind loads, only two-thirds of the minimum dead load likely to be in place during a design wind event shall be used. Where wind loads are calculated in accordance with Chapter 6 of ASCE 7, the coefficient ω in the following equations shall be taken as 1.3. For other wind loads, ω shall be taken as 1. When using these alternative load combinations to evaluate sliding, overturning and soil bearing at the soil-structure interface, the reduction of foundation overturning from Section 12.13.4 in ASCE 7 shall not be used.

$D + L + (L_r \text{ or } R)$ **(Equation 16-16)**

$D + L + (\omega W)$ **(Equation 16-17)**

Equation 16-18. Reserved.

$D + L + \omega W/2$ **(Equation 16-19)**

$D + L$ **(Equation 16-20)**

$0.9D$ **(Equation 16-21)**

Exception: Crane hook loads need not be combined with roof live load or with more than three-fourths of the snow load or one-half of the wind load.

1605.3.2.1 Other loads. Where F, H or T are to be considered in the design, each applicable load shall be added to the combinations specified in Section 1605.3.2.

1605.4 Special seismic load combinations. Reserved.

1605.5 Heliports and helistops. Heliport and helistop landing areas shall be designed for the following loads, combined in accordance with Section 1605:

1. Dead load, D, plus the gross weight of the helicopter, Dh, plus snow load, S.
2. Dead load, D, plus two single concentrated impact loads, L, approximately 8 feet (2438 mm) apart applied anywhere on the landing area (representing the helicopter's two main landing gear, whether skid type or wheeled type), having a magnitude of 0.75 times the gross weight of the helicopter. Both loads acting together total one-and one half times the gross weight of the helicopter.

3. Dead load, *D*, plus a uniform live load, *L*, of 100 psf (4.79 kN/m^2).

   Exception: Landing areas designed for helicopters with gross weights not exceeding 3,000 pounds (13.34 kN) in accordance with Items 1 and 2 shall be permitted to be designed using a 40 psf (1.92 kN/m^2) uniform live load in Item 3, provided the landing area is identified with a 3,000 pound (13.34 kN) weight limitation. This 40 psf (1.92 kN/m^2) uniform live load shall not be reduced. The landing area weight limitation shall be indicated by the numeral "3" (kips) located in the bottom right corner of the landing area as viewed from the primary approach path. The landing area weight limitation shall be a minimum of 5 feet (1524 mm) in height.

SECTION 1606
DEAD LOADS

1606.1 General. Dead loads are those loads defined in Section 1602.1. Dead loads shall be considered permanent loads.

1606.2 Design dead load. For purposes of design, the actual weights of materials of construction and fixed service equipment shall be used. In the absence of definite information, values used shall be subject to the approval of the building official.

SECTION 1607
LIVE LOADS

1607.1 General. Live loads are those loads defined in Section 1602.1.

1607.2 Loads not specified. For occupancies or uses not designated in Table 1607.1, the live load shall be determined in accordance with a method approved by the building official.

1607.3 Uniform live loads. The live loads used in the design of buildings and other structures shall be the maximum loads expected by the intended use or occupancy but shall in no case be less than the minimum uniformly distributed unit loads required by Table 1607.1.

1607.4 Concentrated loads. Floors and other similar surfaces shall be designed to support the uniformly distributed live loads prescribed in Section 1607.3 or the concentrated load, in pounds (kilonewtons), given in Table 1607.1, whichever produces the greater load effects. Unless otherwise specified, the indicated concentration shall be assumed to be uniformly distributed over an area 2.5 feet by 2.5 feet [6.25 square feet (0.58 m^2)] and shall be located so as to produce the maximum load effects in the structural members.

1607.5 Partition loads. In office buildings and in other buildings where partition locations are subject to change, provisions for partition weight shall be made, whether or not partitions are shown on the construction documents, unless the specified live load exceeds 80 psf (3.83 kN/m^2). The partition load shall not be less than a uniformly distributed live load of 15 psf (0.74 kN/m^2).

1607.6 Truck and bus garages. Minimum live loads for garages having trucks or buses shall be as specified in Table 1607.6, but shall not be less than 50 psf (2.40 kN/m^2), unless other loads are specifically justified and approved by the building official. Actual loads shall be used where they are greater than the loads specified in the table.

TABLE 1607.6
UNIFORM AND CONCENTRATED LOADS

LOADING CLASS[a]	UNIFORM LOAD (pounds/linear foot of lane)	CONCENTRATED LOAD (pounds)[b]	
		For moment design	For shear design
H20-44 and HS20-44	640	18,000	26,000
H15-44 and HS15-44	480	13,500	19,500

For SI: 1 pound per linear foot = 0.01459 kN/m, 1 pound = 0.004448 kN, 1 ton = 8.90 kN.

a. An H loading class designates a two-axle truck with a semitrailer. An HS loading class designates a tractor truck with a semitrailer. The numbers following the letter classification indicate the gross weight in tons of the standard truck and the year the loadings were instituted.

b. See Section 1607.6.1 for the loading of multiple spans.

1607.6.1 Truck and bus garage live load application. The concentrated load and uniform load shall be uniformly distributed over a 10-foot (3048 mm) width on a line normal to the centerline of the lane placed within a 12-foot-wide (3658 mm) lane. The loads shall be placed within their individual lanes so as to produce the maximum stress in each structural member. Single spans shall be designed for the uniform load in Table 1607.6 and one simultaneous concentrated load positioned to produce the maximum effect. Multiple spans shall be designed for the uniform load in Table 1607.6 on the spans and two simultaneous concentrated loads in two spans positioned to produce the maximum negative moment effect. Multiple span design loads, for other effects, shall be the same as for single spans.

1607.7 Loads on handrails, guards, grab bars and vehicle barriers. Handrails, guards, grab bars as designed in Chapter 11 and vehicle barriers shall be designed and constructed to the structural loading conditions set forth in this section.

1607.7.1 Handrails and guards. Handrail assemblies and guards shall be designed to resist a load of 50 plf (0.73 kN/m) applied in any direction at the top and to transfer this load through the supports to the structure. Glass handrail assemblies and guards shall also comply with Section 2407.

Exceptions:

1. For one- and two-family dwellings, only the single concentrated load required by Section 1607.7.1.1 shall be applied.
2. In Group I-3, F, H and S occupancies, for areas that are not accessible to the general public and that have an occupant load less than 50, the minimum load shall be 20 pounds per foot (0.29 kN/m).

1607.7.1.1 Concentrated load. Handrail assemblies and guards shall be able to resist a single concentrated load of 200 pounds (0.89 kN), applied in any direction at any point along the top, and have attachment devices and supporting structure to transfer this loading to appropri-

TABLE 1607.1
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS AND MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
1. Apartments (see residential)	—	—
2. Access floor systems		
Office use	50	2,000
Computer use	100	2,000
3. Armories and drill rooms	150	—
4. Assembly areas and theaters		
Fixed seats (fastened to floor)	60	
Follow spot, projections and control rooms	50	—
Lobbies	100	
Movable seats	100	
Stages and platforms	125	
5. Balconies	100	
On one- and two-family residences only, and not exceeding 100 sq ft	60	—
6. Bowling alleys	75	—
7. Catwalks	40	300
8. Dance halls and ballrooms	100	—
9. Decks	Same as occupancy served[h]	—
10. Dining rooms and restaurants	100	—
11. Dwellings (see residential)	—	—
12. Cornices	60	—
13. Corridors, except as otherwise indicated	100	—
14. Elevator machine room grating (on area of 4 in^2)	—	300
15. Finish light floor plate construction (on area of 1 in^2)	—	200
	—	
16. Fire escapes	100	—
On single-family dwellings only	40	
17. Garages (passenger vehicles only)	40	Note a
Trucks and buses	See Section 1607.6	
18. Grandstands (see stadium and arena bleachers)	—	—
19. Gymnasiums, main floors and balconies	100	—
20. Handrails, guards and grab bars	See Section 1607.7	
21. Hospitals		
Corridors above first floor	80	1,000
Operating rooms, laboratories	60	1,000
Patient rooms	40	1,000
22. Hotels (see residential)	—	—

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
23. Libraries		
Corridors above first floor	80	1,000
Reading rooms	60	1,000
Stack rooms	150[b]	1,000
24. Manufacturing		
Heavy	250	3,000
Light	125	2,000
25. Marquees	75	—
26. Office buildings		
Corridors above first floor	80	2,000
File and computer rooms shall be designed for heavier loads based on anticipated occupancy	—	—
Lobbies and first-floor corridors	100	2,000
Offices	50	2,000
27. Penal institutions		
Cell blocks	40	—
Corridors	100	
28. Residential		
One- and two-family dwellings		
Uninhabitable attics without storage[i]	10	
Uninhabitable attics with limited storage[i, j, k]	20	
Habitable attics and sleeping areas	30	
All other areas except balconies and decks	40	—
Hotels and multiple-family dwellings		
Private rooms and corridors serving them	40	
Public rooms and corridors serving them	100	
29. Reviewing stands, grandstands and bleachers	Note c	
30. Roofs		
All roof surfaces subject to maintenance workers		300
Awnings and canopies		
Fabric construction supported by a lightweight rigid skeleton structure	5 nonreduceable	
All other construction	20	
Ordinary flat, pitched, and curved roofs	20	
Primary roof members, exposed to a work floor		
Single panel point of lower chord of roof trusses or any point along primary structural members supporting roofs:		
Over manufacturing, storage warehouses, and repair garages		2,000
All other occupancies		300
Roofs used for other special purposes	Note 1	Note 1
Roofs used for promenade purposes	60	
Roofs used for roof gardens or assembly purposes	100	

(continued)

TABLE 1607.1—continued
MINIMUM UNIFORMLY DISTRIBUTED LIVE LOADS AND MINIMUM CONCENTRATED LIVE LOADS[g]

OCCUPANCY OR USE	UNIFORM (psf)	CONCENTRATED (lbs.)
31. Schools		
Classrooms	40	1,000
Corridors above first floor	80	1,000
First-floor corridors	100	1,000
32. Scuttles, skylight ribs and accessible ceilings	—	200
33. Sidewalks, vehicular driveways and yards, subject to trucking	250d	8,000e
34. Skating rinks	100	—
35. Stadiums and arenas		
Bleachers	100c	—
Fixed seats (fastened to floor)	60c	
36. Stairs and exits		Note f
One- and two-family dwellings	40	
All other	100	
37. Storage warehouses (shall be designed for heavier loads if required for anticipated storage)		
Heavy	250	
Light	125	
38. Stores		
Retail		
First floor	100	1,000
Upper floors	75	1,000
Wholesale, all floors	125	1,000
39. Vehicle barriers	See Section 1607.7.3	
40. Walkways and elevated platforms (other than exitways)	60	—
41. Yards and terraces, pedestrians	100	—

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2, 1 square foot = 0.0929 m^2, 1 pound per square foot = 0.0479 kN/m^2, 1 pound = 0.004448 kN, 1 pound per cubic foot = 16 kg/m^3

a. Floors in garages or portions of buildings used for the storage of motor vehicles shall be designed for the uniformly distributed live loads of Table 1607.1 or the following concentrated loads: (1) for garages restricted to vehicles accommodating not more than nine passengers, 3,000 pounds acting on an area of 4.5 inches by 4.5 inches; (2) for mechanical parking structures without slab or deck which are used for storing passenger vehicles only, 2,250 pounds per wheel.

b. The loading applies to stack room floors that support nonmobile, double-faced library bookstacks, subject to the following limitations:
   1. The nominal bookstack unit height shall not exceed 90 inches;
   2. The nominal shelf depth shall not exceed 12 inches for each face; and
   3. Parallel rows of double-faced bookstacks shall be separated by aisles not less than 36 inches wide.

c. Design in accordance with the ICC Standard on Bleachers, Folding and Telescopic Seating and Grandstands.

d. Other uniform loads in accordance with an approved method which contains provisions for truck loadings shall also be considered where appropriate.

e. The concentrated wheel load shall be applied on an area of 20 square inches.

f. Minimum concentrated load on stair treads (on area of 4 square inches) is 300 pounds.

g. Reserved.

h. See Section 1604.8.3 for decks attached to exterior walls.

i. Attics without storage are those where the maximum clear height between the joist and rafter is less than 42 inches, or where there are not two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high by 2 feet wide, or greater, located within the plane of the truss. For attics without storage, this live load need not be assumed to act concurrently with any other live load requirements.

j. For attics with limited storage and constructed with trusses, this live load need be applied only to those portions of the bottom chord where there are two or more adjacent trusses with the same web configuration capable of containing a rectangle 42 inches high by 2 feet wide or greater, located within the plane of the truss. The rectangle shall fit between the top of the bottom chord and the bottom of any other truss member, provided that each of the following criteria is met:
   i. The attic area is accessible by a pull-down stairway or framed opening in accordance with Section 1209.2, and
   ii. The truss shall have a bottom chord pitch less than 2:12.
   iii. Bottom chords of trusses shall be designed for the greater of actual imposed dead load or 10 psf, uniformly distributed over the entire span.

k. Attic spaces served by a fixed stair shall be designed to support the minimum live load specified for habitable attics and sleeping rooms.

l. Roofs used for other special purposes shall be designed for appropriate loads as approved by the building official.

ate structural elements of the building. This load need not be assumed to act concurrently with the loads specified in the preceding paragraph.

1607.7.1.2 Components. Intermediate rails (all those except the handrail), balusters and panel fillers shall be designed to withstand a horizontally applied normal load of 50 pounds (0.22 kN) on an area equal to 1 square foot (0.093 m^2), including openings and space between rails. Reactions due to this loading are not required to be superimposed with those of Section 1607.7.1 or 1607.7.1.1.

1607.7.1.3 Stress increase. Where handrails and guards are designed in accordance with the provisions for allowable stress design (working stress design) exclusively for the loads specified in Section 1607.7.1, the allowable stress for the members and their attachments is permitted to be increased by one-third.

1607.7.2 Grab bars, shower seats and dressing room bench seats. Grab bars, shower seats and dressing room bench seat systems shall be designed to resist a single concentrated load of 250 pounds (1.11 kN) applied in any direction at any point.

1607.7.3 Vehicle barriers. Vehicle barrier systems for passenger cars shall be designed to resist a single load of 6,000 pounds (26.70 kN) applied horizontally in any direction to the barrier system and shall have anchorage or attachment capable of transmitting this load to the structure. For design of the system, the load shall be assumed to act at a minimum height of 1 foot, 6 inches (457 mm) above the floor or ramp surface on an area not to exceed 1 square foot (305 mm^2), and is not required to be assumed to act concurrently with any handrail or guard loadings specified in the preceding paragraphs of Section 1607.7.1. Garages accommodating trucks and buses shall be designed in accordance with an approved method that contains provision for traffic railings.

1607.8 Impact loads. The live loads specified in Section 1607.3 include allowance for impact conditions. Provisions shall be made in the structural design for uses and loads that involve unusual vibration and impact forces.

1607.8.1 Elevators. Elevator loads shall be increased by 100 percent for impact and the structural supports shall be designed within the limits of deflection prescribed by ASME A17.1.

1607.8.2 Machinery. For the purpose of design, the weight of machinery and moving loads shall be increased as follows to allow for impact: (1) elevator machinery, 100 percent; (2) light machinery, shaft- or motor-driven, 20 percent; (3) reciprocating machinery or power-driven units, 50 percent; (4) hangers for floors or balconies, 33 percent. Percentages shall be increased where specified by the manufacturer.

1607.9 Reduction in live loads. Except for roof uniform live loads, all other minimum uniformly distributed live loads, L_o, in Table 1607.1 are permitted to be reduced in accordance with Section 1607.9.1 or 1607.9.2.

1607.9.1 General. Subject to the limitations of Sections 1607.9.1.1 through 1607.9.1.4, members for which a value of $K_{LL}A_T$ is 400 square feet (37.16 m^2) or more are permitted to be designed for a reduced live load in accordance with the following equation:

$$L = L_o\left(0.25 + \frac{15}{\sqrt{K_{LL}A_T}}\right) \qquad \textbf{(Equation 16-24)}$$

For SI: $L = L_o\left(0.25 + \frac{4.57}{\sqrt{K_{LL}A_T}}\right)$

where:

L = Reduced design live load per square foot (meter) of area supported by the member.

L_o = Unreduced design live load per square foot (meter) of area supported by the member (see Table 1607.1).

K_{LL} = Live load element factor (see Table 1607.9.1).

A_T = Tributary area, in square feet (square meters).

L shall not be less than $0.50L_o$ for members supporting one floor and L shall not be less than $0.40L_o$ for members supporting two or more floors.

1607.9.1.1 Heavy live loads. Live loads that exceed 100 psf (4.79 kN/m^2) shall not be reduced.

Exceptions:

1. The live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than L as calculated in Section 1607.9.1.
2. For uses other than storage, where approved, additional live load reductions shall be permitted where shown by the registered design professional that a rational approach has been used and that such reductions are warranted.

TABLE 1607.9.1
LIVE LOAD ELEMENT FACTOR, K_{LL}

ELEMENT	K_{LL}
Interior columns	4
Exterior columns without cantilever slabs	4
Edge columns with cantilever slabs	3
Corner columns with cantilever slabs	2
Edge beams without cantilever slabs	2
Interior beams	2
All other members not identified above including: Edge beams with cantilever slabs Cantilever beams Two-way slabs Members without provisions for continuous shear transfer normal to their span	1

1607.9.1.2 Passenger vehicle garages. The live loads shall not be reduced in passenger vehicle garages except the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent, but the live load shall not be less than L as calculated in Section 1607.9.1.

1607.9.1.3 Special occupancies. Live loads of 100 psf (4.79 kN/m^2) or less shall not be reduced in public assembly occupancies.

1607.9.1.4 Special structural elements. Live loads shall not be reduced for one-way slabs except as permitted in Section 1607.9.1.1. Live loads of 100 psf (4.79 kN/m^2) or less shall not be reduced for roof members except as specified in Section 1607.11.2.

1607.9.2 Alternate floor live load reduction. As an alternative to Section 1607.9.1, floor live loads are permitted to be reduced in accordance with the following provisions. Such reductions shall apply to slab systems, beams, girders, columns, piers, walls and foundations.

1. A reduction shall not be permitted in Group A occupancies.
2. A reduction shall not be permitted where the live load exceeds 100 psf (4.79 kN/m^2) except that the design live load for members supporting two or more floors is permitted to be reduced by 20 percent.
3. A reduction shall not be permitted in passenger vehicle parking garages except that the live loads for members supporting two or more floors are permitted to be reduced by a maximum of 20 percent.
4. For live loads not exceeding 100 psf (4.79 kN/m^2), the design live load for any structural member supporting 150 square feet (13.94 m^2) or more is permitted to be reduced in accordance with the following equation:

$$R = 0.08\,(A - 150) \qquad \textbf{(Equation 16-25)}$$

For SI: $R = 0.861\,(A - 13.94)$

Such reduction shall not exceed the smallest of:

1. 40 percent for horizontal members;

2. 60 percent for vertical members; or

3. R as determined by the following equation.

$R = 23.1\,(1 + D/L_o)$ **(Equation 16-26)**

where:

A = Area of floor supported by the member, square feet (m^2).

D = Dead load per square foot (m^2) of area supported.

L_o = Unreduced live load per square foot (m^2) of area supported.

R = Reduction in percent.

1607.10 Distribution of floor loads. Where uniform floor live loads are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the floor live loads on spans selected to produce the greatest effect at each location under consideration. It shall be permitted to reduce floor live loads in accordance with Section 1607.9.

1607.11 Roof loads. The structural supports of roofs and marquees shall be designed to resist wind loads, in addition to the dead load of construction and the appropriate live loads as prescribed in this section, or as set forth in Table 1607.1. The live loads acting on a sloping surface shall be assumed to act vertically on the horizontal projection of that surface.

1607.11.1 Distribution of roof loads. Where uniform roof live loads are reduced to less than 20 psf (0.96 kN/m^2) in accordance with Section 1607.11.2.1 and are involved in the design of structural members arranged so as to create continuity, the minimum applied loads shall be the full dead loads on all spans in combination with the roof live loads on adjacent spans or on alternate spans, whichever produces the greatest effect. See Section 1607.11.2 for minimum roof live loads.

1607.11.2 Reduction in roof live loads. The minimum uniformly distributed roof live loads, L_o, in Table 1607.1 are permitted to be reduced according to the following provisions.

1607.11.2.1 Flat, pitched and curved roofs. Ordinary flat, pitched and curved roofs are permitted to be designed for a reduced roof live load as specified in the following equation or other controlling combinations of loads in Section 1605, whichever produces the greater load. In structures where special scaffolding is used as a work surface for workers and materials during maintenance and repair operations, a lower roof load than specified in the following equation shall not be used unless approved by the building official. Greenhouses shall be designed for a minimum roof live load of 12 psf (0.58 kN/m^2).

$L_r = L_o R_1 R_2$ **(Equation 16-27)**

where: $12 \le L_r \le 20$

For SI: $L_r = L_o R_1 R_2$

where: $0.58 \le L_r \le 0.96$

L_r = Reduced live load per square foot (m^2) of horizontal projection in pounds per square foot (kN/m^2).

The reduction factors R_1 and R_2 shall be determined as follows:

$R_1 = 1$ for $A_t \le 200$ square feet (18.58 m^2) **(Equation 16-28)**

$R_1 = 1.2 - 0.001A_t$ for 200 square feet $< A_t <$ 600 square feet **(Equation 16-29)**

For SI: $1.2 - 0.011A_t$ for 18.58 square meters $< A_t <$ 55.74 square meters

$R_1 = 0.6$ for $A_t > 600$ square feet (55.74 m^2) **(Equation 16-30)**

where:

A_t = Tributary area (span length multiplied by effective width) in square feet (m^2) supported by any structural member, and

$R_2 = 1$ for $F \le 4$ **(Equation 16-31)**

$R_2 = 1.2 - 0.05F$ for $4 < F < 12$ **(Equation 16-32)**

$R_2 = 0.6$ for $F \ge 12$ **(Equation 16-33)**

where:

F = For a sloped roof, the number of inches of rise per foot (for SI: $F = 0.12 \times$ slope, with slope expressed as a percentage), or for an arch or dome, the rise-to-span ratio multiplied by 32.

1607.11.2.2 Special-purpose roofs. Roofs used for promenade purposes, roof gardens, assembly purposes or other special purposes shall be designed for a minimum live load as required in Table 1607.1. Such roof live loads are permitted to be reduced in accordance with 1607.9.

1607.11.2.3 Landscaped roofs. Where roofs are to be landscaped, the uniform design live load in the landscaped area shall be 20 psf (0.958 kN/m^2). The weight of the landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil.

1607.11.2.4 Awnings and canopies. Awnings and canopies shall be designed for uniform live loads as required in Table 1607.1 as well as for wind loads as specified in Section 1609.

1607.12 Crane loads. The crane live load shall be the rated capacity of the crane. Design loads for the runway beams, including connections and support brackets, of moving bridge cranes and monorail cranes shall include the maximum wheel loads of the crane and the vertical impact, lateral and longitudinal forces induced by the moving crane.

1607.12.1 Maximum wheel load. The maximum wheel loads shall be the wheel loads produced by the weight of the bridge, as applicable, plus the sum of the rated capacity and the weight of the trolley with the trolley positioned on its

runway at the location where the resulting load effect is maximum.

1607.12.2 Vertical impact force. The maximum wheel loads of the crane shall be increased by the percentages shown below to determine the induced vertical impact or vibration force:

Monorail cranes (powered)	25 percent
Cab-operated or remotely operated bridge cranes (powered)	25 percent
Pendant-operated bridge cranes (powered)	10 percent
Bridge cranes or monorail cranes with hand-geared bridge, trolley and hoist	0 percent

1607.12.3 Lateral force. The lateral force on crane runway beams with electrically powered trolleys shall be calculated as 20 percent of the sum of the rated capacity of the crane and the weight of the hoist and trolley. The lateral force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction perpendicular to the beam, and shall be distributed according to the lateral stiffness of the runway beam and supporting structure.

1607.12.4 Longitudinal force. The longitudinal force on crane runway beams, except for bridge cranes with hand-geared bridges, shall be calculated as 10 percent of the maximum wheel loads of the crane. The longitudinal force shall be assumed to act horizontally at the traction surface of a runway beam, in either direction parallel to the beam.

1607.13 Interior walls and partitions. Interior walls and partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the loads to which they are subjected but not less than a horizontal load of 5 psf (0.240 kN/m^2).

Exception: Fabric partitions complying with Section 1607.13.1 shall not be required to resist the minimum horizontal load of 5 psf (0.24 kN/m^2).

1607.13.1 Fabric partitions. Fabric partitions that exceed 6 feet (1829 mm) in height, including their finish materials, shall have adequate strength to resist the following load conditions:

1. A horizontal distributed load of 5 psf (0.24 kN/m^2) applied to the partition framing. The total area used to determine the distributed load shall be the area of the fabric face between the framing members to which the fabric is attached. The total distributed load shall be uniformly applied to such framing members in proportion to the length of each member.
2. A concentrated load of 40 pounds (0.176 kN) applied to an 8-inch diameter (203 mm) area [50.3 square inches (32 452 mm^2)] of the fabric face at a height of 54 inches (1372 mm) above the floor.

SECTION 1608
SNOW LOADS
RESERVED

SECTION 1609
WIND LOADS

1609.1 Applications. Buildings, structures and parts thereof shall be designed to withstand the minimum wind loads prescribed herein. Decreases in wind loads shall not be made for the effect of shielding by other structures.

All exterior wall coverings and soffits shall be capable of resisting the design pressures specified for walls for components and cladding loads in accordance with Section 1609.1.1.

1609.1.1 Determination of wind loads. Wind loads on every building or structure shall be determined in accordance with Chapter 6 of ASCE 7. Wind shall be assumed to come from any horizontal direction and wind pressures shall be assumed to act normal to the surface considered.

Note: Clarification to ASCE 7. Arrows shown on Figure 6-10 of ASCE 7 indicate that the pressure coefficients apply specifically to "Direction of MWFRS being designed." This means that the longitudinal pressure coefficients are not applicable to trusses that span in the transverse direction and, therefore, uplift reactions for trusses that span in the transverse direction would be determined by the pressure coefficients associated with those shown for the transverse direction.

Exceptions:

1. Wind tunnel tests together with applicable section 6.4 of ASCE 7.
2. Subject to the limitations of Sections 1609.1.1.1, 1609.1.2, and 1609.3, the provisions of *IBHS Guideline for Hurricane Resistant Residential Construction* shall be permitted for applicable Group R-2 and R-3 buildings for a basic wind speed of 140 mph (63 m/s) or less in Exposure B in accordance with Figure 1609 and Section 1609.4. Provisions for design wind speeds of 140 mph (63 m/s) in the Guideline shall also be permitted for buildings for a basic wind speed of 120 mph (54 m/s) or less in Exposure C in accordance with Figure 1609 and Section 1609.4 and provisions for design wind speeds of 120 mph (54 m/s) in the Guideline shall be permitted for buildings for a basic wind speed of 100 mph (45 m/s) or less in Exposure C in accordance with Figure 1609 and Section 1609.4.
3. Subject to the limitations of Sections 1609.1.1.1, 1609.1.2, and 1609.3, provisions of ANSI/AF&PA WFCM, *Wood Frame Construction Manual for One- and Two-Family Dwellings* shall be permitted for applicable wood frame buildings of Group R-3 occupancy for a basic

wind speed of 150 mph or less in accordance with Figure 1609 and Section 1609.4.

4. Designs using NAAMM FP-1001 *Specification for Design Loads of Metal Flagpoles*.
5. Subject to the limitations of Sections 1609.1.1.1, 1609.1.2, and 1609.3, the provisions of the FC&PA Guide to Concrete Masonry Residential Construction in High Wind Areas shall be permitted for applicable concrete masonry buildings of Group R-3 occupancy for a basic wind speed of 130 mph (58 m/s) or less in Exposure B and 110 mph (49 m/s) or less in Exposure C in accordance with Figure 1609 and Section 1609.4.
6. ANSI/TIA/EIA 222 shall be permitted for communication tower and steel antenna support structures.
7. Subject to the limitations of Sections 1609.1.1.1, 1609.1.2, and 1609.3, the provisions of the WPPC Guide to Wood Construction in High Wind Areas shall be permitted for applicable wood-frame buildings of Group R-3 occupancy for a basic wind speed of 130 mph (58 m/s) or less in Exposure B and 110 mph (49 m/s) or less in Exposure C in accordance with Figure 1609 and Section 1609.4.
8. Designs using AASHTO LTS-4 Structural Specifications for Highway Signs, Luminaires, and Traffic Signals.
9. Wind loads for screened enclosures shall be determined in accordance with Section 2002.4.

1609.1.1.1 Applicability. The provisions of IBHS *Guideline for Hurricane Resistant Residential Construction*, the AF&PA *Wood Frame Construction Manual for One- and Two-Family Dwellings, High Wind Areas*, the FC&PA *Guide to Concrete Masonry Residential Construction in High Wind Areas* and the WPPC *Guide to Wood Construction in High Wind Areas* are applicable only to buildings located within Exposure B or C as defined in Section 1609.4. The provisions of IBHS *Guideline for Hurricane Resistant Residential Construction*, the AF&PA *Wood Frame Construction Manual for One- and Two-Family Dwellings, High Wind Areas,* the FC & PA *Guide to Concrete Masonry Residential Construction in High Wind Areas* and the WPPC *Guide to Wood Construction in High Wind Areas* shall not apply to buildings sited on the upper half of an isolated hill, ridge or escarpment meeting the following conditions:

1. The hill, ridge or escarpment is 60 feet (18 288 mm) or higher if located in Exposure B or 30 feet (9144 mm) or higher if located in Exposure C;
2. The maximum average slope of the hill exceeds 10 percent; and
3. The hill, ridge or escarpment is unobstructed upwind by other such topographic features for a distance from the high point of 50 times the height of the hill or 1 mile (1.61 km), whichever is greater.

1609.1.2 Protection of openings. Glazed openings in buildings located in wind-borne debris regions shall be protected from wind-borne debris. Glazed opening protection for wind-borne debris shall meet the requirements of SSTD 12, ASTM E 1886 and ASTM E 1996, ANSI/DASMA 115 (for garage doors and rolling doors) or TAS 201, 202 and 203 or AAMA 506 referenced therein.

1. Glazed openings located within 30 feet (9144 mm) of grade shall meet the requirements of the Large Missile Test.
2. Glazed openings located more than 30 feet (9144 mm) above grade shall meet the provisions of the Small Missile Test.
3. Storage sheds that are not designed for human habitation and that have a floor area of 720 square feet (67 m^2) or less are not required to comply with the mandatory windborne debris impact standards of this code.
4. Openings in sunrooms, balconies or enclosed porches constructed under existing roofs or decks are not required to be protected provided the spaces are separated from the building interior by a wall and all openings in the separating wall are protected in accordance with Section 1609.1.2. Such spaces shall be permitted to be designed as either partially enclosed or enclosed structures.

Exceptions:

1. Wood structural panels with a minimum thickness of $^{7}/_{16}$ inch (11.1 mm) and a maximum span of 8 feet (2438 mm) shall be permitted for opening protection in one- and two-story buildings. Panels shall be precut so that they shall be attached to the framing surrounding the opening containing the product with the glazed openings. Panels shall be predrilled as required for the anchorage method and all required hardware shall be provided. Attachment shall be designed to resist the components and cladding loads determined in accordance with the provisions of ASCE 7, with permanent corrosion-resistant attachment hardware provided and anchors permanently installed on the building. Attachment in accordance with Table 1609.1.2, with permanent corrosion resistant attachment hardware provided and anchors permanently installed on the building is permitted for buildings with a mean roof height of 45 feet (13 716 mm) or less where wind speeds do not exceed 140 mph (63 m/s)
2. Glazing in Occupancy Category I buildings as defined in Section 1604.5, including greenhouses that are occupied for growing plants on a production or research basis, without public access shall be permitted to be unprotected.
3. Glazing in Occupancy Category II, III or IV buildings located over 60 feet (18 288 mm) above the ground and over 30 feet (9144 mm) above aggregate surface roofs located within 1,500 feet (458

State of Florida

Wind-Borne Debris Region

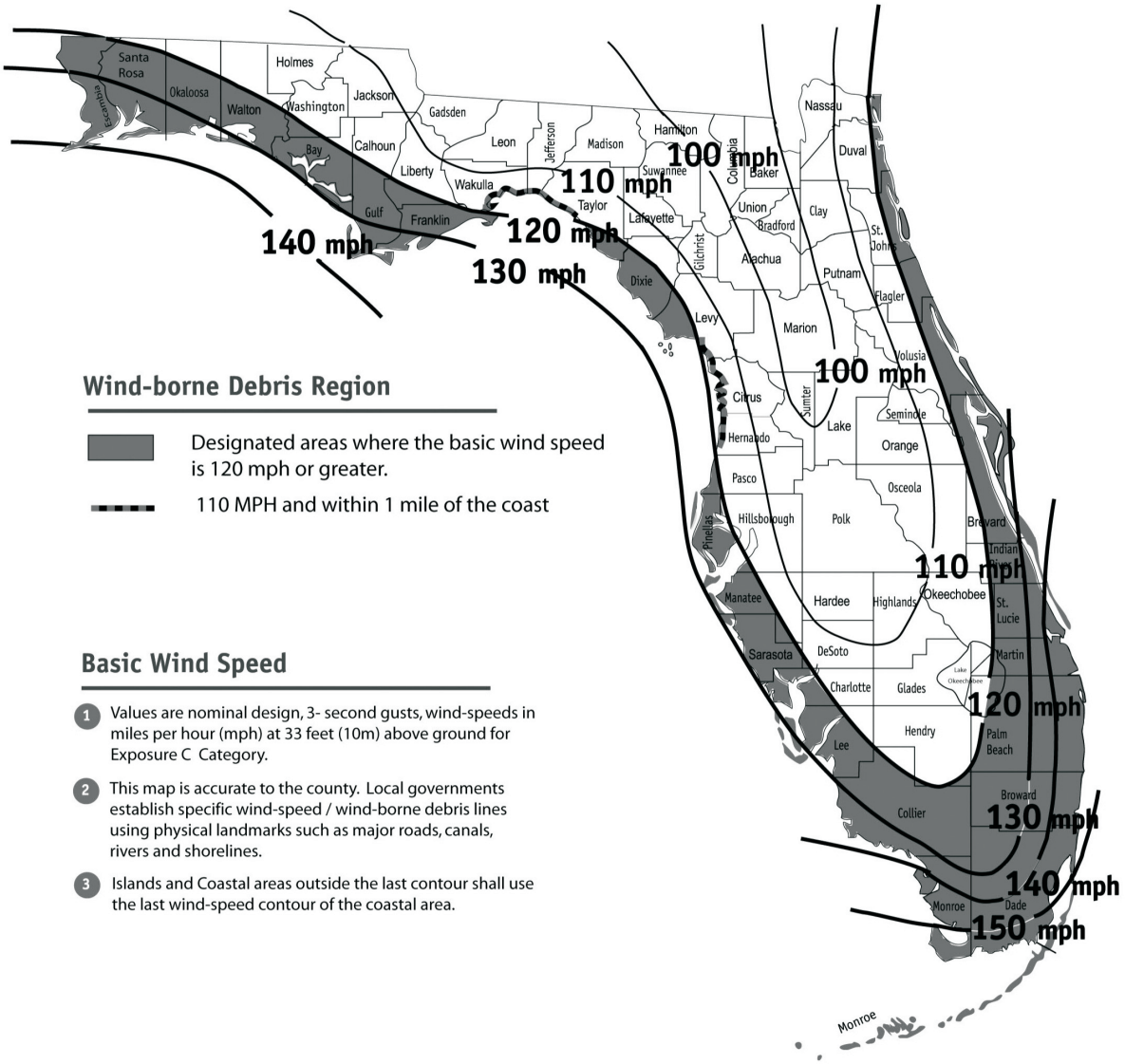

FIGURE 1609
STATE OF FLORIDA DEBRIS REGION & BASIC WIND SPEED

m) of the building shall be permitted to be unprotected.

TABLE 1609.1.2
WIND-BORNE DEBRIS PROTECTION FASTENING SCHEDULE FOR WOOD STRUCTURAL PANELS

FASTENER TYPE	FASTENER SPACING (inches)[1,2]			
	Panel Span ≤ 2 ft	2 foot < panel Span ≤ 4 feet	4 feet < Panel Span ≤ 6 feet	6 feet < Panel Span ≤ 8 feet
#8 Wood screw-based anchor with 2-inch embedment length[3]	16	16	10	8
#10 Wood screw-based anchor with 2-inch embedment length[3]	16	16	12	9
¼ Lag screw-based anchor with 2-inch embedment length[3]	16	16	16	16

For SI: 1 inch = 25.4 mm, 1 foot = 305 mm.

1. This table is based on a maximum wind speed of 140 mph (63 m/s) and mean roof height of 45 feet (13 716 mm) or less.
2. Fasteners shall be installed at opposing ends of the wood structural panel.
3. Where screws are attached to masonry or masonry/stucco, they shall be attached using vibration-resistant anchors having a minimum withdrawal capacity of 1500 lb (6673 kN).

1609.1.2.1 Louvers. Louvers protecting intake and exhaust ventilation ducts not assumed to be open that are located within 30 feet (9144 mm) of grade shall meet requirements of an approved impact-resisting standard or the Large Missile Test of ASTM E 1996.

1609.1.2.2 Impact resistant coverings.

1609.1.2.2.1 Impact resistant coverings shall be tested at 1.5 times the design pressure (positive or negative) expressed in pounds per square feet as determined by the *Florida Building Code, Building* Section 1609 for which the specimen is to be tested.

1609.1.2.2.2 Impact resistant coverings. Impact resistant coverings shall be labeled in accordance with the provisions of Section 1714.8.

1609.1.3 Optional exterior door component testing. Exterior side-hinged door assemblies shall have the option to have the components of the assembly tested and rated for impact resistance in accordance with the following specification: SDI 250.13.

1609.1.4 The wind-borne debris regions requirements shall not apply landward of the designated contour line in Figure 1609. A geographical boundary that coincides with the contour line shall be established.

1609.2 Definitions. The following words and terms shall, for the purposes of Section 1609, have the meanings shown herein.

HURRICANE-PRONE REGIONS. Areas vulnerable to hurricanes defined as:

1. The U. S. Atlantic Ocean and Gulf of Mexico coasts where the basic wind speed is greater than 90 mph (40 m/s) and
2. Hawaii, Puerto Rico, Guam, Virgin Islands and American Samoa.

WIND-BORNE DEBRIS REGION. Portions of hurricane-prone regions that are within 1 mile (1.61 km) of the coastal mean high water line where the basic wind speed is 110 mph (48 m/s) or greater; or portions of hurricane-prone regions where the basic wind speed is 120 mph (53 m/s) or greater; or Hawaii.

1609.3 Basic wind speed. The basic wind speed in miles per hour, for the development of wind loads, shall be determined from Figure1609. The exact location of wind speed lines shall be established by local ordinance using recognized physical landmarks such as major roads, canals, rivers and lake shores whenever possible.

1609.3.1 Wind speed conversion. When required, the 3-second gust basic wind speeds of Figure 1609 shall be converted to fastest-mile wind speeds, V_{fm}, using Table 1609.3.1 or Equation 16-34.

$$V_{fm} = \frac{(V_{3S} - 10.5)}{1.05} \qquad \textbf{(Equation 16-34)}$$

where:

V_{3S} = 3-second gust basic wind speed from Figure 1609.

1609.4 Exposure category. For each wind direction considered, an exposure category that adequately reflects the characteristics of ground surface irregularities shall be determined for the site at which the building or structure is to be constructed. Account shall be taken of variations in ground surface roughness that arise from natural topography and vegetation as well as from constructed features.

Exception: An intermediate exposure between the exposure categories defined is permitted in a transition zone, provided that it is determined by a rational analysis method.

1609.4.1 Wind directions and sectors. For each selected wind direction at which the wind loads are to be evaluated, the exposure of the building or structure shall be determined for the two upwind sectors extending 45 degrees (0.79 rad) either side of the selected wind direction. The exposures in these two sectors shall be determined in accordance with Sections 1609.4.2 and 1609.4.3 and the exposure resulting in the highest wind loads shall be used to represent winds from that direction.

1609.4.2 Surface roughness categories. A ground surface roughness within each 45-degree (0.79 rad) sector shall be determined for a distance upwind of the site as defined in Section 1609.4.3 from the categories defined below, for the purpose of assigning an exposure category as defined in Section 1609.4.3.

Surface Roughness B. Urban and suburban areas, wooded areas or other terrain with numerous closely spaced obstructions having the size of single-family dwellings or larger.

Surface Roughness C. Open terrain with scattered obstructions having heights generally less than 30 feet (9144 mm). This category includes flat open country,

TABLE 1609.3.1
EQUIVALENT BASIC WIND SPEEDS[a,b,c]

V3S	85	90	100	105	110	120	125	130	140	145	150	160	170
Vfm	71	76	85	90	95	104	109	114	123	128	133	142	152

For SI: 1 mile per hour = 0.44 m/s.
a. Linear interpolation is permitted.
b. V_{3S} is the 3-second gust wind speed (mph).
c. V_{fm} is the fastest mile wind speed (mph).

grasslands, and all water surfaces in hurricane-prone regions This surface roughness shall also apply to any building located within surface roughness B-type terrain where the building is within 100 feet horizontally in any direction of open areas of surface roughness C-type terrain that extends more than 600 feet (182.9 m) and width greater than 150 ft. in the upwind direction. Short-term (less than two year) changes in the pre-existing terrain exposure, for the purposes of development, shall not be considered surface roughness C. Where development buildout will occur within three years and the resultant condition will meet the definition of surface roughness B, surface roughness B shall be regulating for the purpose of permitting. This category includes flat open country, grasslands and ocean or gulf shorelines and shall extend downwind for a distance of 1500 feet.

Surface Roughness D. Reserved.

1609.4.3 Exposure categories. An exposure category shall be determined in accordance with the following:

Exposure B. Exposure B shall apply where the ground surface roughness condition, as defined by Surface Roughness B, prevails in the upwind direction for a distance of at least 2,600 feet (792 m) or 20 times the height of the building, whichever is greater.

Exception: For buildings whose mean roof height is less than or equal to 30 feet (9144 mm), the upwind distance is permitted to be reduced to 1,500 feet (457 m).

Exposure C. Exposure C shall apply for all cases where Exposure B does not apply. Buildings located within a distance of 600 feet of inland bodies of water that present a fetch of 1 mile (1.61 km) or more or inland waterways or rivers with a width of 1 mile (1.61 km) or more shall be classified as Exposure C and roof sheathing uplift and roof-to-wall uplift loads shall be increased by 20 percent.

Exposure D. This exposure category is not applicable in Florida.

1609.5 Roof systems.

1609.5.1 Roof deck. The roof deck shall be designed to withstand the wind pressures determined in accordance with ASCE 7.

1609.5.2 Roof coverings. Roof coverings shall comply with Section 1609.5.1.

Exception: Rigid tile roof coverings that are air permeable and installed over a roof deck complying with Section 1609.5.1 are permitted to be designed in accordance with Section 1609.5.3.

Asphalt shingles installed over a roof deck complying with Section 1609.5.1 shall comply with the wind resistance requirements of Section 1507.2.10.

1609.5.3 Rigid tile. Wind loads on rigid tile roof coverings shall be determined in accordance with the following equation:

$$M_a = q_h C_L b L L_a [1.0 - GC_p] \qquad \textbf{(Equation 16-35)}$$

$$\text{For SI: } M_a = \frac{q_h C_L b L L_a \left[1.0 - GC_p\right]}{1{,}000}$$

where:

b = Exposed width, feet (mm) of the roof tile.

C_L = Lift coefficient. The lift coefficient for concrete and clay tile shall be 0.2 or shall be determined by test in accordance with Section 1715.2.

GC_p = Roof pressure coefficient for each applicable roof zone determined from Chapter 6 of ASCE 7. Roof coefficients shall not be adjusted for internal pressure.

L = Length, feet (mm) of the roof tile.

L_a = Moment arm, feet (mm) from the axis of rotation to the point of uplift on the roof tile. The point of uplift shall be taken at $0.76L$ from the head of the tile and the middle of the exposed width. For roof tiles with nails or screws (with or without a tail clip), the axis of rotation shall be taken as the head of the tile for direct deck application or as the top edge of the batten for battened applications. For roof tiles fastened only by a nail or screw along the side of the tile, the axis of rotation shall be determined by testing. For roof tiles installed with battens and fastened only by a clip near the tail of the tile, the moment arm shall be determined about the top edge of the batten with consideration given for the point of rotation of the tiles based on straight bond or broken bond and the tile profile.

1618.6.3 The cable system including anchors shall be protected against corrosion.

1618.6.4 Cable tension under design load shall not exceed 90 percent of the yield strength of the cable.

1618.6.5 The uppermost cable shall be at least 42 inches (1067 mm) above the adjacent surface. Cables shall not be spaced more than 6 inches (152 mm) apart.

1618.6.6 An installation plan prepared by the structural engineer of record shall be submitted to the building official for his or her approval.

1618.6.7 Installation shall be witnessed by the structural engineer of record who shall certify the following:

1. That the installation has been in accordance with the approved installation plan.
2. That the initial tension designated by the structural engineer of record has been provided in all cables.
3. That all anchors have been seated at a total load, including initial tension, equal to 85 percent of the yield strength of the cable, unless a positive locking device is provided that does not require a tension jack for the tensioning of the barrier strand.

1618.6.8 Drawings shall indicate the initial tension, the expected increase in tension under vehicular impact and the required maximum capacity of the strand barrier system.

1618.7 Ornamental projections. Ornamental cantilevered projections on the exterior of buildings shall be designed for not less than 60 psf live load (2873 Pa) or 200 pounds per lineal foot (2919 N/m) applied at the outer edge, whichever is more critical.

1618.8 Interior wall and partitions. Permanent, full-height interior walls and partitions shall be designed to resist a lateral live load not less than 5 psf (239 Pa) and if sheathed with lath and plaster, deflection at this load shall not exceed L/360.

1618.9 Load combination. The safety of structures shall be checked using the provisions of 2.3 and 2.4 of ASCE 7 with commentary.

Exception: Increases in allowable stress shall be permitted in accordance with ACI 530/ASCE 5/TMS 402 provided the load reduction factor of 0.75 of combinations 4 and 6 of ASCE 7 Section 2.4.1 shall not be applied.

SECTION 1619
HIGH VELOCITY HURRICANE ZONES — LIVE LOAD REDUCTIONS

1619.1 Application. No reduction in assumed live loads set forth in this section shall be allowed in the design of columns, walls, beams, girders and foundations, except as permitted by the provisions of Section 4.8 ASCE 7 with commentary.

Exceptions:

1. No reduction of the assumed live loads shall be allowed in the design of any slabs, joists or other secondary members, except as set forth herein.
2. No reduction in roof live loads shall be permitted except as set forth by Section 1616.1.

1619.2 Allowable live load reductions.

1619.2.1 Permissible reduction in live loads shall be as provided in Section 4.8.1 of ASCE 7 with commentary.

1619.2.2 Limitations on live load reduction shall be as noted in Section 4.8.2 of ASCE 7 with commentary.

1619.2.3 No reduction in live loads shall be permitted for buildings or structures of Group A assembly occupancy.

SECTION 1620
HIGH-VELOCITY HURRICANE ZONES—WIND LOADS

1620.1 Buildings and structures, and every portion thereof, shall be designed and constructed to meet the requirements of Section 6 of ASCE 7, as more specifically defined in this section, based on a 50-year mean recurrence interval.

1620.2 Wind velocity (3-second gust) used in structural calculations shall be 140 miles per hour (63 m/s) in Broward County and 146 miles per hour (65 m/s) in Miami-Dade County.

1620.3 All buildings and structures shall be considered to be in Exposure Category C as defined in Section 6.5.6.3 of ASCE 7.

1620.4 For wind force calculations, roof live loads shall not be considered to act simultaneously with the wind load.

1620.5 Utility sheds shall be designed for a wind load of not less than 15 psf (718 Pa).

SECTION 1621
HIGH-VELOCITY HURRICANE ZONES—OVERTURNING MOMENT AND UPLIFT

1621.1 Computations for overturning moment and uplift shall be based on ASCE 7.

1621.2 Overturning and uplift stability of any building, structure or part thereof taken as a whole shall be provided, and shall be satisfied by conforming to the load combination requirements of ASCE 7.

SECTION 1622
HIGH-VELOCITY HURRICANE ZONES—SCREEN ENCLOSURES

1622.1 Screen enclosures.

1622.1.1 The wind loads on screen surfaces shall be per ASCE 7 based on the ratio of solid to gross area.

1622.1.2 Design shall be based on such loads applied horizontally inward and outward to the walls with a shape factor of 1.3 and applied vertically upward and downward on the roof with a shape factor of 0.7.

1622.2 Windbreakers.

1622.2.1 Vinyl and acrylic glazed panels shall be removable. Removable panels shall be identified as removable by a decal. The identification decal shall essentially state "Removable panel SHALL be removed when wind speeds exceed 75 mph (34 m/s)." Decals shall be placed such that the decal is visible when the panel is installed.

1622.2.2 Permanent frame shall be designed per section 1620 and 1622.1.2.

SECTION 1623
HIGH-VELOCITY HURRICANE ZONES—LIVE LOADS POSTED AND OCCUPANCY PERMITS

1623.1 Live loads posted. The live loads in every building, structure or part thereof of Group F, M or S Storage occupancy approved by the building official shall be shown on plates supplied by the owner or his authorized agent, in that part of each space to which such loads apply.

1623.1.1 Such plates shall be of approved durable materials displaying letters and figures not less than $^3/_8$ inch (9.5 mm) in height, and shall be securely affixed to the structure in conspicuous places.

1623.1.2 Such notices shall not be removed or defaced and where defaced, removed or lost, it shall be the responsibility of the owner to cause replacement as soon as possible.

1623.2 Occupant loads. Plans for proposed buildings or structures of Group F, M or S storage occupancy areas in buildings of any occupancy shall show the allowable loading for each portion of the floor and roof areas and certificates of use and occupancy, as defined in Section 110 of this code, shall not be issued until such loads are posted as set forth in Section 1623.1.

1623.2.1 Change in occupant load. No change in the occupancy of any building shall be made until a certificate of occupancy has been issued certifying that the building official has approved the building as suitable for the loads characteristic of the proposed occupancy.

1623.2.2 Maximum floor and roof loads observed. It shall be unlawful at any time to place, or permit to be placed, on any floor or roof of a building or structure, a load greater than that for which the floor or roof is approved by the building official.

SECTION 1624
HIGH-VELOCITY HURRICANE ZONES—FOUNDATION DESIGN

1624.1 Design procedure. The minimum area of a footing or number of piles under a foundation shall be determined in the following manner:

1624.1.1 The total load of the column that has the largest percentage of the live load to the total load shall be divided by the allowable soil pressure or pile capacity.

1624.1.2 The balance soil pressure or pile capacity shall be determined by dividing the total dead load by the area of the footing or the number of piles.

1624.1.3 The minimum area of other footings or number of piles shall be designed on the basis of their respective dead loads only.

1624.1.4 In no case shall the total load of the combined dead, live, wind and any other loads exceed the allowable bearing pressure of the soil for capacity of any pile upon which the foundation is supported.

1624.1.5 The live load used in the above calculations may be the total reduced live load in the member immediately above the foundation.

1624.1.6 The building official may require submittal of design computations employed in foundation design.

1624.2 Wind effects. Reserved.

1624.2.1 Reserved.

SECTION 1625
HIGH-VELOCITY HURRICANE ZONES—LOAD TESTS

1625.1 Application. Whenever there is insufficient evidence of compliance with the provisions of this code or evidence that any material or any construction does not conform to the requirements of this code, or in order to substantiate claims for alternate materials or methods of construction, the building official may require testing by an approved agency, at the expense of the owner or his agent, as proof of compliance. Testing methods shall be as specified by this code for the specific material.

1625.2 Testing method. Such testing shall follow a nationally recognized standard test, or when there is no standard test procedure for the material or assembly in question, the building official shall require the material or assembly under dead plus live load shall deflect not more than as set forth in Section 1613, and that the material or assembly shall sustain dead load plus twice the live load for a period of 24 hours, with a recovery of at least 80 percent or a 100 percent recovery after one-half test load.

1625.3 Alternate test methods. When elements, assemblies or details of structural members are such that their load-carrying capacity, deformation under load, or deflection cannot be calculated by rational analysis, their structural performance shall be established by test in accordance with test procedures as approved by the building official based on consideration of all probable conditions of loading.

1625.4 Fatigue load testing. Where cladding assemblies (including cladding and connections) or roofing framing assemblies (including portions of roof structure and connections) are such that their load-carrying capacity or deformation under load cannot be calculated by rational analysis, the assemblies may be tested to resist the fatigue loading sequence given by Table 1625.4.

TABLE 1625.4
FATIGUE LOADING SEQUENCE

RANGE OF TEST	NUMBER OF CYCLES[1]
0 to 0.5p[2]	600
0 to 0.6p	70
0 to 1.3p	1

1. Each cycle shall have minimum duration of 1 second and a maximum duration of 3 seconds and must be performed in a continuous manner.
2. p = the design wind load for the height and location, when the assembly will be used. For wall and roof components, shape factors given in ASCE 7 shall be used.

Assemblies shall be tested with no resultant failure or distress and shall have a recovery of at least 90 percent over maximum deflection.

Any cladding assembly not incorporated into the *Florida Building Code, Building* after successfully completing the impact test outlined in Section 1626, shall be subject to fatigue loading testing and shall obtain product approval by the building official.

SECTION 1626
HIGH-VELOCITY HURRICANE ZONES—
IMPACT TESTS FOR WIND-BORNE DEBRIS

1626.1 All parts or systems of a building or structure envelope such as, but not limited, to exterior walls, roof, outside doors, skylights, glazing and glass block shall meet impact test criteria or be protected with an external protection device that meets the impact test criteria. Test procedures to determine resistance to wind-borne debris of wall cladding, outside doors, skylights, glazing, glass block, shutters and any other external protection devices shall be performed in accordance with this section.

Exception: The following structures or portion of structures shall not be required to meet the provisions of this section:

a. Roof assemblies for screen rooms, porches, canopies, etc. attached to a building that do not breach the exterior wall or building envelope and have no enclosed sides other than screen.

b. Soffits, soffit vents and ridge vents. Size and location of such vents shall be detailed by the designer and shall not compromise the integrity of the diaphragm boundary.

c. Vents in a garage with four or fewer cars. Size and location of such vents shall be detailed by the designer and shall not exceed the minimum required area by more than 25 percent.

d. Exterior wall or roof openings for wall- or roof-mounted HVAC equipment.

e. Openings for roof-mounted personnel access roof hatches.

f. Storage sheds that are not designed for human habitation and that have a floor area of 720 square feet (67 m^2) or less are not required to comply with the mandatory windborne debris impact standards of this code.

g. Louvers as long as they properly considered ASCE 7 in the design of the building.

h. Buildings and structures for marinas, cabanas, swimming pools, and greenhouses.

1626.2 Large missile impact tests.

1626.2.1 This test shall be conducted on three test specimens. This test shall be applicable to the construction units, assemblies and materials to be used up to and including 30 feet (9.1 m) in height in any and all structures.

1626.2.2 The test specimens shall consist of the entire assembled unit, including frame and anchorage as supplied by the manufacturer for installation in the building, or as set forth in a referenced specification, if applicable. Fasteners used in mounting the test specimen shall be identical in size and spacing to what is used in field installations.

1626.2.3 The large missile shall be comprised of a piece of timber having nominal dimensions of 2 inches by 4 inches (51 mm by 102 m) weighing 9 pounds (4.1 kg).

1626.2.4 The large missile shall impact the surface of each test specimen at a speed of 50 feet per second (15.2 m/s).

1626.2.5 Each test specimen shall receive two impacts except as noted in Sections 1626.2.5.1 and 1626.2.5.2, the first within a 5-inch (127 mm) radius circle having its center on the midpoint of the test specimen and the second within a 5-inch (127 mm) radius circle in a corner having its center in a location 6 inches (152 mm) away from any supporting members.

1626.2.5.1 For window, glass block, fixed glass and skylight assemblies, both impacts shall be to glass or other glazing infill. For test specimens with more than one light of glass, a single light closest to the center of the assembly shall be selected and impacted twice in accordance with Section 1626.2.5. If a light of glass is sufficiently small to cause the 5-inch (127 mm) radius circle to overlap, two separate lights shall be impacted one time each.

1626.2.5.1.1 For window, fixed glass and skylight assemblies comprised of different glass thickness, types of glass or different types of glazing infill, each separate thickness or type shall be impacted twice in accordance with Section 1626.2.5.

1626.2.5.2 For doors, wall cladding and external protection devices, both impacts shall be to the thinnest section through the assembly. For doors, wall cladding and external protection devices with horizontal and/or vertical bracing, both impacts shall be within a single area that is not reinforced and shall be in accordance with Section 1626.2.5.

1626.2.5.2.1 For doors with glass, the glass shall be impacted twice and the thinnest section through the assembly that is not glass shall be impacted twice in accordance with Section 1626.2.5.

1626.2.6 In the case of glazing, if the three test specimens that comprise a test successfully reject the two missile impacts, they shall then be subjected to the cyclic pressure loading defined in Table 1626.

1626.2.6.1 If external protection devices are employed to protect windows, fixed doors or skylights, they must resist the large missile impacts specified in Sections 1626.2.3 and 1626.2.4 without deformations which result in contact with the windows, fixed glass, glass block, and doors or skylights they are intended to protect.

1626.2.6.2 If external protection devices are not designed to be air tight, following the large missile impact test, they must resist an application of force corresponding to those listed in Table 1625.4 (fatigue load testing) without detaching from their mountings. The acting pressure cycles shall be simulated with loads applied through a mechanical system attached to the shutter specimen to apply uniformly around the shutter perimeter a force equal

to the product of the required pressure and the area of the shutter specimen.

1626.2.7 If air leakage through the test specimen is excessive, tape may be used to cover any cracks and joints through which leakage is occurring. Tape shall not be used when there is a probability that it may significantly restrict differential movement between adjoining members. It is also permissible to cover both sides of the entire specimen and mounting panel with a single thickness of polyethylene film no thicker than 0.050 mm (2 mils). The technique of application is important in order that the full load is transferred to the specimen and that the membrane does not prevent movement or failure of the specimen. Apply the film loosely with extra folds of material at each corner and at all offsets and recesses. When the load is applied, there shall be no fillet caused by tightness of plastic film.

1626.2.8 A particular system of construction shall be deemed to comply with this recommended practice if three test specimens reject the two missile impacts without penetration and resist the cyclic pressure loading with no crack forming longer than 5 inches (127 mm) and $^{1}/_{16}$ inch (1.6 mm) wide through which air can pass.

1626.2.9 If only one of the three test specimens in a test fails to meet the above listed criteria, one retest of this system of construction (another test sequence with three specimens) shall be permitted.

1626.3 Small missile impact test.

1626.3.1 This test shall be conducted on three test specimens. This test shall be applicable to the construction units, assemblies, and materials to be used above 30 feet (9.1 m) in height in any and all structures.

1626.3.2 Each test specimen shall consist of the entire assembled unit, including frame and anchorage as supplied by the manufacturer for installation in the building, or as set forth in a referenced specification, if applicable. The fasteners used in mounting the test specimen shall be identical in size and spacing to those to be used in field installations.

1626.3.3 The missiles shall consist of solid steel balls each having a mass of 2 grams (0.07 oz) (+/-5 percent) with a $^{5}/_{16}$-in. (7.9 mm) nominal diameter.

1626.3.4 Each missile shall impact the surface of each test specimen at a speed of 130 feet per second (40 m/s).

1626.3.5 Each test specimen shall receive 30 small missile impacts except as noted in Sections 1626.3.5.1 and 1626.3.5.2 delivered in groups of 10 at a time: the first 10 distributed uniformly over a 2 square foot (0.19 m^2) area located at the center of the test specimen, the second 10 distributed uniformly over a 2 square foot area (0.19 m^2) located at the center of the long dimension of the specimen near the edge, and the third 10 distributed uniformly over a 2 square foot (0.19 m^2) area located at a corner of the specimen.

1626.3.5.1 For window and skylight assemblies, all impacts shall be to glass or other glazing infill. For test specimens with more than one light of glass, a single light closest to the center of the assembly shall be selected and impacted in accordance with Section 1626.3.5. If a light of glass is sufficiently small to cause the 5-inch (127 mm) radius circles to overlap, separate lights may be impacted; however, there must be a total of 30 impacts within the assembly.

1626.3.5.1.1 For window, fixed glass and skylight assemblies comprised of glass with different thickness, types of glass or different types of glazing infill, each separate thickness or type shall be impacted in accordance with Section 1626.3.5.

1626.3.5.2 For doors, wall cladding and external protection devices, all impacts shall be to the thinnest section through the assembly. For doors, wall cladding and external protection devices with horizontal and/or vertical bracing, all impacts shall be within a single area that is not reinforced and shall be impacted in accordance with Section 1626.3.5.

1626.3.5.2.1 For doors with glass, the glass shall be impacted in accordance with Section 1626.3.5 and the thinnest section through the assembly that is not glass shall be impacted in accordance with Section 1626.3.5.

1626.3.6 In the case of glazing, after completion of the small missile impacts, each test specimen shall then be subjected to the cyclic pressure loading defined in Table 1626.

1626.3.6.1 If external protection devices are employed to protect windows, doors or skylights, they must resist the small missile impacts specified in Sections 1626.3.3 and 1626.3.4 without deformations that result in contact with the windows, glass, doors or skylights they are intended to protect.

1626.3.6.2 If external protection devices are not designed to be air tight, following the small missile impact test, they must resist an application of force corresponding to those listed in Table 1625.4 (fatigue load testing) without detaching from their mountings. The acting pressure cycles shall be simulated with loads applied through a mechanical system attached to the shutter specimen to apply uniformly around the shutter perimeter a force equal to the product of the required pressure and the area of the shutter specimen.

1626.3.7 If air leakage through the test specimen is excessive, tape may be used to cover any cracks and joints through which leakage is occurring. Tape shall not be used when there is a probability that it may significantly restrict differential movement between adjoining members. It is also permissible to cover both sides of the entire specimen and mounting panel with a single thickness of polyethylene film no thicker than 0.050 mm (2 mils). The technique of application is important for the full load to be transferred to the specimen and to insure the membrane does not prevent movement or failure of the specimen. Apply the film loosely with extra folds of material at each corner and at all offsets and recesses. When the load is applied, there shall be no fillet caused by tightness of plastic film.

1626.3.8 A particular system of construction shall be deemed to comply with this test if three test specimens reject the small missile impacts without penetration and resist the cyclic pressure loading with no crack forming longer than 5

1710.2 New materials. For materials that are not specifically provided for in this code, the design strengths and permissible stresses shall be established by tests as provided for in Section 1711.

SECTION 1711
ALTERNATIVE TEST PROCEDURE

1711.1 General. In the absence of approved rules or other approved standards, the building official shall make, or cause to be made, the necessary tests and investigations; or the building official shall accept duly authenticated reports from approved agencies in respect to the quality and manner of use of new materials or assemblies as provided for in Section 104.11. The cost of all tests and other investigations required under the provisions of this code shall be borne by the permit applicant.

SECTION 1712
TEST SAFE LOAD

1712.1 Where required. Where proposed construction is not capable of being designed by approved engineering analysis, or where proposed construction design method does not comply with the applicable material design standard, the system of construction or the structural unit and the connections shall be subjected to the tests prescribed in Section 1714. The building official shall accept certified reports of such tests conducted by an approved testing agency, provided that such tests meet the requirements of this code and approved procedures.

SECTION 1713
IN-SITU LOAD TESTS

1713.1 General. Whenever there is a reasonable doubt as to the stability or load-bearing capacity of a completed building, structure or portion thereof for the expected loads, an engineering assessment shall be required. The engineering assessment shall involve either a structural analysis or an in-situ load test, or both. The structural analysis shall be based on actual material properties and other as-built conditions that affect stability or load-bearing capacity, and shall be conducted in accordance with the applicable design standard. If the structural assessment determines that the load-bearing capacity is less than that required by the code, load tests shall be conducted in accordance with Section 1713.2. If the building, structure or portion thereof is found to have inadequate stability or load-bearing capacity for the expected loads, modifications to ensure structural adequacy or the removal of the inadequate construction shall be required.

1713.2 Test standards. Structural components and assemblies shall be tested in accordance with the appropriate material standards listed in Chapter 35. In the absence of a standard that contains an applicable load test procedure, the test procedure shall be developed by a registered design professional and approved. The test procedure shall simulate loads and conditions of application that the completed structure or portion thereof will be subjected to in normal use.

1713.3 In-situ load tests. In-situ load tests shall be conducted in accordance with Section 1713.3.1 or 1713.3.2 and shall be supervised by a registered design professional. The test shall simulate the applicable loading conditions specified in Chapter 16 as necessary to address the concerns regarding structural stability of the building, structure or portion thereof.

1713.3.1 Load test procedure specified. Where a standard listed in Chapter 35 contains an applicable load test procedure and acceptance criteria, the test procedure and acceptance criteria in the standard shall apply. In the absence of specific load factors or acceptance criteria, the load factors and acceptance criteria in Section 1713.3.2 shall apply.

1713.3.2 Load test procedure not specified. In the absence of applicable load test procedures contained within a standard referenced by this code or acceptance criteria for a specific material or method of construction, such existing structure shall be subjected to a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components that are not a part of the seismic-load-resisting system, the test load shall be equal to two times the unfactored design loads. The test load shall be left in place for a period of 24 hours. The structure shall be considered to have successfully met the test requirements where the following criteria are satisfied:

1. Under the design load, the deflection shall not exceed the limitations specified in Section 1604.3. The HVHZ shall comply with Section 1613.1.
2. Within 24 hours after removal of the test load, the structure shall have recovered not less than 75 percent of the maximum deflection.
3. During and immediately after the test, the structure shall not show evidence of failure.

SECTION 1714
PRECONSTRUCTION LOAD TESTS

1714.1 General. In evaluating the physical properties of materials and methods of construction that are not capable of being designed by approved engineering analysis or do not comply with applicable material design standards listed in Chapter 35, the structural adequacy shall be predetermined based on the load test criteria established in this section.

1714.2 Load test procedures specified. Where specific load test procedures, load factors and acceptance criteria are included in the applicable design standards listed in Chapter 35, such test procedures, load factors and acceptance criteria shall apply. In the absence of specific test procedures, load factors or acceptance criteria, the corresponding provisions in Section 1714.3 shall apply.

1714.3 Load test procedures not specified. Where load test procedures are not specified in the applicable design standards listed in Chapter 35, the load-bearing and deformation capacity of structural components and assemblies shall be determined on the basis of a test procedure developed by a registered design professional that simulates applicable loading and deformation conditions. For components and assemblies that

are not a part of the seismic-load-resisting system, the test shall be as specified in Section 1714.3.1. Load tests shall simulate the applicable loading conditions specified in Chapter 16.

1714.3.1 Test procedure. The test assembly shall be subjected to an increasing superimposed load equal to not less than two times the superimposed design load. The test load shall be left in place for a period of 24 hours. The tested assembly shall be considered to have successfully met the test requirements if the assembly recovers not less than 75 percent of the maximum deflection within 24 hours after the removal of the test load. The test assembly shall then be reloaded and subjected to an increasing superimposed load until either structural failure occurs or the superimposed load is equal to two and one-half times the load at which the deflection limitations specified in Section 1714.3.2 were reached, or the load is equal to two and one-half times the superimposed design load. In the case of structural components and assemblies for which deflection limitations are not specified in Section 1714.3.2, the test specimen shall be subjected to an increasing superimposed load until structural failure occurs or the load is equal to two and one-half times the desired superimposed design load. The allowable superimposed design load shall be taken as the lesser of:

1. The load at the deflection limitation given in Section 1714.3.2.
2. The failure load divided by 2.5.
3. The maximum load applied divided by 2.5.

1714.3.2 Deflection. The deflection of structural members under the design load shall not exceed the limitations in Section 1604.3. The HVHZ shall comply with Section 1613.1.

1714.4 Wall and partition assemblies. Load-bearing wall and partition assemblies shall sustain the test load both with and without window framing. The test load shall include all design load components. Wall and partition assemblies shall be tested both with and without door and window framing.

1714.5 Exterior window and door assemblies. This section defines performance and construction requirements for exterior window and door assemblies installed in wall systems. Waterproofing, sealing and flashing systems are not included in the scope of this section.

1714.5.1 The design pressure for window and door assemblies shall be calculated in accordance with component and cladding wind loads in Section 1609.

1714.5.2 Exterior windows, sliding and patio glass doors.

1714.5.2.1 Testing and labeling. Exterior windows and glass doors shall be tested by an approved independent testing laboratory, and shall be labeled to indicate compliance with the requirements of one of the following specifications:

ANSI/AAMA/NWWDA 101/I.S. 2 or ANSI/AAMA/WDMA101/I.S. 2/NAFS or AAMA/WDMA/CSA 101/I.S. 2/A440 or TAS 202 (HVHZ shall comply with TAS 202 utilizing ASTM E 1300-98 or ASTM E 1300-04 or Section 2404).

Exterior windows and sliding glass doors shall be labeled with a permanent label, marking or etching providing traceability to the manufacturer and product. The following shall also be required either on a permanent label or on a temporary supplemental label applied by the manufacturer: information identifying the manufacturer, the product model/series number, positive and negative design pressure rating, product maximum size, glazing thickness, impact-resistance rating if applicable, Florida Product Approval number or Miami-Dade Product Approval number, applicable test standard(s), and approved product certification agency, testing laboratory, evaluation entity or Miami-Dade Product Approval.

The labels are limited to one design pressure rating per referenced standard. The temporary supplemental label shall remain on the window or door until final approval by the building official.

Exceptions:

1. Door assemblies installed in nonhabitable areas where the door assembly and area are designed to accept water infiltration need not be tested for water infiltration.
2. Door assemblies installed where the overhang (OH) ratio is equal to or more than 1 need not be tested for water infiltration. The overhang ratio shall be calculated by the following equation:

   OH ratio = OH Length/OH Height

   Where:

   OH length = The horizontal measure of how far an overhang over a door projects out from door surface.

   OH height = The vertical measure of the distance from the door sill to the bottom of the overhang over a door.
3. Pass-through windows for serving from a single-family kitchen, where protected by a roof overhang of 5 feet (1.5 m) or more shall be exempted from the requirements of the water infiltration test.

Glass Strength: Products tested and labeled as conforming to ANSI/AAMA/NWWDA 101/I.S. 2 or ANSI/AAMA/WDMA 101/I.S. 2/NAFS or AAMA/WDMA/CSA 101/I.S. 2/A440 or TAS 202 shall not be subject to the requirements of Sections 2403.2 or 2403.3 or 2404.1. Determination of load resistance of glass for specific loads of products not tested and certified in accordance with Section 1714.5.2.1 shall be designed to comply with ASTM E 1300 in accordance with Section 2404. The temporary supplemental label shall designate the type and thickness of glass or glazing material.

1714.5.2.1.1 Testing and labeling of skylights. Exterior skylights shall be tested by an approved independent testing laboratory, and shall be labeled

to indicate compliance with the requirements of one of the following specifications:

ANSI/AAMA/WDMA 101/I.S.2/NAFS or AAMA/WDMA/CSA 101/I.S.2/A440, or TAS 202 (HVHZ shall comply with TAS 202).

Exterior skylights shall be labeled with a permanent label, marking or etching providing traceability to the manufacturer and product. The following shall also be required either on a permanent label or on a temporary supplemental label applied by the manufacturer: information identifying the manufacturer, the product model/series number, positive and negative design pressure rating, product maximum size, type and thickness of glass or glazing material, impact-resistance rating if applicable, Florida Product Approval number or Miami-Dade Product Approval number, applicable test standard(s), and approved product certification agency, testing laboratory, evaluation entity or Miami-Dade Product Approval.

Labels are limited to one design pressure rating per referenced standard. The temporary supplemental label shall remain on the skylight until final approval by the building official.

1714.5.2.2 Comparative analysis label. A temporary supplemental label conforming to AAMA 203, Procedural Guide for the Window Inspection and Notification System, shall be acceptable for establishing and communicating the calculated allowable design pressures higher than indicated on the label required by Section 1714.5.2.1 for window or door sizes smaller than that required by the ANSI/AAMA/NWWDA 101/I.S.2 or ANSI/AAMA/WDMA101/I.S.2/NAFS or AAMA/WDMA/CSA 101/I.S.2/A440 test requirements. This temporary supplemental label shall be applied by the manufacturer and remain on the window or door until final approval by the building official.

Exception 1:

Comparative analysis of operative windows and glazed doors may be made, provided the proposed unit complies with the following:

1. Shall always be compared with a tested and currently approved unit.
2. Varies only in width, height and/or load requirements.
3. Shall not exceed 100 percent of the proportional deflection for fiber stress of the intermediate members of the approved unit.
4. Shall conform as to extruded members, reinforcement and in all other ways with the tested approved unit.
5. Shall not exceed 100 percent of the concentrated load at the juncture of the intermediate members and the frame of the approved unit.
6. Shall not permit more air and water infiltration than the approved unit based on the height above grade.
7. Compared unit shall not exceed the maximum cyclic pressure when tested per TAS 203 or ASTM E 1886 and ASTM E 1996.

Exception 2 :

Comparative analysis of fixed glass windows may be made provided the proposed unit complies with the following:

1. Shall always be compared with a tested and currently approved unit.
2. Varies only in width, height and/or load requirements.
3. The design is identical in all respects. e.g., extrusions, glazing system, joinery, fasteners, etc.
4. Shall not permit more air and water infiltration than the approved unit based on height above grade.
5. The maximum uniform load distribution (ULD) of any side is equal to the uniform load carried by the side divided by the length of the side.
6. The ULD of any member must not exceed the ULD of the corresponding member of the tested window.
7. The uniform load distribution on each member shall be calculated in accordance to Section 2, Engineering Design Rules, of the AAMA 103.3 Procedural Guide.
8. Compared unit shall not exceed the maximum cyclic pressure when tested per TAS 201,TAS 202 and TAS 203 or ASTM E 1886 and ASTM E 1996.

1714.5.3 Exterior door assemblies. Exterior door assemblies not covered by Section 1714.5.2 or Section 1714.5.3.1 shall be tested for structural integrity in accordance with ASTM E 330 Procedure A, at a load of 1.5 times the required design pressure load. The load shall be sustained for 10 seconds with no permanent deformation of any main frame or panel member in excess of 0.4 percent of its span after the load is removed. High-velocity hurricane zones shall comply with TAS 202. After each specified loading, there shall be no glass breakage, permanent damage to fasteners, hardware parts, or any other damage which causes the door to be inoperable.

The minimum test sizes and minimum design pressures shall be as indicated in Table 1714.5.3.

The unit size tested shall qualify all units smaller in width and/or height of the same operation type and be limited to cases where frame, panels and structural members maintain the same profile as tested.

TABLE 1714.5.3
MINIMUM TEST SIZES, INCLUDING FRAMING

PERFORMANCE CLASS[1]	WIDTH X HEIGHT (mm)	WIDTH X HEIGHT (IN.)	MINIMUM PERFORMANCE GRADE (DESIGN PRESSURE)
Residential (R)	900 × 2000	(36 × 79)	720 Pa (15 psf)
Light Commercial (LC)	900 × 2100	(36 × 83)	1200 Pa (25 psf)
Commercial (C)	1000 × 2100	(40 × 83)	1440 Pa (25 psf)
Heavy Commercial (HC)	1200 × 2400	(48 × 95)	1920 Pa (40 psf)
Architectural (AW)	1200 × 2400	(48 × 95)	1920 Pa (40 psf)

1. Performance Class and Performance Grade per ANSI/AAMA/NWWDA 101/I.S.2.

1714.5.3.1 Sectional garage doors and rolling doors shall be tested for determination of structural performance under uniform static air pressure difference in accordance with ANSI/DASMA 108, ASTM E 330 Procedure A, or TAS 202. For products tested in accordance with ASTM E 330, testing shall include a load of 1.5 times the required design pressure load sustained for 10 seconds, and acceptance criteria shall be in accordance with ANSI/DASMA 108 (HVHZ shall comply with TAS 202).

1714.5.3.2 Custom doors. Custom (one of a kind) exterior door assemblies shall be tested by an approved testing laboratory or be engineered in accordance with accepted engineering practices.

1714.5.3.3 Door components evaluated by an approved product evaluation entity, certification agency, testing laboratory or engineer may be interchangeable in exterior door assemblies provided that the door component(s) provide equal or greater structural performance as demonstrated by accepted engineering practices.

1714.5.3.3.1 Glazed curtain wall, window wall and storefront systems shall be tested in accordance with the requirements of this section and the Laboratory Test requirements of the American Architectural Manufacturers Association (AAMA) Standard 501; HVHZ shall comply with Section 2411.3.2.1.1.

Exceptions:

1. Door assemblies installed in nonhabitable areas where the door assembly and area are designed to accept water infiltration need not be tested for water infiltration.
2. Door assemblies installed where the overhang (OH) ratio is equal to or more than 1 need not be tested for water infiltration. The overhang ratio shall be calculated by the following equation:

   OH ratio = OH Length/OH Height

   where:

   OH Length = The horizontal measure of how far an overhang over a door projects out from door surface.

   OH Height = The vertical measure of the distance from the door sill to the bottom of the overhang over a door.

1714.5.3.3.2 Optional exterior door component testing. With the exception of HVHZ, exterior side-hinged door assemblies not covered by Section 1714.5.2 shall have the option to have the components of the assembly tested and rated for structural integrity in accordance with the following specification:

SDI A250.13

Following the structural testing of exterior door components, there shall be no permanent deformation of any perimeter frame or panel member in excess of 0.4 percent of its span after the load is removed. After each specified loading, there shall be no glass breakage, permanent damage to fasteners, hardware parts, or any other damage that causes the door to be inoperable, as applicable.

1714.5.3.4 Garage door labeling. Garage doors shall be labeled with a permanent label provided by the manufacturer. The label shall identify the manufacturer, the garage door model/series number, the positive and negative design pressure rating, indicate impact rated if applicable, the installation instruction drawing reference number, the Florida Product Approval or Miami-Dade Product Approval number if applicable, and the applicable test standards.

The required garage door components for an approved garage door assembly may be indicated using a checklist format on the label. If a checklist format is used on the label, the installer or manufacturer shall mark the selected components on the checklist that are required to assemble an approved garage door system.

The installation instructions shall be provided and available on the job site.

1714.5.4 Anchorage methods. The methods cited in this section apply only to anchorage of window and door assemblies to the main wind force resisting system.

1714.5.4.1 Anchoring requirements. Window and door assemblies shall be anchored in accordance with the published manufacturer's recommendations to achieve the design pressure specified. Substitute anchoring systems used for substrates not specified by the fenestration manufacturer shall provide equal or greater anchoring performance as demonstrated by accepted engineering practice.

1714.5.4.2 Masonry, concrete or other structural substrate. Where the wood shim or buck thickness is less than $1^1/_2$ inches (38 mm), window and door assemblies shall be anchored through the main frame or by jamb clip

construction are permitted to be reinforced as required by rational analysis but not less than a minimum of one No. 4 bar, without ties or spirals, when detailed so the pier is not subject to lateral loads and the soil is determined to be of adequate stiffness.

2. Isolated piers supporting posts and bracing from decks and patios appurtenant to Group R-3 and U occupancies not exceeding two stories of light-frame construction are permitted to be reinforced as required by rational analysis but not less than one No. 4 bar, without ties or spirals, when the soil is determined to be of adequate stiffness.
3. Piers supporting the concrete foundation wall of Group R-3 and U occupancies not exceeding two stories of light-frame construction are permitted to be reinforced as required by rational analysis but not less than two No. 4 bars, without ties or spirals, when the soil is determined to be of adequate stiffness.
4. Reserved.

1812.5 Concrete placement. Concrete shall be placed in such a manner as to ensure the exclusion of any foreign matter and to secure a full-sized shaft. Concrete shall not be placed through water except where a tremie or other approved method is used. When depositing concrete from the top of the pier, the concrete shall not be chuted directly into the pier but shall be poured in a rapid and continuous operation through a funnel hopper centered at the top of the pier.

1812.6 Belled bottoms. Where pier foundations are belled at the bottom, the edge thickness of the bell shall not be less than that required for the edge of footings. Where the sides of the bell slope at an angle less than 60 degrees (1 rad) from the horizontal, the effects of vertical shear shall be considered.

1812.7 Masonry. Where the unsupported height of foundation piers exceeds six times the least dimension, the allowable working stress on piers of unit masonry shall be reduced in accordance with ACI 530/ASCE 5/TMS 402.

1812.8 Concrete. Where adequate lateral support is not provided, and the unsupported height to least lateral dimension does not exceed three, piers of plain concrete shall be designed and constructed as pilasters in accordance with ACI 318. Where the unsupported height to least lateral dimension exceeds three, piers shall be constructed of reinforced concrete, and shall conform to the requirements for columns in ACI 318.

Exception: Where adequate lateral support is furnished by the surrounding materials as defined in Section 1808.2.9, piers are permitted to be constructed of plain or reinforced concrete. The requirements of ACI 318 for bearing on concrete shall apply.

1812.9 Steel shell. Where concrete piers are entirely encased with a circular steel shell, and the area of the shell steel is considered reinforcing steel, the steel shall be protected under the conditions specified in Section 1808.2.17. Horizontal joints in the shell shall be spliced to comply with Section 1808.2.7.

1812.10 Dewatering. Where piers are carried to depths below water level, the piers shall be constructed by a method that will provide accurate preparation and inspection of the bottom, and the depositing or construction of sound concrete or other masonry in the dry.

SECTIONS 1813 – 1815
RESERVED

SECTION 1816
TERMITE PROTECTION

1816.1 Termite protection. Termite protection shall be provided by registered termiticides, including soil-applied pesticides, baiting systems and pesticides applied to wood, or other approved methods of termite protection labeled for use as a preventative treatment to new construction. See Section 202, Registered Termiticide. Upon completion of the application of the termite protective treatment, a certificate of compliance shall be issued to the building department by the licensed pest control company that contains the following statement: "The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accordance with rules and laws established by the Florida Department of Agriculture and Consumer Services."

1816.1.1 If soil treatment is used for subterranean termite prevention, the initial chemical soil treatment inside the foundation perimeter shall be done after all excavation, backfilling and compaction is complete.

1816.1.2 If soil treatment is used for subterranean termite prevention, soil area disturbed after initial chemical soil treatment shall be retreated with a chemical soil treatment, including spaces boxed or formed.

1816.1.3 If soil treatment is used for subterranean termite prevention, space in concrete floors boxed out or formed for the subsequent installation of plumbing traps, drains or any other purpose shall be created by using plastic or metal permanently placed forms of sufficient depth to eliminate any planned soil disturbance after initial chemical soil treatment.

1816.1.4 If soil treatment is used for subterranean termite prevention, chemically treated soil shall be protected with a minimum 6 millimeter vapor retarder to protect against rainfall dilution. If rainfall occurs before vapor retarder placement, retreatment is required. Any work, including placement of reinforcing steel, done after chemical treatment until the concrete floor is poured, shall be done in such manner as to avoid penetrating or disturbing treated soil.

1816.1.5 If soil treatment is used for subterranean termite prevention, concrete overpour or mortar accumulated along the exterior foundation perimeter shall be removed prior to exterior chemical soil treatment to enhance vertical penetration of the chemicals.

1816.1.6 If soil treatment is used for subterranean termite prevention, chemical soil treatments shall also be applied under all exterior concrete or grade within 1 foot (305 mm) of the primary structure sidewalls. Also, a vertical chemical barrier shall be applied promptly after construction is completed, including initial landscaping and irrigation/sprinkler

installation. Any soil disturbed after the chemical vertical barrier is applied shall be promptly retreated.

1816.1.7 If a registered termiticide formulated and registered as a bait system is used for subterranean termite prevention, Sections 1816.1.1 through 1816.1.6 do not apply; however, a signed contract assuring the installation, maintenance and monitoring of the baiting system for a minimum of 5 years from the issue of the certificate of occupancy shall be provided to the building official prior to the pouring of the slab, and the system must be installed prior to final building approval. If the baiting system directions for use require a monitoring phase prior to installation of the pesticide active ingredient, the installation of the monitoring phase components shall be deemed to constitute installation of the system.

1816.1.8 If a registered termiticide formulated and registered as a wood treatment is used for subterranean termite prevention, Sections 1816.1.1 through 1816.1.6 do not apply. Application of the wood-treatment termiticide shall be as required by label directions for use, and must be completed prior to final building approval. Changes in framing or additions to framing in areas of the structure requiring treatment that occur after the initial wood treatment must be treated prior to final building approval.

1816.2 Penetration. Protective sleeves around piping penetrating concrete slab-on-grade floors shall not be of cellulose-containing materials. If soil treatment is used for subterranean termite protection, the sleeve shall have a maximum wall thickness of 0.010 inch (0.254 mm), and be sealed within the slab using a noncorrosive clamping device to eliminate the annular space between the pipe and the sleeve. No termiticides shall be applied inside the sleeve.

SECTION 1817
HIGH-VELOCITY HURRICANE ZONES – EXCAVATIONS

1817.1 General. Until provisions for permanent support have been made, all excavations shall be properly guarded and protected so as to prevent them from becoming dangerous to life and property and shall be sheet piled, braced and/or shored, where necessary, to prevent the adjoining earth from caving in; such protection to be provided by the person causing the excavation to be made. All excavations shall comply with the minimum requirements of Section 553.60, *Florida Statute* "Trench Safety Act," and 29 CFR 1926-650 (P) "Occupational Safety and Health Administration Excavation Safety Act." No excavation, for any purpose, shall extend within 1 foot (305 mm) of the angle of repose of any soil bearing footing or foundation unless such footing or foundation is first properly underpinned or protected against settlement.

1817.2 Permanent excavations. No permanent excavation shall be made nor shall any construction excavations be left on any lot that will endanger adjoining property or buildings or be a menace to public health or safety. Any such excavations made or maintained shall be properly drained and such drainage provisions shall function properly as long as the excavation exists. Permanent excavations shall have retaining walls of steel, masonry, concrete or similar approved material of sufficient strength to retain the embankment together with any surcharged loads.

1817.3 Enforcement. Where, in the opinion of the building official, an unsafe condition may result or damage may occur as the result of an excavation, he or she may order the work stopped or may approve the work of excavation subject to such limitations, as he or she may deem necessary.

SECTION 1818
HIGH-VELOCITY HURRICANE ZONES— BEARING CAPACITY OF SOIL

1818.1 Design bearing capacity. Plans for new buildings, structures or additions shall clearly identify the nature of the soil under the structure and the allowable bearing capacity used in sizing the building foundation support system.

Exception: See Section1822.1 for plans for new buildings, structures or additions that are to be supported on a piling foundation system.

1818.2 Allowable bearing capacity. Prior to the installation of any footing foundation system for new buildings, structures or additions, the building official shall be provided with a statement of allowable bearing capacity from an architect or professional engineer. Said statement shall clearly identify the allowable in-place bearing capacity of the building pad for the new building or addition and verify the existing soil conditions. The certified in-place bearing capacity shall have been determined using recognized tests or rational analysis and shall meet or exceed the design bearing capacity identified under Section 1818.1.

SECTION 1819
HIGH-VELOCITY HURRICANE ZONES— SOIL BEARING FOUNDATIONS

1819.1 General. Footings shall be constructed of reinforced concrete, as set forth in Chapter 19 (High-Velocity Hurricane Zones) of this code and in this section, and shall, insofar as is practicable, be so designed that the soil pressure shall be reasonably uniform to minimize differential settlement.

1819.2 Continuous wall footings.

1819.2.1 Footings under walls shall be continuous or continuity otherwise provided and shall be not less than required to keep the soil pressure within that set forth in Section1818 nor less than the following minimums:

3. Date and job locations identified.
4. Results of any field test conducted.

1917.2.4 Once the roof deck system can support foot traffic, the building official shall have clear access and clear path at his option for inspection of lightweight insulating concrete.

1917.3 Testing. The building official may require tests of the lightweight insulating concrete to confirm the fastener withdrawal resistance, compressive strength or drainage ability.

1917.3.1 Existing roof assemblies to receive lightweight insulating concrete other than galvanized G-90 steel deck or structural concrete deck shall be tested for uplift for adhesion to the substrate to confirm compliance with design pressure.

1917.4 Materials and limitations of use. Lightweight insulating concrete, in conjunction with galvanized formed steel sheets, shall not be used as a roof deck in areas where highly corrosive chemicals are used or stored.

1917.4.1 Lightweight insulating concrete shall be poured over bottom slotted galvanized (G-90) steel decking as follows; cellular, 0.5 percent open; hybrid, 0.75 percent open, aggregate 1.5 percent open. No lightweight insulating concrete shall be poured over a painted or non-galvanized steel deck.

1. Lightweight insulating concrete over structural concrete slabs, twin tees, precast units or other non venting substrates shall be vented to allow the escape of excess moisture.

1917.4.2 Minimum thickness of lightweight insulating concrete shall be 2 inches (51 mm) over the top plane of the substrate unless otherwise specified in the Product Approval. Lightweight insulating concrete shall be of sufficient thickness to receive the specified base ply fastener length.

1917.4.3 Reserved.

1917.4.4 Galvanized coatings of formed steel sheets shall be in accordance with ASTM A 525 with a minimum coating designation of G-90. Base steel shall conform to ASTM A 446, Grade A, B, C, D or greater and ASTM A 611 C, D or E.

1917.4.5 Chemical admixtures shall be in compliance with ASTM C 494. Calcium chloride or any admixture containing chloride salts shall not be used in insulating concrete. Fiber reinforcement may be used to control cracking. Mineral admixtures shall conform to ASTM C618.

1917.4.6 Vermiculite or perlite shall be in compliance with ASTM C332, Group I. Foam concentrates shall be in compliance with ASTM C796 and ASTM C869.

1917.4.7 Mixing, placing and finishing shall be in compliance with the deck system Product Approval. Slurry coating, two-density casting and double casting shall be acceptable per the specific manufacturer's recommendations.

1917.4.8 If the lightweight insulating concrete deck is to receive Product Approval for a direct-adhered roofing system, the deck surface shall be prepared to the requirements set forth in the roof system Product Approval.

1917.4.9 All base ply fasteners for use in lightweight insulating concrete roof decks shall have a Product Approval for use with the specific lightweight insulating concrete roof system in compliance with manufacturer's recommendations and the design pressure of Section 1609.

1917.4.10 The lightweight insulating concrete fastener withdrawal shall have a minimum resistance for new pours of

1. 60 pounds (267 N) in 28 days when the fastener is installed and allowed to age in the concrete.
2. 40 pounds (178 N) at time of roofing.

1917.4.11 Lightweight insulating concrete system expansion joints shall be provided at the following locations:

1. Where expansion joints are provided in the structural assembly.
2. Where steel framing, structural steel or decking change direction
3. Where separate wings of "L," "U," "T" or similar configurations exist
4. Where the type of decking changes (for example, where a precast concrete deck and a steel deck abut)
5. Whenever additions are connected to existing buildings.
6. At junctions where interior heating conditions change
7. Wherever differential movement between vertical walls and the roof deck may occur.

1917.4.12 Insulation board with lightweight insulating concrete shall conform to Type I expanded polystyrene insulation as defined in ASTM C578.

1. Packaged insulation board delivered to the job site shall comply with the provisions of Section 2603.2 or Section 2612.1.3.
2. Installation of insulating board in conjunction with lightweight insulating concrete shall comply with uplift requirements set forth in Section 1609. Insulation panels shall be placed in a minimum $^{1}/_{8}$-inch (3.2 mm) slurry bed of insulating concrete while the material is still in a plastic state. The insulating concrete shall be cast over the insulation boards according to the insulating concrete manufacturer's Product Approval. Insulation panels shall be provided with holes and/or slots for keying and venting.

1917.4.13 Reinforcing mesh shall be provided as required to meet fire-rating and/or special structural design requirements. Refer to a specific Product Approval for the specific requirements applicable to the product being installed.

SECTION 1918
SPECIAL WIND PROVISIONS FOR CONCRETE

1918.1 Reinforced concrete components. The design and construction of reinforced concrete components for buildings sited in areas with a basic wind speed greater than 100 mph (45 m/s) in accordance with Figure 1609 shall conform to the

requirements of ACI 318 or with Section 1609.1.1, Exception 3, as applicable, except as modified in this section.

1918.2 Insulated concrete form wall. Insulated concrete form (ICF) wall construction for buildings shall be in accordance with ACI 318 or with Section 1609.1.1, Exception 2, as applicable.

1918.3 Gable endwalls.

1918.3.1 General. Gable endwalls shall be structurally continuous between points of lateral support.

1918.3.2 Cathedral endwalls. Gable endwalls adjacent to cathedral ceilings shall be structurally continuous from the uppermost floor to ceiling diaphragm or to the roof diaphragm.

SECTION 1919
HIGH-VELOCITY HURRICANE ZONES—GENERAL

1919.1 Scope. This section prescribes requirements for reinforced concrete in construction regulated by this code.

1919.2 Application. Reinforced concrete shall be of the materials, proportions strength and consistency as set forth in this section and shall be designed by methods admitting of rational analysis according to established principles of mechanics.

1919.3 Requirements. All structures of reinforced concrete, including prestressed concrete, shall be designed and constructed in accordance with the provisions of ACI 318 as adopted herein.

1919.4 Workmanship. Concrete construction shall be in conformance with the tolerance, quality and methods of construction set forth in Section1920.

SECTION 1920
HIGH-VELOCITY HURRICANE ZONES — STANDARDS

1920.1 The following standards are hereby adopted as part of this code as set forth in Chapter 35 of this code.

1920.2 American Concrete Institute (ACI).

1. Standard Tolerances for Concrete Construction and Materials, ACI 117.
2. Specifications for Structural Concrete for Buildings, ACI 301.
3. Manual of Standard Practice for Detailing Reinforced Concrete Structures, ACI 315.
4. Building Code Requirements for Reinforced Concrete, ACI 318.
5. Recommended Practice for Concrete Formwork, ACI 347.
6. Recommended Practice for Shotcreting, ACI 506.
7. Specification for Materials, Proportioning, and Application of Shotcrete, ACI 506.2.
8. Deformed and Plain Billet Steel Bars for Concrete Reinforcement, ASTM A615, including S1.

1920.3 American National Standards Institute (ANSI)/American Society of Civil Engineers (ASCE).

1. Specifications for the Design and Construction of Composite Slabs and Commentary on Specifications for the Design and Construction of Composite Slabs, ANSI/ASCE 3.
2. Guideline for Structural Assessment of Existing Buildings, ANSI/ASCE 11.

1920.4 American Society for Testing Materials (ASTM).

1. Deformed and Plain Billet Steel Bars for Concrete Reinforcement, ASTM A 615, including S1.
2. Testing Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation, ASTM C 1077.

SECTION 1921
HIGH-VELOCITY HURRICANE ZONES—DEFINITIONS

1921.1 The following definitions apply to the provisions of Sections 1919 through 1929.

PLAIN CONCRETE. Concrete that is either unreinforced or contains less reinforcement than the minimum amount specified for reinforced concrete.

REINFORCED CONCRETE. Concrete reinforced with no less than the minimum amount required by ACI 318, prestressed or non-prestressed, and designed on the assumption that the two materials act together in resisting forces.

PRESTRESSED CONCRETE. Reinforced concrete in which internal stresses have been introduced to reduce potential tensile stresses in concrete resulting from loads, The term prestressed concrete refers to pretensioned concrete in which the reinforcing is tensioned before hardening of the concrete, to postensioned concrete in which the reinforcing is tensioned after hardening of the concrete, or combinations of both pretensioning and posttensioning.

PRECAST CONCRETE. Plain or reinforced concrete elements cast elsewhere than their final position in a structure.

SHOTCRETE. Mortar or concrete pneumatically projected at high velocity onto a surface.

SECTION 1922
HIGH-VELOCITY HURRICANE ZONES—MATERIALS

1922.1 Cements. Cements shall conform to one of the following specifications for portland cement as set forth in Chapter 35.

1. Portland Cement, ASTM C 150.
2. Blended Hydraulic Cements, ASTM C 595, excluding Types S and SA, which are not intended as principal cementing constituents of structural concrete.

1922.2 Aggregates for concrete shall conform to one of the following specifications as set forth in Chapter 35 of this code or Section 1922.2.1.

1. Concrete Aggregates, ASTM C 33.

CHAPTER 20
ALUMINUM

SECTION 2001
GENERAL

2001.1 Scope. Provisions of this chapter shall govern the quality, design, fabrication and erection of aluminum alloys used in building construction.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Section 2003.

SECTION 2002
MATERIALS

2002.1 General. The quality, design, fabrication and erection of aluminum used structurally in buildings or structures shall conform to good engineering practice, the provisions of this chapter and other applicable requirements of this code.

Exception: All buildings located within the high-velocity hurricane zone shall comply with the requirements of Section 2003.

2002.2 Structural aluminum construction. The design, fabrication and assembly of structural aluminum for buildings or structures shall conform to AA ASM 35 and Specifications for Aluminum Structures, Aluminum Design Manual, Part 1-A and 1-B, of the Aluminum Association. The use of aluminum alloys not listed in the manual shall be permitted provided their standard of performance is not less than those required in the manual and the performance is substantiated to the satisfaction of the building official.

2002.2.1 Definitions

PRIMARY MEMBER. Structural framing members providing structural support to other members and/or surfaces of a structure including, but not limited to beams, posts, columns, joists, structural gutters, headers, eave rail, purlins, roof brace.

SECONDARY MEMBERS. Structural framing members which do not provide basic support for the entire structure, generally including, but not limited to, such members as kickplate rails, chair rails, roof or wall panels, wall brace.

STRUCTURAL MEMBERS. Members or sections that provide support to an assembly and/or resist applied loads.

2002.3 Screen enclosures.

2002.3.1 Actual wall thickness of extruded aluminum members shall be not less than 0.040 inch (1 mm).

2002.3.2 Reserved.

2002.3.3 Vinyl and acrylic panels shall be removable. Removable panels shall be identified as removable by a decal. The identification decal shall essentially state "Removable panel SHALL be removed when wind speeds exceed 75 mph (34 m/s)." Decals shall be placed such that the decal is visible when the panel is installed.

2002.4 Loads. Structural members supporting screened enclosures shall be designed for wind in both of two orthogonal directions using the pressures given in Table 2002.4. Each primary member shall also be designed for a 300 pound (1.33 kN) load applied vertically downward along any 1 foot (305 Mm) of any member, not occurring simultaneously with wind load.

2002.4.1 The following design guides shall be accepted as conforming to accepted engineering practices:

AAF Guide to Aluminum Construction in High Wind Areas.

2002.5 Wall panels. The minimum thickness for formed sheet aluminum structural wall panels shall be not less than 0.024 inch (0.6 mm), subject to approved tolerances.

2002.6 Sunrooms. Sunrooms shall comply with AAMA/NPEA/NSA 2100 with the structural requirements and testing provisions of Chapter 5 modified to incorporate ASCE 7. Sunrooms shall be categorized in one of the following categories.

Category I: A roof or a covering of an outdoor space. The openings shall be permitted to be enclosed with insect screening or 0.5 mm (20 mil) maximum thickness plastic film. The space is defined as nonhabitable and unconditioned.

Category II: A roof or a covering of an outdoor space with enclosed walls. The openings are permitted to be enclosed with translucent or transparent plastic or glass. The space is defined as nonhabitable and unconditioned.

Category III: A roof or a covering of an outdoor space with enclosed walls. The openings are permitted to be enclosed with translucent or transparent plastic or glass. The sunroom complies with additional requirements for forced-entry resistance, air-leakage resistance and water-penetration resistance. The space is defined as nonhabitable and unconditioned.

Category IV: A roof or a covering of an outdoor space with enclosed walls. The sunroom is designed to be heated and/or cooled by a separate temperature control or system and is thermally isolated from the primary structure. The sunroom complies with additional requirements for forced-entry resistance, water-penetration resistance, air-leakage resistance, and thermal performance. The space is defined as habitable and conditioned.

Category V: A roof or a covering of an outdoor space with enclosed walls. The sunroom is designed to be heated and/or cooled and is open to the main structure. The sunroom complies with additional requirements for forced-entry resistance, water-penetration resistance, air-leakage resistance, and thermal performance. The space is defined as habitable and conditioned.

TABLE 2002.4
DESIGN WIND PRESSURES FOR ALUMINUM SCREENED ENCLOSURES[a,b,c]

SURFACE	BASIC WIND SPEED (mph)											
	100		110		120		130		140		150	
	Exposure Category (B or C) Design Pressure (psf)											
	B	C	B	C	B	C	B	C	B	C	B	C
Horizontal Pressure on Windward Surfaces	12	17	13	18	15	21	18	25	21	29	24	33
Horizontal Pressure on Leeward Surfaces	10	13	10	14	13	17	14	19	15	23	18	27
Vertical Pressure - Screen Surfaces	3	5	4	5	4	6	5	7	6	8	7	9
Vertical Pressure - Solid Surfaces	10	14	11	15	13	18	15	21	17	24	20	28

For SI: 1 pound per square foot = 9.479 kN/m^2.

NOTES:

a. Pressures include importance factors determined in accordance with Table 1604.5.
b. Pressures apply to enclosures with a mean enclosure roof height of 30 feet (10 m). For other heights, multiply the pressures in this table by the factors in Table 2002.4A.
c. Apply horizontal pressures to the area of the enclosure projected on a vertical plane normal to the assumed wind direction, simultaneously inward on the windward side and outward on the leeward side.
d. Apply vertical pressures upward and downward to the area of the enclosure projected on a horizontal plane.
e. Apply horizontal pressures simultaneously with vertical pressures.
f. Table pressures are MWFRS Loads. The design of solid roof panels and their attachments shall be based on component and cladding loads for enclosed or partially enclosed structures as appropriate.
g. Table pressures apply to 20×20×0.013" mesh screen. For 18 × 14 × 0.013" mesh screen, pressures on screen surfaces may be multiplied by 0.88. For screen densities greater than 20×20×0.013", use pressures for enclosed buildings.
h. Table pressures may be interpolated using ASCE 7 methodology.

SECTION 2003
HIGH-VELOCITY HURRICANE ZONES—ALUMINUM

2003.1 Design. Aluminum members shall be designed by methods admitting of rational analysis according to established principles of mechanics.

2003.2 Standards. The design, fabrication, and erection of structural aluminum shall conform to the Aluminum Design Manual.

2003.3 Workmanship. Aluminum construction shall be in conformance with the tolerances, quality and methods of construction as set forth in Section 2003.2 and the American Welding Society's Structural Welding Code-Aluminum (D1.2).

2003.4 Definitions. Members shall be defined as in Section 2002.2.1.

2003.5 Identification. Aluminum for structural elements shall at all times be segregated or otherwise handled in the fabricator's plant so that the separate alloys and tempers are positively identified and, after completion of fabrication, shall be marked to identify the alloy and temper. Such markings shall be affixed to complete members and assemblies or to boxed or bundled shipments of multiple units prior to shipment from the fabricator's plant.

Exception: Certification by the fabricator and or contractor shall be provided attesting to the alloy and temper of the material.

TABLE 2002.4A
HEIGHT ADJUSTMENT FACTORS

MEAN ROOF HEIGHT	EXPOSURE	
	B	C
15	1	0.86
20	1	0.92
25	1	0.96
30	1	1.00
35	1.05	1.03
40	1.09	1.06
45	1.12	1.09
50	1.16	1.11
55	1.19	1.14
60	1.22	1.16

2314.4.3 APA The Engineered Wood Association (Formerly APA American Plywood Association) P.O. Box 11700, Tacoma, WA 98411

1. APA Design Construction Guide, Residential and Commercial E30D
2. Plywood Design Specification Y510J
3. Plywood Design Specification-Design and Fabrication of Plywood Beams Supplement No. 1 S811
4. Plywood Design Specification-Design and Fabrication of Plywood Beams Supplement No. 2 S812
5. Plywood Design Specification-Design and Fabrication of Plywood Stressed-Skin Panels Supplement No. 3 U813
6. Plywood Design Specifications-Design and Fabrication of Plywood Sandwich Panels Supplement No. 4 U814
7. Plywood Design Specifications-Design and Fabrication of All-Plywood Beams. Supplement No. 5 H815
8. Plywood Folded Plate, Laboratory Report 21 V910
9. APA Design/Construction Guide Diaphragms L350
10. Performance Standards and Policies for Structural-Use Panels PRP-108
11. 303 Siding Manufacturing Specifications B840

2314.4.4 American Society for Testing Materials 1916 Race Street, Philadelphia, PA 19103-1187 ASTM

1. Standard Test Methods for Mechanical Fasteners in Wood D 1761
2. Accelerated Weathering on Fire-Retardant Treated Wood for fire testing D 2898
3. Surface Burning Characteristics of Building Materials E 84
4. Hygroscopic Properties of Fire-Retardant Wood and Wood-Base Products D 3201
5. Standard Specifications for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems D 3498

2314.4.5 American Wood Preservers Association P.O. Box 361784, Birmingham, AL 35236-1784

1. AWPA Use Category Systems Standard U1.
2. AWPA Standard M4 Care of Pressure Treated Wood Products.

2314.4.6 National Institute for Standards and Technology Standard Development Services Section, Standards Application and Analysis Division, Washington, D.C. 20234 NIST

1. Mat-Formed Particleboard CS236
2. Structural Glued Laminated Timber PS56
3. Construction and Industrial Plywood PS1
4. American Softwood Lumber Standard PS20
5. Performance Standard for Wood Based Structural Use Panels PS2{*}

{*} All wood-based structural panels except plywood shall have Product Approval and shall be tested in accordance with High-Velocity Hurricane Zone Testing Protocols.

2314.4.7 American Forest and Paper Association, 1111 19 Street NW, Washington, D.C. 20036

1. ANSI/AF&PA National Design Specification for Wood Construction, 2001
2. ANSI/AF&PA Design Values for Wood Construction, 2001
3. Wood Structural Design Data, 1992
4. Span Tables for Joists and Rafters, 1993
5. Working Stresses for Joists and Rafters, 1993
6. Wood Construction Data No. 1, Details for Conventional Wood Frame Construction, 2001
7. Wood Construction Data No. 4, Plank-and-Beam Framing for Residential Building, 1989
8. Wood Construction Data No. 5, Heavy Timber Construction Details, 1989
9. Wood Construction Data No. 6, Design of Wood Frame Structures for Permanence, 1988
10. Technical Report No. 7, The Permanent Wood Foundation System, 1987
11. ANSI/AF&PA WFCM-2001, Wood Frame Construction Manual for one and Two-Family Dwellings, 2001
12. All-Weather Wood Foundation System, Design, Fabrication, Installation Manual, 1987
13. Technical Report No. 7, All-Weather Wood Foundation System Basic Requirements with Supplements, 1987

2314.4.8 Timber Company, Inc. 2402 Daniels Street, Madison, WI 53704

TECO Performance Standards and Policies for Structural use Panels. PRP-133

2314.4.9 Truss Plate Institute.
218 N. Lee Street, Suite 312, Alexandria, VA 22314

1. *National Design Standard for Metal Plate Connected Wood Truss Construction* (Excluding Chapter 2).
2. Building Component Safety Information (BCSI 1) *Guide to Good Practice for Handling, Installing & Bracing of Metal Plate Connected Wood Trusses* [A joint publication with the Wood Truss Council of America (WTCA)].

2314.4.10 Underwriters Laboratories, Inc.
333 Pfingsten Road, Northbrook, IL 60062

Test Methods for Fire Resistance of UL-790 Roof Covering Materials

SECTION 2315
HIGH-VELOCITY HURRICANE ZONES — QUALITY

2315.1 Identification. All lumber used structurally, including end-jointed lumber, shall be identified by the grade mark of a lumber grading or inspection bureau or agency approved by the Board of Review of the American Lumber Standards Committee or the Canadian Lumber Standards Administrative Board: except that precut material, rough-sawn lumber and lumber thicker than 2 inches (51 mm) may be covered by a certificate of inspection in lieu of grade marking. The glued joints in end-jointed lumber, when used for load supporting purposes, shall be certified to be in accordance with the appropriate grading rules.

2315.1.1 Structural glued-laminated timber shall be manufactured and identified as required in ANSI/AITC 190.1 as adopted in Section 2314.4.

2315.1.2 All wood-based structural panels used structurally, including siding, roof sheathing, wall sheathing, floor sheathing, diaphragms and built-up members, shall be identified for grade and exposure level by the grade stamp of an approved testing and grading agency indicating conformance with PS-1, PS-2, APA PRP-108 or TECO PRP-133 as adopted in Section 2314.4.

2315.1.3 Wood shingles and/or shakes shall be identified by the grademark of an approved grading or inspection bureau or agency.

2315.1.4 Fiberboard for its various uses shall conform to ANSI/AHA A 194.1.

2315.1.5 Hardboard shall conform to AHA Standards as adopted in Section 2314.4, and shall be identified as to classification.

2315.1.6 Particleboard shall conform to the *Mat-Formed Particleboard Standard,* NIST CS Section 236, as adopted in Section 2314.4.6, and shall be identified by the grade mark or certificate of inspection issued by an approved agency.

2315.1.7 All lumber and wood-based structural panels required to be fire retardant treated shall bear permanent identification showing the fire performance rating thereof issued by an approved testing agency having a follow-up service. When exposed to the weather the material shall be permanently identified as suitable for such use in accordance with Section 2327.4. When exposed to sustained high humidity, the material shall be permanently identified as a low hygroscopic type suitable for interior use. Allowable design values, including connection design values, for lumber, glued laminated timber and wood-based structural panels, pressure treated with fire retardant chemicals shall be obtained from the company providing the treatment and redrying services. Listing of allowable design values shall be submitted and approved by the certification agency.

2315.1.8 All lumber, sawn timber, wood-based structural panels and poles supporting permanent structures and required by this code to be pressure treated and as described in the AWPA standards shall bear the quality mark of an approved inspection agency which maintains continued supervision, testing and inspection over the product. Agencies shall be accredited in accordance with the procedures of the American Lumber Standard (PS 20) or approved equivalent.

2315.1.9 Pressure-treated poles shall be treated in accordance with AWPA U1 for sawn timber posts (Commodity Specification A, Use Category 4B) and for round timber posts (Commodity Specification B, Use Category 4B). *

2315.1.10 The quality mark shall contain, as a minimum, the following information:

1. The treating company and plant location.
2. The AWPA standard to which the product is treated.
3. The trademark of an approved inspection agency which maintains continued supervision, testing and inspection over the quality of the product as described in the AWPA standards.
4. The preservative used.
5. The amount of retention of the chemical per cubic foot of wood.
6. If applicable, the method of drying after treatment.
7. The purpose for which the wood has been treated: ground contact, above ground or foundation.

   Exception: When the size of individual pieces, e.g. lumber less than 1 inch (25 mm) in nominal thickness, or lumber less than nominal 1inch by 5 inches (25 mm by 127 mm) or 2 inches by 4 inches (25 mm by 127 mm), or lumber 36 inches (914 mm) and shorter, except that $^5/_4$ by 4 shall be quality marked, prevents application of full legible marks, the quality mark shall be applied by stamping the faces of exterior pieces or by end labeling not less than 2 percent of the pieces of a bundled unit.

2315.1.11 All wood-based structural panels, including those made of fiberboard, hardboard and particleboard shall have Product Approval. Product Approval shall be given upon certification by an approved independent testing laboratory that the product:

1. Complies with the applicable standards set forth above.
2. The product complies with the manufacturer's published design properties before and after a wet-dry, wet-dry cycle.
3. The product when tested dry maintains a safety factor of 2:1 and when tested after the cycles specified in Section 2315.1.11(2) above maintains a safety

factor of 1.5:1. Testing shall be as specified in the testing protocol.

2315.2 Wood-based structural panels permanently exposed in outdoor locations shall be rated for exterior use. When used for roof sheathing exposed to the outdoors on the underside or used structurally for wall, floor or roof cladding or for diaphragms, the panels shall be rated for Exposure 1 or exterior use.

2315.3 All lumber 2 inches (51 mm) or less in thickness shall contain not more than 19 percent moisture at the time of permanent incorporation in a building or structure and/or at the time of treatment with a wood preservative.

2315.4 Grade and species.

2315.4.1 All structural wood members not limited by other sections of this chapter shall be of sufficient size and capacity to carry all loads as required by the high-velocity hurricane provisions of Chapter 16 without exceeding the allowable design stresses specified in the *National Design Specification for Wood Construction* and in compliance with Section 2317.

2315.4.2 Lumber boards used for floor and roof sheathing shall be in accordance with Table 2315.4.2

TABLE 2315.4.2
MINIMUM GRADE REQUIREMENTS: BOARD GRADES

FLOOR OR ROOF SHEATHING	GRADING RULES
Utility	NLGA, WCLIB or WWPA
No. 4 Common or Utility	NLGA, WCLIB, WWPA, NHPMA or NELMA
No. 3	SPIB
Merchantable	RIS

SECTION 2316
HIGH-VELOCITY HURRICANE ZONES — SIZES

2316.1 Sizes of lumber, structural glued-laminated timber and plywood and other wood-based structural panels referred to in this code are nominal sizes.

2316.2 Computations to determine the required sizes of members shall be based on net dimensions (actual sizes).

SECTION 2317
HIGH-VELOCITY HURRICANE ZONES — UNIT STRESSES

2317.1 General.

2317.1.1 Lumber used for joists, rafters, trusses, columns, beams and/or other structural members shall be of no less strength than No. 2 grade of Southern Pine, Douglas Fir-Larch, Hem-Fir or Spruce-Pine-Fir. Joists and rafters shall be sized according to AF&PA Span Tables for Joists and Rafters adopted in Section 2314.4.

2317.1.2 Lumber used for studs in exterior walls and interior bearing walls shall be of no less strength than stud grade of Southern Pine, Douglas Fir-Larch, Hem-Fir or Spruce-Pine-Fir and capable of resisting all loads determined in accordance with Chapter 16 (High-Velocity Hurricane Zones). The unbraced height of the wall shall be no more than 8 feet 6 inches (2.6 m) (including top and bottom plates). Heights may be increased where justified by rational analysis prepared by a registered professional engineer or registered architect proficient in structural design.

2317.1.3 Lumber used for studs in interior non-bearing walls shall have a modulus of elasticity of no less than 0.9×10^6 pounds per square inch.

2317.1.4 The designer shall specify on the design drawings the size, spacing, species and grade of all load supporting members.

2317.2 Allowable stress design value may be modified for repetitive, duration, etc., factors where design is by a registered professional engineer or registered architect proficient in structural design or where such modified values are reflected in the tables of the standards in Section 2314.4.

SECTION 2318
HIGH-VELOCITY HURRICANE ZONE — VERTICAL FRAMING

2318.1 Studs in bearing and exterior walls. Studs in walls framing over 8 feet 6 inches (2.6 m) (including top and bottom plates) or supporting floor and roof loads shall be designed by rational analysis prepared by a registered professional engineer or registered architect proficient in structural design.

2318.1.1 Minimum size. Studs shall be not less than 2 inch by 6 inch for exterior walls or 2 inch by 4 inch (51 mm by 102 mm) for interior bearing or load resisting walls unless designed by rational analysis by a registered professional engineer or registered architect proficient in structural design.

2318.1.2 Spacing. Studs shall be spaced not more than 16 inches (406 mm) on center unless designed by rational analysis as a system of columns and beams by a registered professional engineer or registered architect proficient in structural design.

2318.1.3 Placing.

2318.1.3.1 Studs in exterior and bearing walls shall be placed with the longer dimension perpendicular to the wall.

2318.1.3.2 Studs in exterior walls and in bearing walls shall be supported by foundation plates, sills, or girders or floor framing directly over supporting walls or girders. Stud bearing walls when perpendicular to support-

ing joists may be offset from supporting walls or girders not more than the depth of the joists unless such joists are designed for the extra loading conditions.

2318.1.3.3 Stud walls framing into base plates of exterior walls and interior bearing walls resting on masonry or concrete shall be anchored past the plate to the masonry or concrete, or shall be anchored to a sill plate which is anchored in accordance with Section 2318.1.4.1 when the net wind uplift is up to 300 pounds per foot (4378 N/m).

2318.1.4 Sills and/or base plates.

2318.1.4.1 Sills and/or base plates, where provided in contact with masonry or concrete, shall be of an approved durable species or be treated with an approved preservative and shall be attached to the masonry or concrete with $^1/_2$ inch (13 mm) diameter bolts with oversized washer spaced not over 2 feet (610 mm) apart and embedded not less than 7 inches (178 mm) into a grout filled cell of masonry or into concrete. Base plates shall be placed in a recess $^3/_4$ inch (19 mm) deep and the width of the base plate at the edge of a concrete slab, beam/slab or any other type of construction which uses a masonry surface or concrete slab, or be provided with an alternate waterstop method as approved by the building official. Alternate methods of anchorage may be designed by rational analysis by a registered professional engineer or a registered architect proficient in structural design.

2318.1.4.2 Where the base plate of a bearing wall is supported on joists or trusses running perpendicular to the wall and the studs from the wall above do not fall directly over a joist or truss, a double base plate or a single base plate supported by a minimum 2 inch by 4 inch (51 mm by 102 mm) inset ribbon shall be used to support the upper stud wall.

2318.1.5 Top plates.

2318.1.5.1 The top plate of stud bearing walls shall be doubled and lapped at each intersection of walls and partitions.

2318.1.5.2 Joints shall be lapped not less than 4 feet (1219 mm).

2318.1.6 Corners. Corners of stud walls and partitions shall be framed solid by not less than three studs.

2318.1.7 Splicing. Studs, other than end-jointed lumber, shall be spliced only at points where lateral support is provided.

2318.1.8 Framing types.

2318.1.8.1 Wood framing may be any one, or a combination of, the following types: platform, balloon, plank and beam or pole type.

2318.1.8.2 Exterior stud walls of two-story buildings shall be balloon-framed with studs continuous from foundation to second floor ceiling and with second floor joists supported as indicated in Section 2319.3.3. Gable end walls in wood frame buildings shall be balloon framed with studs continuous from foundation to roof.

Exception: Platform framing is allowed in buildings over one story in height provided an additional mandatory inspection for floor level connectors is made before the framing/firestopping inspection. Gable end walls shall be balloon framed with studs continuous from top floor to roof.

2318.1.9 Notching.

2318.1.9.1 Studs that carry loads in excess of 75 percent of their capacity shall not be notched or cut.

2318.1.9.2 Studs that carry loads 75 percent or less of their capacity may be notched to one-third of the depth without limit of the number of consecutive studs.

2318.1.10 Pipes in walls.

2318.1.10.1 Stud walls and partitions containing pipes shall be framed to give proper clearance for the piping.

2318.1.10.2 Where walls and partitions containing piping are parallel to floor joists, the joists shall be doubled and may be spaced to allow vertical passage of pipes.

2318.1.10.3 Where vertical pipe positions necessitate the cutting of plates, a metal tie not less than 1 inch by $^1/_8$ inch (25 mm by 3 mm) shall be placed on each side of the plate across the opening and nailed with not less than two 16d or three 8d nails at each end.

2318.1.11 Headers.

2318.1.11.1 All headers in bearing walls shall be designed by rational analysis.

2318.1.11.2 Headers or lintels over stud wall openings shall have not less than nominal 2-inch (51 mm) bearings.

2318.1.12 Studs joining masonry or reinforced concrete walls. Where stud walls or partitions join masonry or concrete walls, such studs shall be secured against lateral movement by bolting to the masonry or concrete with $^1/_2$ inch (13 mm) diameter anchor bolts with oversized washer spaced not more than 4 feet (1219 mm) apart and embedded not less than 5 inches (127 mm) into a grout filled cell or into concrete or as designed by a registered professional engineer or registered architect proficient in structural design using rational analysis.

2318.1.13 Wind bracing. Exterior stud walls shall be effectively wind-braced in accordance with Section 2322.3.

2324.5 Safe loads and design practice for types of connectors not mentioned or fully covered herein shall be determined by the building official before approval.

SECTION 2325
HIGH-VELOCITY HURRICANE ZONES–WOOD SUPPORTING MASONRY

2325.1 Wood shall not support masonry or concrete except as permitted in Sections 2325.2 and 2325.3.

2325.2 Wood foundation piles may be used to support concrete or masonry.

2325.3 Plywood decking and approved wood panels, wood joists and wood studs supporting such wood joists may be used to support reinforced concrete slabs, concrete-base tile and terrazzo floors and lightweight concrete toppings as follows:

1. There shall be an approved moisture vapor barrier between the concrete or other cementitious materials and the wood.
2. Wood members supporting concrete shall be preservative treated in compliance with AWPA Use Category Systems Standard U1, Commodity Specification A Use Category 4B set forth in Sections 2314.4 and 2326.
3. Approved wood-based structural-use panel decking shall be rated for Exposure 1.
4. Wood rafters may support concrete roof tile.

SECTION 2326
HIGH-VELOCITY HURRICANE ZONES — PROTECTION OF WOOD

2326.1 Wood piles shall be treated with preservatives as set forth in Section 1823.1.2.

2326.2 Preservative treated or durable species wood.

2326.2.1 All wood used in areas of building or structures where the climatic condition is conducive to deterioration which would affect the structural safety shall be treated in an approved method with an approved preservative or shall be of an approved durable species.

2326.2.2 All wood in contact with or embedded in the ground that supports of permanent structures shall be approved pressure-treated wood suitable for ground contact use.

Exceptions:

1. Naturally durable wood or pressure-treated wood may be used in contact with the ground for support of structures other than buildings and walking surfaces.
2. Untreated wood may be used for supports where entirely below water level and continuously submerged in fresh water.

2326.2.3 Sleepers and sills on concrete slabs in contact with the ground, wood joists and the underside of wood structural floors without joists less than 18 inches (457 mm) above ground; or wood girders less than 12 inches (305 mm) from exposed ground within the crawl space under buildings, shall be treated in an approved method with an approved preservative, or shall be of an approved durable species.

TABLE 2324.1
NAIL CONNECTION FOR WOOD MEMBERS

CONNECTION	COMMON NAILS	NUMBER OR SPACING
Joists to sill or girder, toe nail	16d	2
Bridging to joist, toe nail	8d	2 each end
1-inch x 6-inch subfloor or less to each joist, face nail	8d	2
Over 1-inch x 6-inch subfloor to each joist, face nail	8d	3 + 1 for each size increase
2-inches subfloor to joist or girder, blind and face nail	16d	2
Sole plate to joist or blocking, face nail	16d	16 inches o.c.
Top or sole plate to stud, end nailed	16d	2
Stud to sole plate, toe nail	3d	3 or 2 16d
Doubled studs, face nail	16d	24 inches o.c.
Doubled top plates, face nail	16d	16 inches o.c.
Top plates, laps and intersections, face nail	16d	2
Continuous header, two pieces	16	16 inches o.c.along each edge
Ceiling joists to plate, toe nail	16d	2
Continuous header to stud, toe nail	16d	3
Ceiling joists, laps over partitions, face nail	16d	3
Ceiling joists to parallel rafters, face nail	16d	3
Rafter plate, toe nail	16d	3
1-inch x 6-inch sheathing or less, to each bearing, face nail	8d	2
Over 1-inch x 6-inch sheathing, to each bearing, face nail	8d	3 + 1 for each size increase
Built-up corner studs, face nail	16d	30 inches o.c.
Built-up girders and beams	20d	32 inches o.c. At top and bottom and staggered, 2 at ends and at each splice
2-inch planks	16d	2 each bearing

For SI: 1 inch = 25.4 mm.
NOTE: In spacing specifications, o.c. means "on-center."

2326.2.4 All wood not separated from and/or in direct contact with concrete masonry, including sills, sleepers, plates, posts, columns, beams, girders and furring; shall be treated in an approved method with and approved preservative, or shall be of an approved durable species.

2326.2.5 The expression "pressure treated wood" refers to wood meeting the retention, penetration and other requirements applicable to the species, product, treatment and conditions of use in the approved standards of the American Wood Preservers Association (AWPA). Quality Control Program for Softwood Lumber, Timber and Plywood Pressure Treated with Water-borne Preservatives for Ground Contact Use in Residential and Light Commercial Foundations for the American Wood Preservers Bureau.

2326.2.6 The expression "durable wood" refers to the heartwood of the following species with the exception that an occasional piece with corner sapwood may be included if 90 percent or more of the width of each side on which it occurs is heartwood:

Decay resistant: Redwood, Cedars, Black Locust.

Termite resistant: Redwood, Bald and Eastern Red Cedar.

2326.2.7 Where durable species of wood are used as structural members in buildings and structures, the stress grade shall be not less than that required in Section 2317.

2326.2.8 When wood pressure treated with a waterborne preservative is used in enclosed locations where drying in service cannot readily occur, such wood shall have a moisture content of 19 percent or less before being covered with insulation, interior wall finish, floor covering or other material.

2326.2.9 All wood framing less than 8 inches (203 mm) from exposed earth in exterior walls that rest on concrete or masonry foundations shall be approved naturally durable species or pressure treated wood.

2326.2.10 All posts, poles and columns embedded in concrete which is in contact with ground and supporting permanent structures shall be approved pressure treated wood suitable for ground contact use except naturally durable wood may be used for posts, poles and columns embedded in concrete for structures other than buildings and walking surfaces or in structures where wood is above ground level and not exposed to the weather.

2326.2.11 For conditions not specifically covered, compliance with American Forest & Paper Product Association Wood Construction Data #6 "Design of Wood Frame Structures for Permanence" shall be deemed as compliance with this code.

2326.3 Ventilation.

2326.3.1 Ventilation of crawl spaces. Crawl spaces under buildings without basements shall be ventilated by approved mechanical means or by openings in foundation walls. Ventilation openings shall be covered with a corrosion-resistant wire mesh with openings not greater than $^1/_{16}$ inch (1.6 mm).

2326.3.1.1 Where practicable, ventilating openings shall be arranged on three sides.

2326.3.1.2 The minimum total area of ventilating openings shall be 2 square feet (0.19 m^2) for each 15 linear feet (4.6 m) or a fraction thereof of exterior wall. Such opening need not be placed in the front of the building. Where mechanical ventilation is used, the ventilation rate shall be at least six air changes per hour.

2326.3.2 Ventilation of attic spaces. Attic space between ceiling joists and roof rafters shall be effectively cross-ventilated by approved mechanical means or with vent openings. The ratio of total net free ventilating area to the area of the ceiling shall be not less than $^1/_{150}$.

Exception: The venting ratio may be reduced to $^1/_{300}$ where at least 50 percent of the installed ventilating area is provided by a ventilation system located in the upper portion of the space to be ventilated [within 18 inches (457 mm) of ridge]. The balance of the required ventilation shall be provided by eave or cornice vents.

2326.3.2.1 Where practical, ventilating openings shall be arranged on three sides.

2326.3.2.2 Where mechanical ventilation is used, the ventilation rate shall be at least six air changes per hour.

2326.3.2.3 All openings into the attic space of any habitable building shall be covered with screening, hardware cloth or equivalent to prevent the entry of birds, squirrels, rodents, etc. The openings therein shall not exceed $^1/_8$ inch (3.2 mm).

2326.3.2.4 For existing structures that were built before 1992 without soffit ventilation, and where in the opinion of the building official the soffit ventilation would be impossible or impractical to install, the building official may determine the extent to which the existing structure shall be made to conform to the requirements of this section.

2326.4 Debris.

2326.4.1 Before any new building is erected, all stumps and roots shall be removed from the soil to a depth of at least 12 inches (305 mm) below the surface of the ground in the area to be occupied by the building.

2326.4.2 In buildings or portions thereof having wood first-floor systems, all wood forms which have been used in placing concrete, if within the ground or less than 18 inches (457 mm) above the ground, shall be removed before the building is occupied or used for any purpose.

2326.4.3 Loose or casual wood shall not be stored in direct contact with the ground under any building, and this space must be thoroughly cleaned of all wood and debris.

2326.5 Termite protection. All buildings shall have a pre-construction treatment protection against subterranean termites. The rules and laws as established by the Florida Department of Agriculture and Consumer Services shall be deemed as approved with respect to pre-construction soil treatment for protection against subterranean termites. A certificate of compliance shall be issued to the building department by the licensed pest control company that contains the following statement: "The building has received a complete treatment for the prevention of subterranean termites. Treatment is in accor-

CHAPTER 24
GLASS AND GLAZING

SECTION 2401
GENERAL

2401.1 Scope. The provisions of this chapter shall govern the materials, design, construction and quality of glass, light-transmitting ceramic and light-transmitting plastic panels for exterior and interior use in both vertical and sloped applications in buildings and structures.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 2410 through 2415.

2401.2 Glazing replacement. The installation of replacement glass shall be as required for new installations.

SECTION 2402
DEFINITIONS

2402.1 Definitions. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

DALLE GLASS. A decorative composite glazing material made of individual pieces of glass that are embedded in a cast matrix of concrete or epoxy.

DECORATIVE GLASS. A carved, leaded or Dalle glass or glazing material whose purpose is decorative or artistic, not functional; whose coloring, texture or other design qualities or components cannot be removed without destroying the glazing material and whose surface, or assembly into which it is incorporated, is divided into segments.

SECTION 2403
GENERAL REQUIREMENTS FOR GLASS

2403.1 Identification. Each pane shall bear the manufacturer's mark designating the type and thickness of the glass or glazing material. With the exception of tempered glazing materials or laminated materials, the identification shall not be omitted unless approved and an affidavit is furnished by the glazing contractor certifying that each light is glazed in accordance with approved construction documents that comply with the provisions of this chapter. Safety glazing shall be identified in accordance with Section 2406.2.

Each pane of tempered glass, except tempered spandrel glass, shall be permanently identified by the manufacturer and each pane of laminated glass shall be permanently identified with the laminator, overall glass thickness and trade name of interlayer. The identification mark shall be acid etched, sand blasted, ceramic fired, laser etched, embossed or of a type that, once applied, cannot be removed without being destroyed. Tempered or laminated spandrel glass shall be provided with a removable paper marking by the manufacturer.

2403.2 Glass supports. Where one or more sides of any pane of glass are not firmly supported, or are subjected to unusual load conditions, detailed construction documents, detailed shop drawings and analysis or test data assuring safe performance for the specific installation shall be prepared by a registered design professional.

2403.3 Framing. To be considered firmly supported, the framing members for each individual pane of glass shall be designed so the deflection of the edge of the glass perpendicular to the glass pane shall not exceed $^1/_{175}$ of the glass edge length or $^3/_4$ inch (19.1 mm), whichever is less, when subjected to the larger of the positive or negative load where loads are combined as specified in Section 1605.

2403.4 Interior glazed areas. Where interior glazing is installed adjacent to a walking surface, the differential deflection of two adjacent unsupported edges shall not be greater than the thickness of the panels when a force of 50 pounds per linear foot (plf) (730 N/m) is applied horizontally to one panel at any point up to 42 inches (1067 mm) above the walking surface.

2403.5 Louvered windows or jalousies. Float, wired and patterned glass in louvered windows and jalousies shall be no thinner than nominal $^3/_{16}$ inch (4.8 mm) and no longer than 48 inches (1219 mm). Exposed glass edges shall be smooth.

Wired glass with wire exposed on longitudinal edges shall not be used in louvered windows or jalousies.

Where other glass types are used, the design shall be submitted to the building official for approval.

SECTION 2404
WIND AND DEAD LOADS ON GLASS

2404.1 Vertical glass. Glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads for components and cladding. The load resistance of glass under uniform load shall be determined in accordance with ASTM E 1300. Design of exterior windows and glass doors in accordance with Section 2404.1 shall utilize the same edition of ASTM E 1300 used for testing in accordance with Section 1714.5.

The design of vertical glazing shall be based on the following equation:

$$F_{gw} \le F_{ga} \qquad \textbf{(Equation 24-1)}$$

where:.

F_{gw} is the wind load on the glass computed in accordance with Section 1609 and F_{ga} is the short duration load resistance of the glass as determined in accordance with ASTM E 1300.

2404.2 Sloped glass. Glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunrooms, sloped roofs and other exterior applications shall be designed to resist the most critical of the following combinations of loads.

$$F_g = W_o - D \qquad \textbf{(Equation 24-2)}$$

$F_g = W_i + D$ **(Equation 24-3)**

$F_g = 0.5\,W_i + D$ **(Equation 24-4)**

where:

D = Glass dead load psf (kN/m^2).

For glass sloped 30 degrees (0.52 rad) or less from horizontal,

= 13 t_g (For SI: 0.0245 t_g).

For glass sloped more than 30 degrees (0.52 rad) from horizontal,

= 13 t_g cos θ (For SI: 0.0245 t_g cos θ).

F_g = Total load, psf (kN/m^2) on glass.

t_g = Total glass thickness, inches (mm) of glass panes and plies.

W_i = Inward wind force, psf (kN/m^2) as calculated in Section 1609.

W_o = Outward wind force, psf (kN/m^2) as calculated in Section 1609.

θ = Angle of slope from horizontal.

Exception: Unit skylights shall be designed in accordance with Section 2405.5. The design of sloped glazing shall be based on the following equation:

$F_g \le F_{ga}$ **(Equation 24-5)**

F_g = Total load on the glass determined from the load combinations above.

F_{ga} = Short duration load resistance of the glass as determined according to ASTM E 1300 for Equations 24-2 and 24-3; or the long duration load resistance of the glass as determined according to ASTM E 1300 for Equation 24-4.

2404.3 Wired, patterned and sandblasted glass.

2404.3.1 Vertical wired glass. Wired glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$F_{gw} < 0.5\,F_{ge}$ **(Equation 24-6)**

where:

F_{gw} = Is the wind load on the glass computed per Section 1609.

F_{ge} = Nonfactored load from ASTM E 1300 using a thickness designation for monolithic glass that is not greater than the thickness of wired glass.

2404.3.2 Sloped wired glass. Wired glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

$F_g < 0.5\,F_{ge}$ **(Equation 24-7)**

For Equation 24-4:

$F_g < 0.3\,F_{ge}$ **(Equation 24-8)**

where:

F_g = Total load on the glass.

F_{ge} = Nonfactored load from ASTM E 1300.

2404.3.3 Vertical patterned glass. Patterned glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$F_{gw} < 1.0\,F_{ge}$ **(Equation 24-9)**

where:

F_{gw} = Wind load on the glass computed per Section 1609.

F_{ge} = Nonfactored load from ASTM E 1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between nonfactored load charts in ASTM E 1300 shall be permitted.

2404.3.4 Sloped patterned glass. Patterned glass sloped more than 15 degrees (0.26 rad) from vertical in skylights, sunspaces, sloped roofs and other exterior applications shall be designed to resist the most critical of the combinations of loads from Section 2404.2.

For Equations 24-2 and 24-3:

$F_g < 1.0\,F_{ge}$ **(Equation 24-10)**

For Equation 24-4:

$F_g < 0.6F_{ge}$ **(Equation 24-11)**

where

F_g = Total load on the glass.

F_{ge} = Nonfactored load from ASTM E 1300. The value for patterned glass shall be based on the thinnest part of the glass. Interpolation between the nonfactored load charts in ASTM E 1300 shall be permitted.

2404.3.5 Vertical sandblasted glass. Sandblasted glass sloped 15 degrees (0.26 rad) or less from vertical in windows, curtain and window walls, doors, and other exterior applications shall be designed to resist the wind loads in Section 1609 for components and cladding according to the following equation:

$F_g < 0.5\,F_{ge}$ **(Equation 24-12)**

where:

F_g = Total load on the glass.

F_{ge} = Nonfactored load from ASTM E 1300. The value for sandblasted glass is for moderate levels of sandblasting.

2404.4 Other designs. For designs outside the scope of this section, an analysis or test data for the specific installation shall be prepared by a registered design professional.

CHAPTER 26
PLASTIC

SECTION 2601
GENERAL

2601.1 Scope. These provisions shall govern the materials, design, application, construction and installation of foam plastic, foam plastic insulation, plastic veneer, interior plastic finish and trim and light-transmitting plastics. See Chapter 14 for requirements for exterior wall finish and trim.

Exception: Buildings and structures located within the high-velocity hurricane zone shall comply with the provisions of Sections 2603.8 and 2612.

SECTION 2602
DEFINITIONS

2602.1 General. The following words and terms shall, for the purposes of this chapter and as used elsewhere in this code, have the meanings shown herein.

FOAM PLASTIC INSULATION. A plastic that is intentionally expanded by the use of a foaming agent to produce a reduced-density plastic containing voids consisting of open or closed cells distributed throughout the plastic for thermal insulating or acoustical purposes and that has a density less than 20 pounds per cubic foot (pcf) (320 kg/m^3).

LIGHT-DIFFUSING SYSTEM. Construction consisting in whole or in part of lenses, panels, grids or baffles made with light-transmitting plastics positioned below independently mounted electrical light sources, skylights or light-transmitting plastic roof panels. Lenses, panels, grids and baffles that are part of an electrical fixture shall not be considered as a light-diffusing system.

LIGHT-TRANSMITTING PLASTIC ROOF PANELS. Structural plastic panels other than skylights that are fastened to structural members, or panels or sheathing and that are used as light-transmitting media in the plane of the roof.

LIGHT-TRANSMITTING PLASTIC WALL PANELS. Plastic materials that are fastened to structural members, or to structural panels or sheathing, and that are used as light-transmitting media in exterior walls.

PLASTIC, APPROVED. Any thermoplastic, thermosetting or reinforced thermosetting plastic material that conforms to combustibility classifications specified in the section applicable to the application and plastic type.

PLASTIC GLAZING. Plastic materials that are glazed or set in frame or sash and not held by mechanical fasteners that pass through the glazing material.

REINFORCED PLASTIC, GLASS FIBER. Plastic reinforced with glass fiber having not less than 20 percent of glass fibers by weight.

THERMOPLASTIC MATERIAL. A plastic material that is capable of being repeatedly softened by increase of temperature and hardened by decrease of temperature.

THERMOSETTING MATERIAL. A plastic material that is capable of being changed into a substantially nonreformable product when cured.

SECTION 2603
FOAM PLASTIC INSULATION

2603.1 General. The provisions of this section shall govern the requirements and uses of foam plastic insulation in buildings and structures.

2603.2 Labeling and identification. Packages and containers of foam plastic insulation and foam plastic insulation components delivered to the job site shall bear the label of an approved agency showing the manufacturer's name, the product listing, product identification and information sufficient to determine that the end use will comply with the code requirements.

2603.3 Surface-burning characteristics. Unless otherwise indicated in this section, foam plastic insulation and foam plastic cores of manufactured assemblies shall have a flame spread index of not more than 75 and a smoke-developed index of not more than 450 where tested in the maximum thickness intended for use in accordance with ASTM E 84. Loose fill-type foam plastic insulation shall be tested as board stock for the flame spread index and smoke-developed index.

Exceptions:

1. Smoke-developed index for interior trim as provided for in Section 2604.2.
2. In cold storage buildings, ice plants, food plants, food processing rooms and similar areas, foam plastic insulation where tested in a thickness of 4 inches (102 mm) shall be permitted in a thickness up to 10 inches (254 mm) where the building is equipped throughout with an automatic fire sprinkler system in accordance with Section 903.3.1.1. The approved automatic sprinkler system shall be provided in both the room and that part of the building in which the room is located.
3. Foam plastic insulation that is a part of a Class A, B or C roof-covering assembly provided the assembly with the foam plastic insulation satisfactorily passes FM 4450 or UL 1256. The smoke-developed index shall not be limited for roof applications.
4. Foam plastic insulation greater than 4 inches (102 mm) in thickness shall have a maximum flame spread index of 75 and a smoke-developed index of 450 where tested at a minimum thickness of 4 inches (102 mm), provided the end use is approved in accordance with Section 2603.9 using the thickness and density intended for use.

5. Flame spread and smoke-developed indexes for foam plastic interior signs in covered mall buildings provided the signs comply with Section 402.15.

2603.4 Thermal barrier. Except as provided for in Sections 2603.4.1 and 2603.9, foam plastic shall be separated from the interior of a building by an approved thermal barrier of 0.5-inch (12.7 mm) gypsum wallboard or equivalent thermal barrier material that will limit the average temperature rise of the unexposed surface to not more than 250°F (120°C) after 15 minutes of fire exposure, complying with the standard time-temperature curve of ASTM E 119. The thermal barrier shall be installed in such a manner that it will remain in place for 15 minutes based on FM 4880, UL 1040, NFPA 286 or UL 1715. Combustible concealed spaces shall comply with Section 717.

2603.4.1 Thermal barrier not required. The thermal barrier specified in Section 2603.4 is not required under the conditions set forth in Sections 2603.4.1.1 through 2603.4.1.13.

2603.4.1.1 Masonry or concrete construction. A thermal barrier is not required for foam plastic installed in a masonry or concrete wall, floor or roof system where the foam plastic insulation is covered on each face by a minimum of 1 inch (25 mm) thickness of masonry or concrete.

2603.4.1.2 Cooler and freezer walls. Foam plastic installed in a maximum thickness of 10 inches (254 mm) in cooler and freezer walls shall:

1. Have a flame spread index of 25 or less and a smoke-developed index of not more than 450, where tested in a minimum 4 inch (102 mm) thickness.
2. Have flash ignition and self-ignition temperatures of not less than 600°F and 800°F (316°C and 427°C), respectively.
3. Have a covering of not less than 0.032-inch (0.8 mm) aluminum or corrosion-resistant steel having a base metal thickness not less than 0.0160 inch (0.4 mm) at any point.
4. Be protected by an automatic sprinkler system. Where the cooler or freezer is within a building, both the cooler or freezer and that part of the building in which it is located shall be sprinklered.

2603.4.1.3 Walk-in coolers. In nonsprinklered buildings, foam plastic having a thickness that does not exceed 4 inches (102 mm) and a maximum flame spread index of 75 is permitted in walk-in coolers or freezer units where the aggregate floor area does not exceed 400 square feet (37 m^2) and the foam plastic is covered by a metal facing not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a minimum base metal thickness of 0.016 inch (0.41 mm). A thickness of up to 10 inches (254 mm) is permitted where protected by a thermal barrier.

2603.4.1.4 Exterior walls—one-story buildings. For one-story buildings, foam plastic having a flame spread index of 25 or less, and a smoke-developed index of not more than 450, shall be permitted without thermal barriers in or on exterior walls in a thickness not more than 4 inches (102 mm) where the foam plastic is covered by a thickness of not less than 0.032-inch-thick (0.81 mm) aluminum or corrosion-resistant steel having a base metal thickness of 0.0160 inch (0.41 mm) and the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

2603.4.1.5 Roofing. Foam plastic insulation under a roof assembly or roof covering that is installed in accordance with the code and the manufacturer's instructions shall be separated from the interior of the building by wood structural panel sheathing not less than 0.47 inch (11.9 mm) in thickness bonded with exterior glue, with edges supported by blocking, tongue-and-groove joints or other approved type of edge support, or an equivalent material. A thermal barrier is not required for foam plastic insulation that is a part of a Class A, B or C roof-covering assembly, provided the assembly with the foam plastic insulation satisfactorily passes FM 4450 or UL 1256.

2603.4.1.6 Attics and crawl spaces. Within an attic or crawl space where entry is made only for service of utilities, foam plastic insulation shall be protected against ignition by 1.5-inch-thick (38 mm) mineral fiber insulation; 0.25-inch-thick (6.4 mm) wood structural panel, particleboard or hardboard; 0.375-inch (9.5 mm) gypsum wallboard, corrosion-resistant steel having a base metal thickness of 0.016 inch (0.4 mm) or other approved material installed in such a manner that the foam plastic insulation is not exposed. The protective covering shall be consistent with the requirements for the type of construction.

2603.4.1.7 Doors not required to have a fire protection rating. Where pivoted or side-hinged doors are permitted without a fire protection rating, foam plastic insulation, having a flame spread index of 75 or less and a smoke-developed index of not more than 450, shall be permitted as a core material where the door facing is of metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or steel having a base metal thickness of not less than 0.016 inch (0.4 mm) at any point.

2603.4.1.8 Exterior doors in buildings of Group R-2 or R-3. In occupancies classified as Group R-2 or R-3, foam-filled exterior entrance doors to individual dwelling units that do not require a fire-resistance rating shall be faced with wood or other approved materials.

2603.4.1.9 Garage doors. Where garage doors are permitted without a fire-resistance rating and foam plastic is used as a core material, the door facing shall be metal having a minimum thickness of 0.032-inch (0.8 mm) aluminum or 0.010-inch (0.25 mm) steel or the facing shall be minimum 0.125-inch-thick (3.2 mm) wood. Garage doors having facings other than those described above shall be tested in accordance with, and meet the acceptance criteria of, DASMA 107.

TABLE 2703—continued
Florida Building Code—Fuel Gas

Section		Section	
Chapter 2	Definitions	Chapter 6	Specific Appliances
		627	Air Conditioning Equipment
Chapter 3	General Regulations	630	Infrared Radiant Heaters
306	Access and Service Space		
309	Electrical	Chapter 7	Gaseous Hydrogen Systems
310	Electrical Bonding	703	General Requirements
		706	Location of Gaseous Hydrogen Systems
Chapter 4	Gas Piping Installations		
413	Compressed Natural Gas Motor Vehicle	Chapter 8	Referenced Standards
	Fuel-Dispensing Stations		

This table is provided only as a tool to assist the construction industry as a general guide. Users should review all sections of the code in order to determine specific applicable electrical requirements.

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SECTION 2705
GFCI PROTECTION

2705.1 NFPA 70-08: *National Electric Code*, Article 680 (Swimming Pools, Fountains, and Similar Installation), Section 680.22(B), GFCI Protection, is amended to read as follows:

(B) **GFCI Protection.** Outlets supplying pool pump motors from branch circuits with short-circuit and ground-fault protection rated 15 or 20 amperes, 125 volt or 240 volt, single phase, whether by receptacle or direct connection, shall be provided with ground-fault circuit-interrupter protection for personnel.

Exception: One-and two-family dwellings.

CHAPTER 30
ELEVATORS AND CONVEYING SYSTEMS

SECTION 3001
GENERAL

3001.1 Scope. This chapter governs the design, construction, installation, alteration and repair of elevators and conveying systems and their components.

Note: Other administrative and programmatic provisions may apply. See the Department of Business and Professional Regulation [DBPR] Chapter 399, *Florida Statutes*, and 61C-5, *Florida Administrative Code*. The regulation and enforcement of the following sections of the adopted codes, and their addenda, are preempted to the Bureau of Elevator Safety of the Department of Business and Professional regulation: ASME A 17.1, Part 8, ASME A17.3, Sections 1.2, 1.5, ASME A 18.1, Part 10.

3001.2 Referenced standards. Except as otherwise provided for in this code, the design, construction, installation, alteration, repair and maintenance of elevators and conveying systems and their components shall conform to ASME A17.1, ASME A17.1S, ASME A90.1, ASME B20.1, ALI ALCTV, ASME A17.3 and ASME A18.1.

The Division of Hotels and Restaurants may grant exceptions, variances and waivers to the *Elevator Safety Code* as authorized by the *Elevator Safety Code (ASME A 17.1, Section 1.2) and Florida Statutes* (Chapter 120.)

3001.3 Accessibility. Passenger elevators required to be accessible by Chapter 11.

3001.4 Change in use. A change in use of an elevator from freight to passenger, passenger to freight, or from one freight class to another freight class shall comply with Part XII of ASME A17.1.

3001.5 Design, installation and alteration of elevators.

1. Each elevator shall comply with the *Elevator Safety Code* that was in effect at the time of receipt of application for the construction permit for the elevator.
2. Each alteration to, or relocation of, an elevator shall comply with the *Elevator Safety Code* that was in effect at the time of receipt of the application for the construction permit for the alteration or relocation.

3001.6 As used in this chapter, the term:

ALTERATION. Any change or addition to the vertical conveyance other than maintenance, repair or replacement.

CERTIFICATE OF OPERATION means a document issued by the department which indicates that the conveyance has had the required safety inspection and tests and that fees have been paid as provided in Chapter 399, FS.

CONVEYANCE. An elevator, dumbwaiter, escalator, moving sidewalk, platform lift and stairway chairlift.

DEPARTMENT. For the purpose of this section, means the Department of Business and Professional Regulation.

DIVISION. For the purpose of this section, means the Division of Hotels and Restaurants of the Department of Business and Professional Regulation.

ELEVATOR. One of the following mechanical devices:

(a) A hoisting and lowering mechanism, equipped with a car and platform that moves in guide rails and serves two or more landings to transport material or passengers or both.

(b) An escalator, which is a power-driven, inclined continuous stairway used for raising or lowering passengers.

(c) A dumbwaiter, which is a hoisting and lowering mechanism equipped with a car of limited size which moves in guide rails and serves two or more landings.

(d) A moving walk, which is a type of passenger-carrying device on which passengers stand or walk and in which the passenger-carrying surface remains parallel to its direction of motion and is uninterrupted.

(e) An inclined stairway chairlift, which is a device used to transport physically handicapped persons over architectural barriers.

(f) An inclined or vertical wheelchair lift, which is a device used to transport wheelchair handicapped persons over architectural barriers.

Exceptions:

Personnel hoists and material hoists within the scope of ASME A10.

Man lifts within the scope of ASME A90.1.

Mobile scaffolds, towers and platforms within the scope of ANSI A92.

Powered platforms and equipment for exterior and interior maintenance within the scope of ASME A120.1.

Conveyors and related equipment within the scope of ASME B20.1.

Cranes, derricks, hoists, hooks, jacks and slings within the scope of ASME B30.

Industrial trucks within the scope of ASME B56.

Portable equipment, except for portable escalators that are covered by this code.

Tiered or piling machines used to move materials to and from storage located and operating entirely within one story.

Equipment for feeding or positioning materials at machine tools and printing presses.

Skip or furnace hoists.

Wharf ramps.

Railroad car lifts or dumpers.

Line jacks, false cars, shafters, moving platforms and similar equipment used for installing an elevator by a contractor licensed in this state.

Automated people movers at airports.

Elevators in television and radio towers.

Hand-operated dumbwaiters.

Sewage pump station lifts.

Automobile parking lifts.

Equipment covered in Section 1.1.2 of the *Elevator Safety Code*.

Elevators, inclined stairway chairlifts and inclined or vertical wheelchair lifts located in private residences.

ESCALATOR. An installation defined as an escalator in the *Florida Building Code*.

EXISTING INSTALLATION. An installation defined as an "installation, existing" in the *Florida Building Code*.

PRIVATE RESIDENCE. A separate dwelling or a separate apartment in a multiple dwelling which is occupied by members of a single family.

SECTION 3002
HOISTWAY ENCLOSURES

3002.1 Hoistway enclosure protection. Elevator, dumbwaiter and other hoistway enclosures shall be shaft enclosures complying with Section 707.

3002.1.1 Opening protectives. Openings in hoistway enclosures shall be protected as required in Chapter 7.

Exception: The elevator car doors and the associated hoistway enclosure doors at the floor level designated for recall in accordance with Section 3003.2 shall be permitted to remain open during Phase I Emergency Recall Operation.

3002.1.2 Hardware. Hardware on opening protectives shall be of an approved type installed as tested, except that approved interlocks, mechanical locks and electric contacts, door and gate electric contacts and door-operating mechanisms shall be exempt from the fire test requirements.

3002.2 Number of elevator cars in a hoistway. Where four or more elevator cars serve all or the same portion of a building, the elevators shall be located in at least two separate hoistways. Not more than four elevator cars shall be located in any single hoistway enclosure.

3002.3 Emergency signs. An approved pictorial sign of a standardized design shall be posted adjacent to each elevator call station on all floors instructing occupants to use the exit stairways and not to use the elevators in case of fire. The sign shall read: IN FIRE EMERGENCY, DO NOT USE ELEVATOR. USE EXIT STAIRS. The emergency sign shall not be required for elevators that are part of an accessible means of egress complying with Section 1007.4.

3002.4 Elevator car to accommodate ambulance stretcher. Where elevators are provided in buildings four or more stories above grade plane or four or more stories below grade plane, or where the rise exceeds 25 feet (7620 mm), at least one elevator shall be provided for fire department emergency access to all floors. The elevator car shall be of such a size and arrangement to accommodate a 24-inch by 76-inch (610 mm by 1950 mm) ambulance stretcher in the horizontal, open position and shall be identified by the international symbol for emergency medical services (star of life). The symbol shall not be less than 3 inches (76 mm) high and shall be placed inside on both sides of the hoistway door frame.

3002.5 Emergency doors. Where an elevator is installed in a single blind hoistway or on the outside of a building, there shall be installed in the blind portion of the hoistway or blank face of the building, an emergency door in accordance with ASME A17.1.

3002.6 Prohibited doors. Doors, other than hoistway doors and the elevator car door, shall be prohibited at the point of access to an elevator car unless such doors are readily openable from the car side without a key, tool, special knowledge or effort.

3002.7 Common enclosure with stairway. Elevators shall not be in a common shaft enclosure with a stairway.

3002.8 Glass in elevator enclosures. Glass in elevator enclosures shall comply with Section 2409.1.

3002.9 Automatic fire alarm-initiating devices shall be located and installed in accordance with ASME A17.1 and NFPA 72.

[F] SECTION 3003
EMERGENCY OPERATIONS

[F] 3003.1 Standby power. In buildings and structures where standby power is required or furnished to operate an elevator, the operation shall be in accordance with Sections 3003.1.1 through 3003.1.4.

[F] 3003.1.1 Manual transfer. Standby power shall be manually transferable to all elevators in each bank.

[F] 3003.1.2 One elevator. Where only one elevator is installed, the elevator shall automatically transfer to standby power within 60 seconds after failure of normal power.

[F] 3003.1.3 Two or more elevators. Where two or more elevators are controlled by a common operating system, all elevators shall automatically transfer to standby power within 60 seconds after failure of normal power where the standby power source is of sufficient capacity to operate all elevators at the same time. Where the standby power source is not of sufficient capacity to operate all elevators at the same time, all elevators shall transfer to standby power in sequence, return to the designated landing and disconnect from the standby power source. After all elevators have been returned to the designated level, at least one elevator shall remain operable from the standby power source.

buildings and buildings with multiple wings shall be considered one structure.

3104.3 Construction. The pedestrian walkway shall be of noncombustible construction.

Exceptions:

1. Combustible construction shall be permitted where connected buildings are of combustible construction.
2. Fire-retardant-treated wood, in accordance with Section 603.1, Item 1.3, shall be permitted for the roof construction of the pedestrian walkway where connected buildings are a minimum of Type I or II construction.

3104.4 Contents. Only materials and decorations approved by the building official shall be located in the pedestrian walkway.

3104.5 Fire barriers between pedestrian walkways and buildings. Walkways shall be separated from the interior of the building by fire-barrier walls with a fire-resistance rating of not less than 2 hours. This protection shall extend vertically from a point 10 feet (3048 mm) above the walkway roof surface or the connected building roof line, whichever is lower, down to a point 10 feet (3048 mm) below the walkway and horizontally 10 feet (3048 mm) from each side of the pedestrian walkway. Openings within the l0-foot (3048 mm) horizontal extension of the protected walls beyond the walkway shall be equipped with devices providing a 3/4-hour fire protection rating in accordance with Section 715.

Exception: The walls separating the pedestrian walkway from a connected building are not required to have a fire-resistance rating by this section where any of the following conditions exist:

1. The distance between the connected buildings is more than 10 feet (3048 mm), the pedestrian walkway and connected buildings, except for open parking garages, are equipped throughout with an automatic sprinkler system in accordance with NFPA 13 and the wall is constructed of a tempered, wired or laminated glass wall and doors subject to the following:
   1.1. The glass shall be protected by an automatic sprinkler system in accordance with NFPA 13 and the sprinkler system shall completely wet the entire surface of interior sides of the glass wall when actuated.
   1.2. The glass shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler operates.
   1.3. Obstructions shall not be installed between the sprinkler heads and the glass.
2. The distance between the connected buildings is more than 10 feet (3048 mm) and both sidewalls of the pedestrian walkway are at least 50 percent open with the open area uniformly distributed to prevent the accumulation of smoke and toxic gases.
3. Buildings are on the same lot in accordance with Section 503.1.2.
4. Where exterior walls of connected buildings are required by Section 704 to have a fire-resistance rating greater than 2 hours, the walkway shall be equipped throughout with an automatic sprinkler system installed in accordance with NFPA 13.

The previous exceptions shall apply to the pedestrian walkways that have a maximum height above grade of three stories or 40 feet (12 192 mm), or five stories or 55 feet (16 764 mm) where sprinklered.

3104.6 Public way. Pedestrian walkways over a public way shall also comply with Chapter 32.

3104.7 Egress. Access shall be provided at all times to a pedestrian walkway that serves as a required exit.

3104.8 Width. The unobstructed width of pedestrian walkways shall not be less than 36 inches (914 mm). The total width shall not exceed 30 feet (9144 mm).

3104.9 Exit access travel. The length of exit access travel shall not exceed 200 feet (60 960 mm).

Exceptions:

1. Exit access travel distance on a pedestrian walkway equipped throughout with an automatic sprinkler system in accordance with NFPA 13 shall not exceed 250 feet (76 200 mm).
2. Exit access travel distance on a pedestrian walkway constructed with both sides at least 50 percent open shall not exceed 300 feet (91 440 mm).
3. Exit access travel distance on a pedestrian walkway constructed with both sides at least 50 percent open, and equipped throughout with an automatic sprinkler system in accordance with NFPA 13, shall not exceed 400 feet (122 m).

3104.10 Tunneled walkway. Separation between the tunneled walkway and the building to which it is connected shall not be less than 2-hour fire-resistant construction and openings therein shall be protected in accordance with Table 715.4.

SECTION 3105
AWNINGS AND CANOPIES

3105.1 Fabric awnings and fabric-covered frames. Fabric awnings and fabric-covered frames shall comply with the provisions of Section 3105 as applicable.

3105.1.1 Location.

3105.1.1.1 Fabric awnings and fabric-covered frames located over public property or in areas accessible to the general public shall be constructed so that no rigid part of such fabric awnings or fabric-covered frames shall be less than 7 feet, 6 inches (2286 mm) from the grade directly below, and no part of the cloth drop shall be less than 7 feet (2134 mm).

3105.1.1.2 A fixed fabric awning or fabric-covered frame shall not extend over public property more than two-thirds the distance from the property line to the nearest curb line in front of the building site as measured from

the exterior face of the building nor shall any portion be closer than 18 inches (457 mm) to the curb line.

Exceptions:

1. If installed over 14 feet (4267 mm) in height, it may occupy the entire width of the sidewalk.
2. Unless otherwise regulated by local zoning requirements.

3105.1.1.3 Fabric-covered framework in whole or in part of fabric, erected in connection with gasoline service stations may not be erected within 15 feet (4572 mm) of where flammable liquids are transferred.

3105.1.1.4 Movable fabric awnings or fabric covered frames may extend over public property for a distance of not more than 5 feet (1524 mm), provided such awnings or any part thereof maintain a clear height of 8 feet (2438 mm) above the sidewalk. All such movable awnings shall be supported on metal frames attached to the building.

3105.1.1.5 Every fabric awning or fabric-covered frame shall be located not to interfere with the operation of any exterior standpipe, stairway, fire escape or any means of egress to and from the building.

3105.2 Area. No fabric awning or fabric-covered frame shall exceed the area of the building to which it is attached.

3105.3 Material.

3105.3.1 Fabric used for awnings or fabric-covered frames shall meet the flame propagation performance criteria of NFPA 701.

Exception: Awnings or fabric-covered frames used in conjunction with Group R-3 occupancies.

3105.3.2 Supports for fabric awnings and fabric-covered frame shall be of metal or similar durable material.

3105.4 Design.

3105.4.1 Design of the framing members shall not be based on removal or repositioning of parts, or the whole, during periods of 75 mph wind velocity.

3105.4.2 Design of the structural framing members shall be based on rational analysis, using the applicable wind loads of Chapter 16 as shown below:

3105.4.2.1 The wind design loads for any fabric or membrane-covered structure designed with a quick removal or breakaway membrane or fabric at wind velocities of 75 mph, shall be based on the following criteria:

1. Minimum wind velocity of 3-second wind gust 90 mph
2. Importance factor based on low hazard to human life of 0.77.
3. Exposure Category B for or C as defined in Chapter 16.

3105.4.2.2 The wind design loads for any fabric or membrane covered structure designed with a permanent or nonremovable fabric or membrane, shall be based on the following criteria:

1. Minimum wind velocity as required in Chapter 16.
2. Importance factor based on low hazard to human life of 0.77.
3. Exposure Category B or C as defined in Chapter 16.

3105.4.3 The fabric portions of awnings fabric covered frames shall be securely laced, tied or otherwise fastened to the frame; no rafter or front bar will be permitted in pockets; and in no case shall a rolling curtain be caused to operate over a canopy frame.

3105.4.4 The horizontal projection of cantilevered portions shall not be greater than two times the height, except where the building construction does not permit a proper installation; in which case, variance may be permitted by the building official, based on special design and construction.

3105.5 Rigid awnings and canopy shutters.

3105.5.1 Loads. Rigid awnings and canopy shutters shall be designed to resist the loads set forth in Chapter 16 of this Code except that structures or parts thereof which are intended to be removed or repositioned during periods of high wind velocity shall be designed in their open or extended position to design pressures based on a basic wind speed of minimum 90 mph, 3-second wind gust with applicable shape factors and to resist not less than 10 psf (478 Pa) roof live load.

3105.5.2 Where such structure is intended to be folded or otherwise repositioned to close an opening when the building is unattended or act as a storm shutter, the design in the closed position shall also comply with Chapter 16 and shall be impact resistant in accordance with Section1609.1.4.

3105.5.3 Structures designed to be readily removed or repositioned during periods of high wind velocity shall be posted with a legible and readily visible decal or painted instructions to the owner or tenant to remove or reposition the structure or part thereof during such periods of time as are designated by the U.S. Weather Bureau as being a hurricane warning or alert.

SECTION 3106
MARQUEES

3106.1 General. Marquees shall comply with this section and other applicable sections of this code.

3106.2 Thickness. The maximum height or thickness of a marquee measured vertically from its lowest to its highest point shall not exceed 3 feet (914 mm) where the marquee projects more than two-thirds of the distance from the property line to the curb line, and shall not exceed 9 feet (2743 mm) where the marquee is less than two-thirds of the distance from the property line to the curb line.

3106.3 Roof construction. Where the roof or any part thereof is a skylight, the skylight shall comply with the requirements of Chapter 24. Every roof and skylight of a marquee shall be sloped to downspouts that shall conduct any drainage from the marquee in such a manner so as not to spill over the sidewalk.

3106.4 Location prohibited. Every marquee shall be so located as not to interfere with the operation of any exterior

CHAPTER 35
REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.4.

AA

Aluminum Association
1525 Wilson Blvd, Suite 600
Arlington, VA 22209

Standard reference number	Title	Referenced in code section number
ADM 2005	Aluminum Design Manual: Part 1-A Specification for Aluminum Structures, Allowable Stress Design; and Part 1-B Specification for Aluminum Structures, Building Load and Resistance Factor Design	1604.3.5, 2002.2, 2003.2
	Specifications for Aluminum Structures	2003.2
	The Aluminum Formed Sheet Building Sheathing Design Guide	2003.2
	The Commentary on Specifications for Aluminum Structures	2003.2
	Engineering Data for Aluminum Structures	2003.2
ASM 35—00	Aluminum Sheet Metal Work in Building Construction (Fourth Edition)	2002.1

AAF

Aluminum Association of Florida, Inc.
3165 McCrory Place, Suite 185
Orlando, FL 32803

Standard reference number	Title	Referenced in code section number
AAF—07-1	Guide to Aluminum Construction in High Wind Areas 2007-1	2002.4.1

AAMA

American Architectural Manufacturers Association
1827 Waldon Office Square, Suite 550
Schaumburg, IL 60173

Standard reference number	Title	Referenced in code section number
101/I.S.2—97	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors	1008.1.6, 1714.5.2.1, 1714.5.2.2, 2411.3.2.1
101/I.S.2/NAFS—02	Voluntary Performance Specification for Windows, Skylights and Glass Doors	1714.5.2.1, 1714.5.2.1.1, 2405.5, 2612.2
103.3—83	Procedural Guide, Sec. 2 — Engineering Design Rules.	2411.3.2.6
203—98	Procedural Guide for the Window Inspection and Notification System	1714.5.2.2
501—05	Method for Test for Exterior Wall	1714.5.2.1, 1714.5.2.1.1, 1714.5.3.3.1, 2405.5, 2411.3.2.1.1, 2612.2
AAMA/WDMA/CSA101/ I.S.2/A440-05	Specifications for Windows, Doors and Unit Skylights	1714.5.2.1
AAMA 450-06	Voluntary Performance Rating Method for Mulled Fenestration Assemblies	1714.5.5.1, 1714.5.5.1.2, 1714.5.5.1.3
AAMA 506-06	Voluntary Specifications for Hurricane Impact and Cycle Testing of Fenestration Products	1609.1.4
AAMA 800–05	Voluntary Specifications and Test Methods for Sealants	2510.8
AAMA 812-04	Voluntary Practice for Assessment of Single Component Aerosol Expanding Polyurethane Foams for Sealing Rough Openings of Fenestration Installations	2510.8
AAMA 1402–86	Standard Specifications for Aluminum Siding, Soffit and Fascia	1404.5.1
AAMA/NPEA/NSA 2100-02	Voluntary Specifications for Sunrooms	2002.6

AASHTO

American Association of State Highway & Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, DC 20001

Standard reference number	Title	Referenced in code section number
LTS 4	Structural Specifications for Highway Signs, Luminaires and Traffic Signals	1609.1.1

ACI

American Concrete Institute
P.O. Box 9094
Farmington Hills, MI 48333-9094

Standard reference number	Title	Referenced in code section number
117	Standard Tolerances for Concrete Construction and Materials.	1920.2
216.1–97	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies	Table 720.1(2), 721.1
224.3R—95	Joints in Concrete Construction (Reapproved 2001)	1911.2
301	Specifications for Structural Concrete for Buildings	1920.2
315	Manual of Standard Practice for Detailing Reinforced Concrete Structures	1920.2
318—05	Building Code Requirements for Structural Concrete	1604.3.2, 1805.4.2.6,1805.9, 1806.4,1808.2.23.1.1, 1808.2.23.2, 1808.2.23.2.1, 1808.2.23.2.2, 1809.2.3.2, 1809.2.3.2.2, 1810.1.2.2, 1812.8, 1901.2, 1901.3, 1901.4, 1902, 1903.1, 1903.2, 1903.3, 1903.4, 1903.5.1, 1903.6, 1904.4.2, 1905.1.4, 1905.3, 1905.4, 1905.5, 1905.6.5.5, 1905.8.3, 1905.11.3, 1906.1.5, 1906.3, 1906.4.3, 1907.1, 1907.2, 1907.4.1, 1907.6, 1907.7.2, 1907.7.3, 1907.7.4, 1907.7.5, 1907.8, 1907.9, 1907.10, 1907.11, 1907.12, 1907.13, 1908, 1908.1.1, 1908.1.2, 1908.1.3, 1908.1.4, 1908.1.5, 1908.1.6, 1908.1.7, 1908.1.8, 1908.1.9, 1909.1, 1909.3, 1909.4, 1909.5, 1909.6, 1910, 1910.2.1, 1910.2.2, 1910.2.3, 1910.2.4, 1910.3.1, 1910.4.1, 1910.4.2, 1910.4.3, 1910.4.3.1, 1910.5.2, 1913.1, 1918.1, 1918.2, 1919.3, 1920.2, 1921.1, 1922.4.1, 1922.4.3, 1922.6.4, 1926.4.1, 1926.4.3, 1926.5.6, 1928.3.1, 1928.7.2, 2108.3
347	Recommended Practice for Concrete Foamwork	1920.2, 1925.1.1
506	Recommended Practice for Shotcreting	1920.2
506.2	Specification for Shotcrete	1920.2, 1929.1.2, 1929.8.1
530—05	Building Code Requirements for Masonry Structures	1405.5, 1405.5.3, 1405.9, 1604.3.4, 1605.3.1.1, 1618.9,1805.5.2, 1812.7, 2101.2.3, 2101.2.4, 2101.2.5, 2103.11.6, 2106.1, 2106.1.1.1, 2106.1.1.2, 2106.1.1.3, 2106.3, 2106.4, 2106.5, 2106.6, 2107.1, 2107.2, 2107.2.1, 2107.2.2, 2107.2.4, 2107.2.5, 2107.2.6, 2108.1, 2108.2, 2108.3, 2108.4, 2109.1, 2109.2.3.1, 2109.2.3.2, 2114.2, 2121.2.12, 2122.1
530.1—05	Specifications for Masonry Structures	1405.5.1, Table 1704.5.1, Table 1704.5.3, 2103.13.7, 2104.1, 2104.1.1, 2104.3, 2104.4

AF&PA

American Forest & Paper Association
1111 19th St, NW Suite 800
Washington, DC 20036

Standard reference number	Title	Referenced in code section number
AF&PA—87 (HVHZ)	All-Weather Wood Foundation System, Design, Fabrication, Installation Manual.	2314.4.7
AF&PA—92	Wood Structural Design Data.	2314.4.7
AF&PA—93	Span Tables for Joists and Rafters.	2306.1.1, 2308.8, 2308.10.2, 2308.10.3
NDS—05	National Design Specification (NDS) for Wood Construction— with 2005 Supplement	721.6.3.2, 1715.1.1, 1715.1.4, 1805.4.5, 1808.1, 1823.1.8.1, 2306.1, 2306.2.1, 2306.3.2, Table 2306.3.1, Table 2306.4.1, 2306.3.4, 2306.3.5, 2306.4.1, Table 2308.9.3(4), 2314.4.7, 2315.4.1, 2319.17.2.2.1, 2319.17.2.1.3, 2319.17.2.1.5
SDPWS–05	AF&PA Supplement Special Design Provisions for Wind and Seismic.	2305.1
T.R. No. 7—87	Permanent Wood Foundation System	1805.4.6, 1807.2, 2304.9.5, 2314.4.7
WCD 1—01	Wood Construction Data No. 1, Details for Conventional Wood Frame Construction	2314.4.7
WCD 3—83	Wood Construction Data No. 3, Design of Wood Formwork for Concrete Structures	2314.4.7
WCD 4—89	Wood Construction Data No. 4, Plank and Beam Framing for Residential Buildings	2306.1.2, 2314.4.7
WCD 5—89	Wood Construction Data No. 5, Heavy Timber Construction Details	2314.4.7
WCD 6—88	Wood Construction Data No. 6, Design of Wood Frame Structures for Permanence	2314.4.7, 2326.2.11
WFCM–01	Wood Frame Construction Manual for One- and Two-family Dwellings	2301.2, 2308.1, 2308.2.1

ANSI - continued

A108.4—99	Installation of Ceramic Tile with Organic Adhesives or Water-cleanable Tile-setting Epoxy Adhesive	2103.10.6
A108.5—99	Installation of Ceramic Tile with Dry-set Portland Cement Mortar or Latex-portland Cement Mortar	2103.9.3, 2103.10.1, 2103.10.2
A108.6—99	Installation of Ceramic Tile with Chemical-resistant, Water Cleanable Tile-setting and -grouting Epoxy	2103.10.3
A108.8—99	Installation of Ceramic Tile with Chemical-resistant Furan Resin Mortar and Grout	2103.10.4
A108.9—99	Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout	2103.10.5
A108.10—99	Installation of Grout in Tilework	2103.10.7
A112.19.8M – 07	Suction Fittings for Use in Swimming Pools, Spas, Hot Tub and Whirlpool Bathtub Appliances.	424.16.5.3.2.3, 424.1.6.5.10.2
A112.19.8M – 87(R1996)	Suction Fittings for Use in Swimming Pools, Spas, Hot Tub and Whirlpool Bathtub Appliances.	424.2.6.6.2
A118.1—99	American National Standard Specifications for Dry-set Portland Cement Mortar	2103.10.1
A118.3—99	American National Standard Specifications for Chemical-resistant, Water-cleanable Tile-setting and -grouting Epoxy and Water Cleanable Tile-setting Epoxy Adhesive	2103.10.3
A118.4—99	American National Standard Specifications for Latex-portland Cement Mortar	2103.10.2
A118.5—99	American National Standard Specifications for Chemical Resistant Furan Mortar and Grouts for Tile Installation	2103.10.4
A118.6—99	American National Standard Specifications for Cement Grouts for Tile Installation	2103.10.7
A118.8—99	American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout	2103.10.5
A136.1—99	American National Standard Specifications for Organic Adhesives for Installation of Ceramic Tile	2103.10.6
A137.1—88	American National Standard Specifications for Ceramic Tile	2103.5
A208.1—99	Particleboard	2303.1.7, 2303.1.7.1
Z 53.1	American National Standard Safety Color Code for Marking Physical Hazards	423.4.6, 423.14.6
Z 97.1—84 (R1994)	Safety Glazing Materials Used in Buildings—Safety Performance Specifications and Methods of Test (Reaffirmed 1994)	1618.4.6.3, 2406.1.2, 2409.1, 2411.1.4, 2411.1.6, 3010.1

APA

APA - Engineered Wood Association
P.O. Box 11700
Tacoma, WA 98411-0700

Standard reference number	Title	Referenced in code section number
APA E30	Engineered Wood Construction Guide.	2314.4.3
APA PDS-Y510J—04	Plywood Design Specification (revised 1998)	2306.1, Table 2306.3.1, 2306.3.2, 2306.4.1, 2314.4.3
APA PDS—04	Panel Design Specification	2306.1, 2306.3.1, 2306.4.1
APA PDS Supplement 1—90	Design and Fabrication of Plywood Curved Panels (revised 1995)	2306.1, 2314.4.3
APA PDS Supplement 2—92	Design and Fabrication of Plywood-lumber beams (revised 1998)	2306.1, 2314.4.3
APA PDS Supplement 3—90	Design and Fabrication of Plywood Stressed-skin Panels (revised 1996)	2306.1, 2314.4.3
APA PDS Supplement 4—90	Design and Fabrication of Plywood Sandwich Panels (revised 1993)	2306.1, 2314.4.3
APA PDS Supplement 5—95	Design and Fabrication of All-plywood Beams (revised 1995)	2306.1, 2314.4.3
APA B840	Siding Manufacturing Specifications	2314.4.3
APA L350	Design/Construction Guide Diaphragms and Shearwalls	2314.4.3
APA PRP108	Performance Standards and Policies for Structural-Use Panels.	2314.4.3, 2315.1.2
APA V910	Plywood Folded Plate Laboratory Report 21.	2314.4.3
EWS R540—96	Builders Tips: Proper Storage and Handling of Glulam Beams	2306.1
EWS S475—01	Glued Laminated Beam Design Tables	2306.1
EWS S560—03	Field Notching and Drilling of Glued Laminated Timber Beams	2306.1
EWS T300—02	Glulam Connection Details	2306.1
EWS X440—00	Product Guide—Glulam	2306.1
EWS X450—01	Glulam in Residential Construction —Western Edition	2306.1

APSP

Association of Pool and Spa Professionals
2111 Eisenhower Avenue
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
ANSI/NSF	International Standard 50-1996, Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs	424.1.6.5.1, 424.1.6.5.2, 424.1.6.5.16, 424.1.6.5.16.4.2, 424.1.6.5.16.5.2, 424.1.9.2.5.2
ANSI/NSPI 3—99	American National Standard for Permanently Installed Residential Spas	424.2.6.1
ANSI/NSPI 4—99	American National Standard for Aboveground/Onground Residential Swimming Pools	424.2.6.1
ANSI/NSPI 5—03	American National Standard for Residential Inground Swimming Pools	424.2.6.1
ANSI/NSPI 6—99	American National Standard for Portable Spas	424.2.6.1
ANSI/APSP 7—06	American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins	424.2.6.1, 424.2.6.3, 424.2.6.6

ASAE

American Society of Agricultural Engineers
2950 Niles Road
St. Joseph, MI 49085-9659

Standard reference number	Title	Referenced in code section number
EP 484.2 (1998)	Diaphragm Design of Metal-clad, Post-frame Rectangular Buildings	2306.1
EP 486.1 (2000)	Shallow-post Foundation Design	2306.1
EP 559 (1997)	Design Requirements and Bending Properties for Mechanically Laminated Columns	2306.1

ASCE/SEI

American Society of Civil Engineers
Structural Engineering Institute
1801 Alexander Bell Drive
Reston, VA 20191-4400

Standard reference number	Title	Referenced in code section number
3—91	Structural Design of Composite Slabs	1604.3.3, 1920.3, 2209.2, 2214.3
5—05	Building Code Requirements for Masonry Structures	1405.5, 1405.5.2, 1405.9, 1604.3.4, 1618.9, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, Table 1704.5.3, 1708.1.1, 1708.1.2, 1708.1.3, 1708.1.4, 1805.5.2, 1812.7, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2106.1.1, 2106.1.1.1, 2106.1.1.2, 2106.1.1.3, 2106.3, 2106.4, 2106.5, 2106.6, 2107.1, 2107.2, 2107.3, 2107.4, 2107.5, 2107.6, 2107.7, 2170.8, 2108.1, 2108.2, 2108.3, 2108.4, 2109.1, 2109.2.3.1, 2109.7.3, 2121.2.12, 2122.1
6—05	Specifications for Masonry Structures	1405.5.1, Table 1704.5.1, Table 1704.5.3, 1805.5.2.2, 2103.13.7, 2104.1, 2104.1.1, 2104.3, 2104.4
7—05	Minimum Design Loads for Buildings and Other Structures including Supplement No. 1 and excluding Chapter 14 and Appendix 11A	419.4.2.2.6, 420.4.2.2.6, 423.4.7, 423.9.1, 423.25.4, 423.28.2.6.4, 1514.4, 1605.1, 1605.2.2, 1605.3.1.2, 1605.3.2, 1608.1, 1608.3, 1608.3.4, 1608.3.5, 1608.4, 1608.5, 1608.6, 1608.7, 1608.8, 1608.9, 1609.1.1, 1609.1.4.1, Table 1609.3.1, 1609.4, 1609.7.3, 1612.1.3, 1612.2, 1614.1, 1615.1, 1615.2, 1618.4.8, 1618.9, 1619.1, 1619.2.1, 1619.2.2, 1620.1, 1621.1, 1622.1.1, 1626.1, 2002.6
8—02	Standard Specification for the Design of Cold-formed Stainless Steel Structural Members	1604.3.3, 2209.1, 2214.3
11	Guidelines for Structural Condition Assessment of Existing Buildings	1920.3, 2003.2, 2214.3
19—96	Structural Applications of Steel Cables for Buildings	2207.1, 2207.2
24—05	Flood Resistant Design and Construction	1203.3.2, 1612.4, 1612.5, 3001.2
29—05	Standard Calculation Methods for Structural Fire Protection	721.1
32—01	Design and Construction of Frost Protected Shallow Foundations	1805.2.1

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1719 Tullie Circle NE
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
52.1—92	Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter ASHRAE Handbook—HVAC Applications	Table 13-420.3.13.7
62—01	Ventilation for Acceptable Indoor Air Quality	Table 13-420.3.13.7

ASME

American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Standard reference number	Title	Referenced in code section number
A17.1-1990		11-4.10
A 17.1—04	Safety Code for Elevators and Escalators includes A17.1a in 2005 Addenda	1607.8.1, 3001.1, 3001.2, 3001.4, 3002.5, 3003.2, 3008.1, 3010.1, 3011.1
A17.1S-05	Supplement to Safety Code for Elevators and Escalators	3001.2
A 17.3—96	Safety Code for Existing Elevators and Escalators	3001.1, 3001.2
A18.1—03	Safety Standard for Platform Lifts and Stairway Chairlifts	3001.1, 3001.2
A90.1—03	Safety Standard for Belt Manlifts	3001.2
A 120.1—01	Safety Requirements for Powered Platforms for Building Maintenance	3001.6
A 924/A924M–99	Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process	2319.19.2.2.7
B16.18—2001	Cast Copper Alloy Solder Joint Pressure Fittings.	909.13.1
B16.22—2001	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings	909.13.1
B 18.6.1-97	Wood Screws (Inch Series)	1506.6
B20.1—2003	Safety Standard for Conveyors and Related Equipment	3001.2, 3005.3
B31.3—2002	Process Piping	415.8.6.1

ASTM

ASTM International
100 Barr Harbor Drive
West Conshohocken, PA 19428-2959

Standard reference number	Title	Referenced in code section number
01760—76	Standard Specification for Pressure Treatment of Timber Products	Table 1823
A 6/A 6M— 04a	Specification for General Requirements for Rolled Steel, Structural Steel Bars, Plates, Shapes, and Sheet Piling	2214.3
A 29	Standards for General Requirements for Hot-Rolled and Cold-Finished Carbon and Alloy Steel Bars	1827.1
A 36/A 36M–04	Specification for Carbon Structural Steel	1809.3.1, 2103.13.5
A 82–02	Specification for Steel Wire, Plain, for Concrete Reinforcement	2103.13.5, 2103.13.6
A 123/A 123m–02	Specification for Zinc (Hot-dip Galvanized) Coating on Iron and Steel Products	2103.13.7.2
A 153–03	Specification for Zinc Coating (Hot-dip) on Iron and Steel Hardware.	2103.13.7.2, 2304.9.5
A 185–02	Specification for Steel Welded Wire Reinforcement, Plain for Concrete	2103.13.4, 2103.13.5
A 240–04	Standard Specification for Chromium and Chromium-nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels and for General Applications	Table 1507.4.3(1), 2103.13.5
A 252—98 (2002)	Specification for Welded and Seamless Steel Pipe Piles	1809.3.1, 1810.6.1, 1826.1.5.3
A 283/A 283M–03	Specification for Low and Intermediate Tensile Strength Carbon Steel Plates	1809.3.1, 1810.6.1
A 306	Carbon Steel Bars Subject to Mechanical Property Requirements.	1827.1
A 307–03	Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength	1911.1, 2103.13.5
A 325—94	Specification for Structural Bolts, Steel, Heat-Treated, 120/105 Ksi Minimum Tensile Strength.	2214.3
A 361	Specification for Steel Sheet Zinc-Coated (Withdrawn).	2319.17.1.1
A 416/A 416M–02	Specification for Steel Strand, Uncoated Seven-wire for Prestressed Concrete.	1809.2.3.1, 2103.13.6
A 421/A 421M—02	Specification for Uncoated Stress-Relieved Steel Wire for Prestressed Concrete	1922.4.2, 2103.11.6
A 435/A 435M–90 (2001)	Specification for Straight-beam Ultrasonic Examination of Steel Plates.	1708.4
A 446	Specification for Steel Sheet, Zinc-coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality	1917.4.4
A 463/A 463M–02a	Specification for Steel Sheet, Aluminum-coated, by the Hot Dip Process.	Table 1507.4.3(2)

ASTM - continued

	A 480/A 480M–02	Specification for General Requirements for Flat-rolled Stainless and Heat-resisting Steel Plate, Sheet, and Strip. . . . 2103.13.5
‖	A 490—93	Specification for Heat-Treated, Steel Structural Bolts, 150 ksi Minimum Tensile Strength. 2214.3
	A 496–02	Specification for Steel Wire, Deformed for Concrete Reinforcement. 2103.13.3
	A 497–01	Specification for Steel Welded Reinforcement Deformed, for Concrete. 2103.13.4
	A 510–03	Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel 2103.13.6
‖	A 525—87	Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process 1917.4.4, 2214.3, 2517.2, 2517.5.1, 2517.5.4
	A 568/A 568M–03	Specification for Steel, Sheet, Carbon, and High-strength, Low-alloy, Hot-rolled and Cold-rolled, General Requirements for . . . . . Table 1704.3
‖	A 570/A 570M-98	Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled (withdawn) 1826.1.5.3
	A 572/A 572M–04	Specification for High-strength Low-alloy Columbium-vanadium Structural Steel 1809.3.1
	A 588/A 588M–04	Specification for High-strength Low-alloy Structural Steel with 50 ksi (345 Mpa) Minimum Yield Point to 4 inches (100 mm) Thick. 1809.3.1
‖	A 611	Standard Specification for Structural Steel (SS), Sheet, Carbon, Coil-Rolled. 1826.1.5.3, 1917.4.4
‖	A 615/A 615M—04a	Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement 1908.1.8, 1920.2, 1920.4, 1922.4.6, 2103.11.1, 2103.11.6
‖	A616/A616M-96a	Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement (withdrawn) 1922.4.6
‖	A 617	Standard Specification for Axle-Steel Reformed and Plain Bars for Concrete Reinforcement 1922.4.6
	A 641/A 641M–03	Specification for Zinc-coated (Galvanized) Carbon Steel Wire 2103.13.7.1
‖	A 653/A 653M—04a	Specification for Steel Sheet, Zinc-Coated Galvanized or Zinc-Iron Alloy-Coated Galvannealed by the Hot-Dip Process . . . . . Table 1507.4.3, 2211.2.2.1, 2319.17.2.2.7
	A 690–00a	Standard Specification for High Strength Low-alloy Steel H-piles and Sheet Piling for Use in Marine Environments 1809.3.1
‖	A 706/A 706M—04a	Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement 1903.5.2, 1908.1.3, 1922.4.6
‖	A 722/A 722M—98(2003)	Specification for Uncoated High-Strength Steel Bar for Prestressing Concrete 1922.4.2, 2103.11.6, 2106.1.1.3.1
	A 755/A 755M–04	Specification for Steel Sheet, Metallic-coated by the Hot-dip Process and Prepainted by the Coil-coating Process for Exterior Exposed Building Products . . . . . Table 1507.4.3(1), Table 1507.4.3(2)
‖	A 767/A 767M—00b	Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement. 1922.4.6, 1926.5.5, 2103.11.1
‖	A 775/A 775M—04	Specification for Epoxy-Coated Steel Reinforcing Bars 1922.4.6, 2103.11.1
	A 792/A 792M–03	Specification for Steel Sheet, 55% Aluminum-zinc Alloy-coated by the Hot-dip Process . . . . . Table 1507.4.3(1), Table 1507.4.3(2)
	A 875/A 875M–02a	Standard Specification for Steel Sheet Zinc-5 percent, Aluminum Alloy-coated by the Hot-dip Process. . . . . Table 1507.4.3(2)
	A 884–02	Specification for Epoxy-coated Steel Wire and Welded Wire Fabric for Reinforcement 2103.13.7.3
	A 898/A 898M–91(2001)	Specification for Straight Beam Ultrasonic Examination of Rolled Steel Shapes. 1708.4
	A 913/A 913M–04	Specification for High-strength Low-alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-tempering Process (QST) 1809.3.1
*	A 924/A 924M–04	Standard Specification for General Requirements for Steel Sheet, Metallic-coated by the Hot-dip Process . . . . . Table1507.4.3(1), 2319.17.2.2.7
‖	B 42–02e01	Specification for Seamless Copper Pipe, Standard Sizes 909.13.1
	B 43–04	Specification for Seamless Red Brass Pipe, Standard Sizes 909.13.1
	B 68–02	Specification for Seamless Copper Tube, Bright Annealed (Metric) 909.13.1
	B 88–03	Specification for Seamless Copper Water Tube. 909.13.1
	B 101–02	Specification for Lead-coated Copper Sheet and Strip for Building Construction . . . . . Table 1404.5.3, Table 1507.4.3(1), Table 1507.2.9.2
	B 209–04	Specification for Aluminum and Aluminum Alloy Steel and Plate . . . . . Table 1507.4.3(1)
	B 251–02e01	Specification for General Requirements for Wrought Seamless Copper and Copper-alloy Tube. 909.13.1
	B 280–03	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 909.13.1
	B 370-03	Specification for Cold-rolled Copper Sheet and Strip for Building Construction . 1404.5.2, Table 1507.2.9.2, Table 1507.4.3(1)
	B 695–00	Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel. 2304.9.5
‖	C 5—03	Specification for Quicklime for Structural Purposes . . . . . Table 2507.2, 2525.2.3
	C 22/C 22M–00	Specification for Gypsum . . . . . Table 2506.2
	C 27–98 (2002)	Specification for Standard Classification of Fireclay and High-alumina Refractory Brick 2111.5, 2111.8
	C 28/C 28M—00e01	Specification for Gypsum Plasters . . . . . Table 2507.2
‖	C 31/C 31M—98	Practice for Making and Curing Concrete Test Specimens in the Field. 1905.6.3.2, 1905.6.4.2, 1923.2.2.3, 1923.2.3.2
‖	C 33—03	Specification for Concrete Aggregates . . . . . 721.3.1.4, 721.4.1.1.3, Table 1904.2.1, 1922.1, 1922.2, 1922.2.2
‖	C 34—03	Specification for Structural Clay Load-Bearing Wall Tile 2103.2, 2119.8.3
‖	C 35—95(2001)	Specification for Inorganic Aggregates for Use in Gypsum Plaster . . . . . Table 2507.2, 2515.2.1.1
‖	C 36/C 36M—03	Specification for Gypsum Wallboard . . . . . Figure 721.5.1(2), Figure 721.5.1(3), Table 721.5.1(2), Table 2506.2, 2517.2

ASTM - continued

C 37/C 37M—-01	Specification for Gypsum Lath	Table 2507.2, 2514.2
C 39—99ae1	Test Method for Compressive Strength of Cylindrical Concrete Specimens	1923.2.2.3
C 42/C 42M—99	Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete	1923.2.4.1, 1923.2.4.3
C 52-01A	Specification for Gypsum Partition Tile or Block	2119.9.3
C 55—03	Specification for Concrete Brick	Table 721.3.2, 2103.1, 2105.2.2.1.2, 2119.4.3.2, 2119.4.3.3
C 56—96 (2001)	Specification for Structural Clay Non-Load-Bearing Tile	2103.2, 2119.8.3.3
C 57	Specification for Structural Clay Floor Tile	2119.8.3.2
C 59/C 59M–00	Specification for Gypsum Casting and Molding Plaster	Table 2507.2
C 61/C 61M—00	Specification for Gypsum Keene's Cement	Table 2507.2, 2515.2.4
C 62—04	Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)	2103.2, 2105.2.2.1.1, 2119.4.3.1
C 67—03ae01	Test Methods of Sampling and Testing Brick and Structural Clay Tile	721.4.1.1.1, 1507.3.5, 2104.5, 2105.2.2.1.1, 2109.8.1.1, 2119.4.2
C 73–99a	Specification for Calcium Silicate Face Brick (Sand-lime Brick)	Table 721.3.2, 2103.1
C 79–04a	Specification for Treated Core and Nontreated Core Gypsum SHeathing Board	Table 2506.2
C 90—03	Specification for Loadbearing Concrete Masonry Units	Table 721.3.2, 1805.5.2, 2103.1, 2105.2.2.1.2, 2119.7.2
C 91—03a	Specification for Masonry Cement	Table 2103.7(1), Table 2507.2, 2515.2.6
C 94/C 94M—04	Specification for Ready-Mixed Concrete	109.3.1, 1905.8.2, 1924.2.2, 1924.2.3
C 109/C 109M–02	Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)	2103.11.1
C 126–99	Specification for Ceramic Glazed Structural Clay Facing Tile, Facing Brick, and Solid Masonry Units	2103.2
C 140–03	Test Method Sampling and Testing Concrete Masonry Units and Related Units	721.3.1.2, 2105.2.2.1.2
C 144—03	Standard Specification for Aggregate for Masonry Mortar	1928.7.2, 2119.12.1.1
C 150—04	Specification for Portland Cement	1904, Table 1904.2.3, 1922.1, Table 2103.7(1), Table 2507.2, 2515.2.4
C 172—04	Practice for Sampling Freshly Mixed Concrete	1905.6.3.1, 1923.2.2.2
C 199–84 (2000)	Test Method for Pier Test for Refractory Mortars	2111.5, 2111.8, 2113.12
C 206—03	Specification for Finishing Hydrated Lime	Table 2507.2, 2525.2.3
C 207–04	Specification for Hydrated Lime for Masonry Purposes	Table 2103.8(1)
C 208–95 (2001)	Specification for Cellulosic Fiber Insulatin Board	Table 1508.2, 2303.1.5
C 212—00	Specification for Structural Clay Facing Tile	2103.2, 2119.8.2
C 216—04a	Specification for Facing Brick (Solid Masonry Units Made from Clay or Shale)	2103.2, 2105.2.2.1.1, 2119.4.3.1
C 270—04	Specification for Mortar for Unit Masonry	2103.7, Table 2103.7(2), 2119.12.1
C 315–02	Specification for Clay Flue Linings	2113.11.1, Table 2113.16(1)
C 317/C 317M–00	Specification for Gypsum Concrete	1914.1
C 330—04	Specification for Lightweight Aggregates for Structural Concrete	721.1.1, 1905.1.4, 1922.2.2
C 331–04	Specification for Lightweight Aggregates for Concrete Masonry Units	721.3.1.4, 721.4.1.1.3
C 406–00	Specification for Roofing Slate	1507.7.4
C 442/C 442M–04	Specification for Gypsum Backing Board and Coreboard and Gypsum Shaftliner Board	Table 2506.2
C 471M—01	Standard Test Methods for Chemical Analysis of Gypsum and Gypsum Products	2119.9.2
C 472— 2004	Specification for Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete	Table 2506.2, 2119.9.2
C 473—03	Test Method for Physical Testing of Gypsum Panel Products	Table 2506.2, 2119.9.2
C 474–02	Test Methods for Joint Treatment Materials for Gypsum Board Construction	Table 2506.2
C 475—01	Specification for Joint Compound and Joint Tape for Finishing Gypsum Wallboard	Table 2506.2, 2517.2
C 476–02	Specification for Grout for Masonry	2105.2.2.1.1, 2105.2.2.1.2, 2105.2.2.1.3
C 494/C494M-99	Standard Specification for Chemical Admixtures for Concrete	1917.4.5
C 495–99a	Standard Test Method for Compressive Strength of Lightweight Insulating Concrete	1917.1.1, 1917.1.2, 1917.1.3
C 503–03	Specification for Marble Dimension Stone (Exterior)	2103.4
C 514–01	Specification for Nails for the Application of Gypsum Board	Table 720.1(2), Table 720.1(3), Table 2306.4.5, Table 2506.2
C 516–02	Specifications for Vermiculite Loose Fill Thermal Insulation	721.3.1.4, 721.4.1.1.3
C 547–03	Specification for Mineral Fiber Pipe Insulation	Table 720.1(2), Table 720.1(3)
C 549–02	Specification for Perlite Loose Fill Insulation	721.3.1.4, 721.4.1.1.3
C 552–03	Standard Specification for Cellular Glass Thermal Insulation	Table 1508.2
C 557–03	Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing	Table 2506.2
C 568–03	Specification for Limestone Dimension Stone	2103.4
C 578—04	Standard Specification for Rigid, Cellular Polysturene Thermal Insulation	1917.4.12

ASTM - continued

C 587–02	Specification for Gypsum Veneer Plaster	Table 2507.2
C 588/C 588M–01	Specification for Gypsum Base for Veneer Plasters	Table 2507.2
C 595—03	Specification for Blended Hydraulic Cements	1922.1.2, Table 2103.7(1), Table 2507.2
C 615–03	Specification for Granite Dimension Stone	2103.4
C 616–03	Specification for Quartz Dimension Stone	2103.4
C 629–03	Specification for Slate Dimension Stone	2103.4
C 630/C 630M–03	Specification for Water-resistant Gypsum Backing Board	Table 2506.2
C 631–95a (2000)	Specification for Bonding Compounds for Interior Gypsum Plastering	Table 2507.2
C 635–00	Specification for the Manufacturer, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings	803.9.1.1, 2506.2.1
C 636–04	Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels	803.9.1.1
C 645—04	Specification for Nonstructural Steel Framing Members	2319.17.1.3, Table 2506.2, Table 2507.2, 2517.2, 2517.5.1, 2517.5.4
C 652—04a	Specification for Hollow Brick (Hollow Masonry Units Made from Clay or Shale)	2103.2, 2105.2.2.1.1, 2119.4.3.1, 2119.4.3.1
C 685/ C 685M—98a	Specification for Concrete Made by Volumetric Batching and Continuous Mixing	1924.2.2
C 728–97E1	Standard Specification for Perlite Thermal Insulation Board	Table 1508.2
C 744–99	Specification for Prefaced Concrete and Calcium Silicate Masonry Units	2103.1
C 754–04	Specification for Installation of Steel Framing Members to Receive Screw-attached Gypsum Panel Products	Table 2508.1, Table 2511.1
C 794—01	Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants	2415.4
C 796—97	Standard Test Method for Foaming Agents For Use in Producing Cellular Concrete Using Performed Foam	1917.1.1, 1917.1.2, 1917.1.3, 1917.4.6
C 836–03	Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course	1507.15.2
C 840–04	Specification for Application and Finishing of Gypsum Board	Table 2508.1, 2509.2
C 841–03	Specification for Installation of Interior Lathing and Furring	Table 2508.1, Table 2511.1
C 842–99	Specification for Application of Interior Gypsum Plaster	Table 2511.1, 2511.3, 2511.4
C 843–99e01	Specification for Application of Gypsum Veneer Plaster	Table 2511.1
C 844–99	Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster	Table 2508.1
C 847–00	Specification for Metal Lath	Table 2507.2
C 887–79a (2001)	Specification for Packaged, Dry Combined Materials for Surface Bonding Mortar	807.2.2, 2103.9
C 897–00	Specification for Aggregate for Job-mixed Portland Cement-based Plasters	Table 2507.2
C 920—05	Specification for Elastomeric Joint Sealants	2415.4, 2510.8.8
C 926—98a	Specification for Application of Portland Cement-Based Plaster	2510.3, Table 2511.1, 2511.3, 2511.4, 2512.1, 2512.1.2, 2512.2, 2512.6, 2512.8.2, 2513.7, 2512.9, 2513.7, 2516.1.1, 2516.1.4
C 931/C 931M–04	Specification for Exterior Gypsum Soffit Board	Table 2506.2
C 932–03	Specification for Surface-applied Bonding Agents for Exterior Plastering	Table 2507.2
C 933–04	Specification for Surface-applied Bonding Agents for Exterior Plastering	Table 2507.2
C 946–91 (2001)	Specification for Practice for Construction of Dry-stacked, Surface-bonded Walls	2103.9, 2109.2.3.2
C 954–00	Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 inch (0.84 mm) to 0.112 inch (2.84 mm) in Thickness	Table 2506.2, Table 2507.2
C 955–03	Standard Specification for Load-bearing Transverse and Axial Steel Studs, Runners Tracks, and Bracing or Bridging, for Screw Application of Gypsum Panel Products and Metal Plaster Bases	Table 2506.2, Table 2507.2
C 956–04	Specification for Installation of Cast-in-place Reinforced Gypsum Concrete	1914.1
C 957–04	Specification for High-solids Content, Cold Liquid-applied Elastomeric Waterproofing Membrane with Integral Wearing Surface	1507.15.2
C 950–04	Specification for Predecorated Gypsum Board	Table 2506.2
C 1002–01	Specification for Steel Self-piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs	Table 2506.2, Table 2507.2
C 1006–84 (2001)	Test Method for Splitting Tensile Strength of Masonry Units	2103.11.1
C 1007–04	Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories	Table 2508.1, Table 2511.1
C 1019–03	Test Method of Sampling and Testing Grout	2105.2.2.1.1, 2105.2.2.1.2, 2105.2.2.1.3
C 1029–02	Specification for Spray-applied Rigid Cellular Polyurethane Thermal Insulation	1507.14.2
C 1032–04	Specification for Woven Wire Plaster Base	Table 2507.2
C 1036—01	Specification for Flat Glass	2411.1.1
C 1047–99	Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base	Table 2506.2, Table 2507.2
C 1048—97b	Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass	2411.1.5

ASTM- continued

C 1063–03	Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement Based Plaster	2109.8.4.6, 2510.3, Table 2511.1, 2512.1.1
C 1072–00a	Standard Text Method for Measurement of Masonry Flexural Bond Strength	2103.11.1
C 1077	Standard Practice for Laboratories Testing Concrete and Congete Apparatus for Use in Construction and Criteria for Laboratory Evaluation	1920.4, 1922.6.2
C 1088–02	Specification for Thin Veneer Brick Units Made from Clay or Shale	2103.2
C 1167—03	Specification for Clay Roof Tiles	1507.3.4, 1507.3.5, 1523.6.5.2
C 1177/C 1177M–04	Specification for Glass Mat Gypsum Substrate for Use as Sheathing	Table 2506.2
C 1178/C 1178M–04	Specification for Glass Mat Water-resistant Gypsum Backing Panel	Table 2506.2
C 1186–02	Specification for Flat Nonasbestos Fiber Cement Sheets	1404.10
C 1225	Specification For Nanasbestos Fiber-Cement Roofing Shingles, Shakes and Slates	1518.5.1
C 1261–04	Specification for Firebox Brick for Residential Fireplaces	2111.5, 2111.8
C 1278/C 1278M–03	Specification for Fiber-reinforced Gypsum Panels	Table 2506.2
C 1280–04	Specification for Application of Gypsum Sheathing	Table 2508.1, 2508.2
C 1281-03	Standard Specification for Preformed Tape Sealants for Glazing Applications	2510.8
C 1283–03e01	Practice for Installing Clay Flue Liners	2113.12
C 1288–01	Standard Specification for Discrete Nonasbestos Fiber-cement Interior Substrate Sheets	2509.2
C 1289–03	Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board	Table 1508.2
C1314–03b	Test Method for Compressive Strength of Masonry Prisms	2105.2.2.2.2, 2105.3.1, 2105.3.2
C 1325–04	Standard Specification for Nonasbestos Fiber-mat Reinforced Cement Interior Substrate Sheets	2509.02
C 1328–03a	Specification for Plastic (Stucco Cement)	Table 2507.2
C 1329–04	Specification for Mortar Cement	Table 2103.8(1)
C 1386–98	Specification for Precast Autoclaved Aerated Concrete (PAAC) Wall Construction Units	2102.1, 2103.3, 2105.2.2.1.3
C 1395/1395M–04	Specification for Gypsum Ceiling Board	Table 2506.2
C 1396–02	Standard Specifications for Gypsum Wallboard	Table 2506.2
C 1405–00a	Standard Specification for Glazed Brick (Single Fired, Solid Brick Units)	2103.2
C 1492–03	Standard Specification for Concrete Roof Tile	1507.3.5
D 25—99- e 01	Specification for Round Timber Piles	1809.1.1, 1823.1
D 41—94-00-e01	Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing	Table 1507.10.2, 1514.2.3.2, 1517.6.2.4, 1519.6, 1521.6, 1521.14.1
D 43-94 (2000)	Specification for Coal Tar Primer Used in Roofing, Dampproofing, and Waterproofing	Table 1507.10.2, 1521.14.2, 1517.6.2.4, 1519.6, 1521.6
D 56–02a	Test Method for Flash Point by Tag Closed Tester	307.2
D 86–04b	Test Method for Distillation of Petroleum Products at Atmospheric Pressure	307.2
D 92	Standard Test Method for Flasin and Fire Points by Cleveland Open Cup	1519.2.2
D 93–02a	Test Method for Flash Point By Pensky-Martens Closed Cup Tester	307.2
D 225–04	Specification for Asphalt Shingles (Organic Felt) Surfaced with Mineral Granules	1507.2.5
D 226–97a	Specification for Asphalt-saturated Organic Felt Used in Roofing and Waterproofing	1404.2, 1507.2.3, 1507.3.3, 1507.6.3, 1507.7.3, Table 1507.8, 1607.8.3, 1507.9.3, 1507.9.4, Table 1507.10.2
D 227–03	Specification for Coal-tar saturated Organic Felt Used in Roofing and Waterproofing	Table 1507.10.2
D 256—03	Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics	2612.2
D 312—00	Specification for Asphalt Used in Roofing	Table 1507.10.2, 1519.3, Table 1519.3A, 1519.4, 1521.14.1
D 412—98a (2002)e1	Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension	
D 422–63 (2002)	Test Method for Particle-size Analysis of Soils	1802.3.2
D 450—(2000)e1	Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing	Table 1507.10.2, Table 1519.3B
D 624—00e1	Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers	2415.4
D 635—03	Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position	2606.4, 2612.2
D 638-03	Test Method for Tensile Properties of Plastics	2612.2
D 1079—02	Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials	1513.1
D 1143—81 (1994)e01	Test Method for Piles Under Static Axial Compressive Load	1808.2.8.3, 1829.1.7
D 1167	Methods of Testing Asphalt-Base Emulsions for Use as Protective Coatings for Built-Up Roofs	1523.6.5.2
D 1227–00	Specification for Emulsified Asphalt Used as a Protective Coating for Roofing	Table 1507.10.2, 1507.15.2
D 1556	Standard Test Method for Density of Soil In-Place by the Sandcone	1820.3.2, 1834.3.3
D 1557—02	Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft^3 (2,700 kN m/m^3)	1803.5, 1820.3.2
D 1586–99	Specification for Penetration Test and Split-barrel Sampling of Soils	1613.5.5

ASTM- continued

	D 1621	Standard Test Method for Compressive Properties of Rigid Cellular Plastics 1523.6.5.2.17.1
|	D 1622	Standard Test Method for Apparent Pensity of Rigid Cellular Plastics 1523.6.5.2.17.2
|	D 1623	Standard Test Method for Tersile and Tersile Adhesion Properties of Rigid Cellular Plastics 523.6.5.2.17.3
|	D 1761—88(2000)	Test Method for Mechanical Fasteners in Wood 1715.1.1, 1715.1.2, 1715.1.3, 1834.3.3, 2314.4.4
|	D 1836	Specification for Commercial Hexanes 1519.12.1
|	D 1863—03	Specification for Mineral Aggregate Used on Built-Up Roofs . . . . . Table 1507.10.2, 1519.2.1
|	D 1929—96 (2000)e01	Test Method for Determining Ignition Properties of Plastics 402.14.4, 406.5.2, 1407.11.2.1, 2606.4, 2612.2
	D 1970–01	Specification for Self-adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roof Underlayment for Ice Dam Protection 1507.2.4, 1507.2.9.2, 1507.3.9, 1507.5.6, 1507.8.7, 1507.9.8
|	D 2126	Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging 523.6.5.2.17.4
	D 2166–00	Test Method for Unconfined Compressive Strength of Cohesive Soil 1613.5.5
	D 2178–97a	Specification for Asphalt Glass Felt Used in Roofing and Waterproofing . . . . . Table 1507.10.2
	D 2216–98	Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass 1613.5.5
|	D 2240—03	Standard Test Method for Rubber Property—Durometer Hardness 2415.4
	D 2487–00	Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) . . . . . Table 1610.1, 1802.3.1
|	D 2565—00	Standard Practice for Xenon Arc Exposure of Plastics Intended for Outdoor Applications 2612.2
	D 2626—04	Specification for Asphalt-Saturated and Coated Organic Felt Base Sheet Used in Roofing . . 1507.3.3, Table 1507.10.2, 1518.4
	D 2822–91 (97)e01	Specification for Asphalt Roof Cement . . . . . .Table 1507.10.2
	D 2823–90 (97)e1	Specification for Asphalt Roof Coatings . . . . . .Table 1507.10.2
*	D 2824	Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Nonfibered Asbestos Fibered, and Fibered withoutAsbestos . . . . . .Table 1507.10.2
|	D 2842	Standard Test Method for Water Absorption of Rigid Cellular Plastics. 1523.6.5.2.17.6
|	D 2843—99(2004)	Test for Density of Smoke from the Burning or Decomposition of Plastics 2606.4, 2612.2
	D 2850–03a	Test Method for Uncolsolidated, Undrained Triaxial Compression Test on Cohesive Soils. 1613.5.5
|	D 2856	Standard Test Method for Open-cell Content of Rigid Cellular Plastics by the Air-Pycnometer. 523.6.5.2.17.5
|	D 2898—94 (1999)	Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing 1505.1, 1516.1, 2303.2.1, 2303.2.3, 2314.4.4, 2327.4, 2329.1
|	D 2922	Standard Test Method for Density of Soil and Soil Aggregate In-Place by Nuclear Methods (Shallow Depth) 1820.3.2
|	D 3018	Standard for Specification for Class A Asphalt Shingles Surfaced with Mineral Granules. 1523.6.5.1
	D 3019–e01 (Supp)	Specification for Lap Cement Used with Asphalt Roll Roofing, Nonfibered, Asbestos Fibered and Nonasbestos Fibered. . . . . .Table 1507.10.2
	D 3161–03b	Test Method for a Wind Resistance of Asphalt Shingles (Fan Induced Method) 1504.1.1, 1507.2.5
	D 3200–74 (2000)	Standard Specification and Test Method for Establishing Recommended Design Stresses for Round Timber Construction Poles. 2303.1.11
|	D 3201—94 (1998) el	Test Method for Hygroscopic Properties of Fire-Retardant Wood and Wood-Base Products 2303.2.4, 2314.4.4, 2327.5
	D 3201–94 (2003)	Test Method for Hygroscopic Properties of Fire-retardant-treated Wood and Wood-based Products 2303.2.4
	D 3278–96e01	Test Methods for Flash Point of Liquids by Small Scale Closed-cup Apparatus. 307.2
|	D 3441	Static Cone Soundings 1834.3.3
|	D 3462—04	Specification for Asphalt Shingles Made from Glass Felt and Surfaced with Mineral Granules 1507.2.5, 1523.6.5.1
	D 3468–99	Specification for Liquid-applied Neoprene and Chlorosulfonated Polyethylene Used in Roofing and Waterproofing . 1507.15.2
|	D 3498—03	Standard Specifications for Adhesives for Field-Gluing Plywood to Lumber Framing for Floor Systems . . . 2314.4.4, 2322.1.5
|	D 3679—05	Specification for Rigid Poly (Vinyl Chloride) (PVC) Siding 1404.9, 1405.13
	D 3689–90 (1995)	Method for Testing Individual Piles Under Static Axial Tensile Load. 1808.2.8.5
|	D 3737—05	Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam) 2303.1.3
|	D 3746—85 (2002) el	Test Method for Impact Resistance of Bituminous Roofing Systems 1504.7, 1515.2.4
	D 3747–79 (2000e01)	Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation . . . . . .Table 1507.10.2
|	D 3787—89	Test Method for Bursting Strength of Textiles-Constant-Rate-of-Traverse (CRT) Ball Burst Test 424.2.17.1.15
	D 3909–97b	Specification for Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules . . . 1507.2.9.2, 1507.6.4, Table 1507.10.2
	D 3957–03	Standard Practices for Establishing Stress Grades for Structural Members Used in Log Buildings 2303.1.10
	D 4022–94 (2000)e01	Specification for Coal Tar Roof Cement, Asbestos Containing. . . . . .Table 1507.10.2
|	D 4272—03	Test Method for Total Energy Impact of Plastic Films by Dart Drop. 1504.7, 1515.2.4
|	D 4402	Viscosity Determinations of Unfilled Asphalt Using the Brookfield Thermoset Apparatus. 1519.2.3
	D 4318–00	Test Methods for Liquid Limit, Plastic Limit and Plasticity Index of Soils 1613.5.5, 1802.3.2
	D 4434–04	Specification for Poly (Vinyl Chloride) Sheet Roofing 1507.13.2
|	D 4477-04a	Standard Specification for Rigid (Unplasticized) Poly (Vinyl Chloride) (PVC) Siding 1404.9, 1404.9.1, 1405.13
	D 4479–00	Specification for Asphalt Roof Coatings–Asbestos-free . . . . . .Table 1507.10.2

ASTM- continued

D 458–00	Specification for Asphalt Roof Cement, Asbestos-free	Table 1507.10.2
D 4601–98	Specification for Asphalt-coated Glass Fibr Base Sheet Used in Roofing	Table 1507.10.2
D 4637–04	Specification for EPDM Sheet Used in Single-ply Roof Membrane	1507.12.2
D 4829–03	Test Method for Expansion Index of Soils	1802.3.2
D 4869–04	Specification for Asphalt-saturated (Organic Felt) Underlayment Used in Steep Slope Roofing	1507.2.3, 1507.5.3, 1507.6.3, 1507.7.3, 1507.8.3, 1507.9.3
D 4897–01	Specification for Asphalt-coated Glass Fiber VEnting Base Sheet Used in Roofing	Table 1507.10.2
D 4945–00	Test Method for High-strain Dynamic Testing of Piles	1808.2.8.3
D 4990–97a	Specification for Coal Tar Glass Felt Used in Roofing and Waterproofing	Table 1507.10.2
D 5019–96e01	Specification for Reinforced Nonvulcanized Polymeric Sheet Used in Roofing Membrane	1507.12.2
D 5034—95	Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test)	24.2.17.1.15
D 5055—04	Specification for Establishing and Monitoring Structural Capacities of Prefabricated Wood I-joists	424.2.14.1.15, 2303.1.2
D 5456—05	Specification for Evaluation of Structural Composite Lumber Products	2303.1.9
D 5516–03	Test Method of Evaluating the Flexural Properties of Fire-retardant treated Softwood Plywood Exposed to the Elevated Temperatures	2303.2.2.1
D 5643–94 (2000)e01	Specification for Coal Tar Roof Cement, Asbestos-free	Table 1507.10.2
D 5664–02	Test Methods for Evaluating the Effects of Fire-retardant-treated Lumber	2303.2.2.2
D 5665–99a	Specification for Thermoplastic Fabrics Used in Cold-applied Roofing and Waterproofing	Table 1507.10.2
D 5726–98	Specification for Thermoplastic Fabrics Used in Hot-applied Roofing and Waterproofing	Table 1507.10.2
D 5957-98	Standard Guide for Flood Testing Horizontal Waterproofing Installation	1519.16.6
D 6083—97a	Specification for Liquid Applied Acrylic Coating Used in Roofing	Table 1507.10.2, 1507.15.2, 1523.6.2.1.1, 1523.6.3.1, 1523.6.5.12.2
D 6162–00A	Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	1507.11.2
D 6163–00 E01	Specification for Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheet Metal Materials Using Glass Fiber Reinforcements	1507.11.2
D 6164–00	Specification for Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheet Metal Materials Using Polyester Reinforcements	1507.11.2
D 6222–02	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements	1507.11.2
D 6223–02	Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements	1507.11.2
D 6298–00	Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface	1507.11.2
D 6305–02e01	Practice for Calculating Bending Strength Design Adjustment Factors for Fire-retardant-treated Plywood Roof Sheathing	2303.2.2.1
D 6380-01	Specifications for Asphalt Roll Roofing (Organic Felt)	1507.3.3
D 6381–03	Standard Test Method for Measurement of Asphalt Shingle Mechanical Uplift Resistance	1504.2.1, Table 1504.2.1, 1609.5.2
D 6509–00	Specification for Atactic Polypropylene (APP) Modified Bituminous Base Sheet Materials Using Glass Fiber Reinforcements	1507.11.2
D 6694–01	Standard Specification for Liquid-applied Silicone Coating Used in Spray Polyurethane Foam Roofing	1507.15.2
D 6754–02	Standard Specification for Ketone Ethylene Ester Based Sheet Roofing	1507.13.2
D 6757–02	Standard Specification for Inorganic Underlayment for Use with Steep Slope Roofing Products	1507.2.3
D 6841-03	Standard Practice for Calculating Design Value Treatment Adjustment Factors for Fire-Retardant-Treated Lumber	2303.2.2.2
D 6878–03	Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing	1507.13.2
D 7158-05	Standard Test Method for Wind Resistance of Sealed Asphalt Shingles (Uplift Force/Uplift Resistance Method)	Table 1507.2.10
E 72–02	Standard Test Methods of Conducting Strength Tests of Panels for Building Construction	2103.11.1
E 84—04	Test Method for Surface Burning Characteristics of Building Materials	402.10, 402.14.4, 406.5.2, 410.3.5.3, 422.2.16.3, 423.11.5, 703.4.2, 719.1, 719.4, 802.1, 803.1, 803.5, 803.6.1, 803.6.2, 1407.10, 1407.10.1, 2303.2, 2314.4.4, 2327.1, 2603.3, 2603.4.1.13, 2603.5.4, 2604.2.4, 2606.4, 2612.2, 2612.3
E 90–04	Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements	1207.2
E 96—00e01	Test Method for Water Vapor Transmission of Materials	1203.2, 1523.6.5.2.17.7
E 108—04	Test Methods for Fire Tests of Roof Coverings	423.12.1, 1505.1, 1513.1, 1516.1, 1523.1.2, 2329.1, 2603.6, 2610.2, 2610.3

ASTM- continued

	E 119—00a	Test Methods for Fire Tests of Building Construction and Materials. . . . . 410.3.5.2, 703.2, 703.2.1, 703.2.3, 703.3, 704.7, 704.9, 706.7, 711.3.2, 712.3.1, 712.4.1, 712.4.6, 713.1, 713.4, 714.7, 715.2, 716.5.2, 715.5.3.1, 715.6.2, 716.5.2, 716.5.3.1, 716.6.2, Table 721.1(1), 1407.10.2,2103.2, 2603.3, 2603.4, 2603.4.1.13, 2603.5.4, 2604.2.4, 2606.4, 2612.2, 2612.3.1.1, 2612.3.1.4
	E 136 2004	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C 703.4.1
	E 163-84E01	Methods of Fire Tests For Window Assemblies (withdrawn) 2121.2.1.2.8
*	E 283–04	Test Method for Determining Rate of Leakage through Exterior Windows, Curtain Walls and Doors under Specified Pressure Differences across the Specimen. 13-606.ABC.1.1, 13-606.ABC.1.2.4
	E 328–02	Methods for Stress Relaxation for Materials and Structures 2103.13.6
	E 330—02	Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference 1714.5.3, 2415.4, 2415.7.1
	E 331—00	Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference 1403.2, 2415.4
	E 492–04	Test Method for Laboratory Measurement of Impace Sound Transmission Through Floor-ceiling Assemblies Using the Tapping Machine 1207.3
	E 518–03	Standard Test Methods for Flexural Bond STrength of Masonry 2101.3.11.1
	E 519–02	Standard Test Method for Diagonal Tension (Shear) in Masonry Assemblages 2103.11.1
	E 605–00	Test Method for Thickness and Density of Sprayed Fire-resistive Material (SFRM) Applied to Structural Members. 1704.10.3, 1704.10.3.1, 1704.10.3.2, 1704.10.4
	E 681–04	Test Methods for Concentration Limits of Flammability of Chemical Vapors and Gases 307.2
	E 736–00	Test Method for Cohesion/Adhesion of Sprayed Fire-resistive Materials Applied to Structural Members 1704.10.5
	E 814–02	Test Method of Fire Tests of Through-penetration Firestops 702.1, 712.3.1.2, 712.4.1.1, 712.4.1.1.2
	E 970–00	Test Method for Critical Radiant Flux of Exposed Attic Floor Insulation Usinsg a Radiant Heat Energy Source. 719.3.1
	E1300—04e01 or 98 (HVHZ)	Practice for Determining Load Resistance of Glass in Buildings. 1714.5.2.1, 2404.1, 2404.2, 2404.3, 2411.2.1.1, 2411.2.1.2, 2411.3.1.2
	E1592—01	Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference 1504.3.2, 2411.2.1.2
	E 1602–03	Guide for Construction of Solid Fuel-burning Masonry Heaters 2112.2
	E 1886-02 or 05	Standard Test Method for Performance of Exterior Windows, Curtain Walls, Doors, and Storm Shutters Impacted by Missile(s) and Exposed to Cyclic Pressure Differentials 202, 1609.1.4
	E 1966 2003	Test Method for Fire-Resistant Joint Systems 202, 702.1, 712.3
	E 1966–00	Test Method for Fire-resistant Joint Systems 702.1, 7.13.3
	E 1996-02 or 05	Specification for Performance of Exterior Windows, Glazed Curtain Walls, Doors, and Storm Shutters Impact by Windborne Debris in Hurricanes. 202, 1609.1.4
	E 2307–04	Standard Test Method for Determining Fire Resistance of Perimeter Fire Barrier Systems Using Intermediate-scale, Multistory Test Apparatus 713.4
	F 547–01	Terminology of Nails for Use with Wood and Wood-based Materials . . . . . Table 2506.2
	F 851—87 (2000)	Standard Test Method for Self-Rising Seat Mechanisms 1024.10
*	F 1346—91 (2003)	Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs. 424.1.3.9, 424.2.2, 424.2.17
	F 1667–03	Specification for Driven Fasteners: Nails, Spikes and Staples . . . . . Table 720.1(2), Table 720.1(3), ... 1507.2.6, 2303.6, Table 2506.2
	F 2006–00	Standard/Safety Specification for Window Fall Prevention Devices for Nonemergency Escape (Egress) and Rescue (Ingress) Windows 1405.12.2
	F2090–01a	Specification for Window Fall Prevention Devices with Emergency Escape (Egress) Release Mechanisms 1405.12.2
	G 53—96	Practice for Operating Light-and Water-Exposure Apparatus (Fluorscent UV-Condensation Type) for Exposure of Nonmetallic Materials 424.17.1.15.2
	G 60—01	Standard Practice for Conducting Cyclic Humidity Tests 2319.17.2.2.8
	G 85	Standard Practice for Modified Salt Spray (Fog) Testing 1517.5.1, 1517.5.2, 1523.6.5.2.10, 1523.6.5.2.11
	G 152–04	Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials 1504.6
	G 154–00A	Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials 1504.6
	G 155	Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials. 2612.2
	G 155–04	Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials 1504.6

AWCI

The Association of the Wall and Ceiling Industries International
803 West Broad Street, Suite 600
Falls Church, VA 22046

Standard reference number	Title	Referenced in code section number
12—B—98	Technical Manual 12-B Standard Practice for the Testing and Inspection of Field Applied This—Film Intumescent Fire-resistive Materials; an Annotated Guide, First Edition	1704.11

AWPA

American Wood-Preservers' Association
P.O. Box 5690
Grandbury, TX 76049

Standard reference number	Title	Referenced in code section number
C1—00	All Timber Products—Preservative Treatment by Pressure Processes	1505.6, 2303.1.8, 2314.4.5
C2—01	Lumber, Timber, Bridge Ties and Mine Ties—Preservative Treatment by Pressure Processes	Table 1507.9.5, 1805.4.5, 1805.7.1, 2303.1.8, 2304.11.2, 2304.11.4, 2304.11.7, 2314.4.5
C3—99	Piles—Preservative Treatment by Pressure Processes	1805.4.5, 1809.1.2, 1823.1.3, 2303.1.8, 2314.4.5
C4—99	Poles—Preservative Treatment by Pressure Processes	1805.7.1, 1808.1.2, 2303.1.8, 2314.4.5
C5	Posts - Pressure Treatment	2314.4.5
C6	Cross Ties and Switch Ties Pressure Treatment	2314.4.5
C7	Incised (Red, White & Alaska Yellow Cedar) Poles Butts Thermal Treatment	2314.4.5
C8	Poles (Western Red & Alaska Yellow Cedar) Full Length Thermal Treatment	2314.4.5
C9—00	Plywood—Preservative Treatment by Pressure Processes	2304.11.2, 2304.11.4, 2304.11.7, 2314.4.5
C10	Poles (Lodgepole Pine) Full Length Thermal Treatment.	2314.4.5
C11	Wood Blocks for Floors & Platforms Pressure Treatment.	2314.4.5
C14—99	Wood for Highway Construction, Pressure Treatment by Pressure Process	2314.4.5
C16—00	Wood Used on Farms, Pressure Treatment by Pressure Process	2314.4.5
C18—99	Standard for Pressure Treated Material in Marine Construction	2314.4.5
C20	Structural Lumber, Fire Retardant Pressure Treatment	2314.4.5
C22—96	Lumber and Plywood for Permanent Wood Foundations— Preservative Treatment by Pressure Processes.	1805.4.6, 2314.4.5
C23—00	Round Poles and Posts Used in Building Construction— Preservative Treatment by Pressure Processes.	2314.4.5
C25	Crossarms Pressure Treatment	2314.4.5
C26	Crossarms, Non-Pressure Treatment	2314.4.5
C28—99	Standard for Preservative Treatment by Pressure Process of Structural Glued Laminated Members and Laminations before Gluing.	2314.4.5
C29	Lumber to be Used for the Harvesting, Storage and Transportation of Food Stuffs— Preservative Treatment by Pressure Processes	2314.4.5
M4—02	Standard for the Care of Preservative-Treated Wood Products	1823.1.4, 2314.4.5
M6—96	Brands Used on Forest Products	2315.1.9
U1—04	USE CATEGORY SYSTEM: User Specification for Treated Wood Except Section 6, Commodity Specification H	1403.5, 1505.6, Table 1507.9.5, 1805.4.5, 1805.4.6, 1805.7.1, 1809.1.2, 2303.1.8, 2304.11.2, 2304.11.4, 2304.11.6, 2304.11.7

AWS

American Welding Society
550 N.W. LeJeune Road
Miami, FL 33126

Standard reference number	Title	Referenced in code section number
B2.1	Standard Welding Procedure and Performance Qualification.	2214.3
C5.4	Recommended Practice for Stud Welding	2214.3
D1.1—04	Structural Welding Code—Steel	2214.3
D1.2	Structural Welding Code—Aluminum	2003.3
D1.3—98	Structural Welding Code—Sheet Steel	2214.3
D1.4—98	Structural Welding Code—Reinforcing Steel.	1903.5.2, 1922.4.4, 1922.4.5, 1926.4.6, 1926.4.8, 2119.1.1, 2214.3

AWS - continued

D9.1	Specification for Welding of Sheet Metal	2214.3
D10.9	Standard for Qualification of Welding Procedures and Welders for Piping and Tubing	2214.3

BHMA

Builders Hardware Manufacturers' Association
355 Lexington Avenue, 17th Floor
New York, NY 10017-6603

Standard reference number	Title	Referenced in code section number
A 156.10—99	American National Standard for Power Operated Pedestrian Doors	1008.1.3.2
A 156.19—02	Standard for Power Assist and Low Energy Operated Doors	1008.1.3.2

CGSB

Canadian General Standards Board
222 Queens Street
14th Floor, Suite 1402
Ottawa, Ontario, Canada KIA 1G6

Standard reference number	Title	Referenced in code section number
37-GP-52M (1984)	Roofing and Waterproofing Membrane, Sheet Applied, Elastomeric	1504.7, 1507.12.2
CAN/CGSB 37.54—95	Polyvinyl Chloride Roofing and Waterproofing Membrane	1507.13.2
37-GP-56M (1980)	Membrane, Modified, Bituminous, Prefabricated and Reinforced for Roofing—with December 1985 Amendment	1507.11.2

CPSC

Consumer Product Safety Commission
4330 East West Highway
Bethesada, MD 20814-4408

Standard reference number	Title	Referenced in code section number
16 CFR Part 1201(1977)	Safety Standard for Architectural Glazing Material	2406.1.1, 2406.2.1, 2407.1, 2408.2.1, 2408.3, 2411.1.3, 2411.3.1.3, 2411.4.2, 2612.4.8
16 CFR Part 1209 (1979)	Interim Safety Standard for Cellulose Insulation	719.6
16 CFR Part 1404 (1979)	Cellulose Insulation	719.6
16 CFR Part 1500 (1991)	Hazardous Substances and Articles; Administration and Enforcement Regulations	307.2
16 CFR Part 1500.44 (2001)	Method for Determining Extremely Flammable and Flammable Solids	307.2
16 CFR Part 1507 (2001)	Fireworks Devices	307.2
16 CFR Part 1630 (2000)	Standard for the Surface Flammability of Carpets and Rugs	804.4.1
Pub. No. 362	Safety Barrier Guidelines for Home Pools	424.1.3.1.9

CSA

Canadian Standards Association
5060 Spectrum Way, Suite 100
Mississauga, Ontario, L4W 5N6 Canada

Standard reference number	Title	Referenced in code section number
101/I.S.2/A440—05	Specifications for Windows, Doors and Unit Skylights	1714.5.1, 2405.5

CSSB

Cedar Shake and Shingle Bureau
P.O. Box 1178
Sumas, WA 98295-1178

Standard reference number	Title	Referenced in code section number
CSSB—97	Grading and Packing Rules for Western Red Cedar Shakes and Western Red Shingles of the Cedar Shake and Shingle Bureau	Table 1507.8.4, Table 1507.9.5

DASMA

Door and Access Systems Manufacturers
Association International
1300 Summer Avenue
Cleveland, OH 44115-2851

Standard reference number	Title	Referenced in code section number
ANSI/DASMA107—98 (03)	Room Fire Test Standard for Garage Doors Using Foam Plastic Insulation	2603.4.1.9
ANSI/DASMA108—05	Standard Method for Testing Sectional Garage Doors and Rolling Doors: Determination of Structural Performance Under Uniform Static Air Pressure Difference	1714.5.3.1
ANSI/DASMA115-05	Standard Method for Testing Garage Doors and Rolling Doors: Determination of Structural Performance Under Missile Impact and Cyclic Wind Pressure.	1609.1.4

DECO

Document Engineering Co., Inc.
5210 Stagg Street
Van Nuys, CA 91401

Standard reference number	Title	Referenced in code section number
ANSI Z 358.1 04	Emergency Eyewash and Shower Equipment	Table 420.3.17.2

DOC/NIST

U.S. Department of Commerce
National Institute of Standards and Technology
100 Bureau Drive Stop 3460
Gaithersburg, MD 20899

Standard reference number	Title	Referenced in code section number
CS236	Mat-Formed Particleboard	2314.4.6, 2315.1.6
PS1-95	Construction and Industrial Plywood.	2211.2.2.2, 2303.1.4, 2304.6.2, Table 2304.7(4), 2306.3.2, 2314.4.6, 2315.1.2
PS2-92	Performance Standard for Wood Based Structural Use Panels	1809.1.1, 2211.3.1, 2303.1.4, 2304.6.2, Table 2304.7(4), Table 2304.7(5), Table 2306.3.1, 2306.3.2, 2314.4.6, 2315.1.2
PS20-99	American Softwood Lumber Standard.	1809.1.1, 2302.1, 2303.1.1, 2314.4.6, 2315.1.8
PS56	Structural Glued Laminated Timber	2314.4.6

DOL/OSHA

U.S. Department of Labor
Occupational Safety and Health Administration
Frances Perkins Building
200 Constitution Avenue, N.W.
Washington, D.C. 20210

Standard reference number	Title	Referenced in code section number
29 CFR Part 1910.1000 (1974)	Air Contaminants	902.1
29CFR Part 1910	Occupational Safety and Health Standards.	1618.4
29CFR 1926-950 (p)	Occupational Safety and Health Administration Excavation Safety Act	1817.1

DOT

U.S. Department of Transportation
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
14 CFR Part 150 (2005)	Airport Noise Compatibility Planning, Federal Aviation Administration	3113.1
49 CFR—1998	Specification of Transportation of Explosive and Other Dangerous Articles, UN 0335,UN 0336 Shipping Containers	307.2

DOT- continued

49 CFR Parts 173.137 (1990)	Shippers—General Requirements for Shipments and Packaging—Class 8—Assignment of Packing Group	307.2

FC&PA

Florida Concrete & Products Association Inc.
3030 Dade Ave.
Orlando, Fla. 32804

Standard reference number	Title	Referenced in code section number
FC&PA—97	Guide to Concrete Masonry Residential Construction in High Wind Areas	1609.1.1

FEMA

Federal Emergency Management Agency
Federal Center Plaza
500 C Street S.W.
Washington, DC 20472

Standard reference number	Title	Referenced in code section number
44CFR59	Emergency Management and Assistance, General Provisions	423.4.2, 3110.1.2
44CFR60—97	Criteria for Land Management and Use.	423.4.2, 3110.1.2
FIA-TB11—01	Crawlspace Construction for Buildings Located in Special Flood Hazard Areas	1807.1.2.1

FINA

Federation Internationale de Natation Amateur
Av. de l' Avant-Poste 4
1005 Lausanne
SWITZERLAND

Standard reference number	Title	Referenced in code section number
CHG-22	FINA Handbook 1998-2000	424.1.2.7

Florida Codes

Florida Building Commission
Building Codes and Standards
Department of Community Affairs
2555 Shumard Oak Blvd.
Tallahassee, FL 32399-2100

Standard reference number	Title	Referenced in code section number
Ch. 11 FBC-B—07	Ch. 11, Florida Building Code, Building (Florida Accessible Code for Building Construction)	101.4.8, 104.11.3, 201.5, 403.1.1, 406.2.2, 412.1.6, 423.10.2.8.7, 423.27.4, 423.28.2.4, 427.1.4.1.1.3, 427.1.4.4.1, 427.1.4.4.2, 1003.3.4, 1003.5.3, 1007.1, 1008.1, 1009.5.3, 1009.11.8, 1009.14, 1010.1, 1010.8, 1010.9, 1208.2, 3001.3
Ch. 13 FBC-B—07	Ch. 13 Florida Building Code, Building (Energy Efficiency)	101.4.7, 201.6, 1202.3.2, 1301.1.1, 1403.2
Ch. 27 FBC-B—07	Ch. 27 Florida Building Code, Building (Electrical Systems)	101.4.1, 102.2.6, 107.3, 414.5.4, 414.9.2.8.1, 415.9.2.8, 419.3.8.3, 419.3.8.8, 419.3.14.2, 419.3.14.4, 419.3.15.2, 420.3.19.3, 420.3.19.5, 420.3.20.2, 420.3.20.3, 421.3.9.3, 421.3.9.5, 421.3.10.10, 423.25.5, 423.25.5.2, 424.1.4.1, 424.1.6.5.16.4.1, 424.1.6.5.1, 424.1.9.8.5, 424.2.16, 425.3.5, 426.3.5, 427.1.4.1.5, 603.1.3, 904.3.1, 907.1.3, 907.5, 907.9.3, 909.11, 909.12.1, 909.16.3, 1006.2.3.4, 1006.2.4, 1205.4.1, 1405.10.4, 2701.1, 2702.1
FEBC—07	Florida Existing Building Code	101.2. 1009.3
FPC—07	Florida Fire Prevention Code	101.4.6, 102.6, 201.3, 307.2, Table 307.7(1), Table 307.7(2), 307.9, Table 307.7(1), Table 307.7(2), 307.9, 308.2, 308.3, 404.2, 406.5.1, 406.5.2, 406.6.1, 410.3.6, 411.1, 412.4.1, 413.1, 414.1.1, 414.1.2, 414.1.2.1, 414.2.4, Table 414.2.4, 414.3, 414.5, 414.5.1, Table 414.5.1, 414.5.2, 414.5.4, 414.5.5, 414.6, 415.1, 415.3, 415.3.1, Table 415.3.1, Table 415.3.2, 415.7, 415.7.1, 415.7.1.4, 415.7.2, 415.7.2.3, 415.7.2.5, 415.7.2.7, 415.7.2.8, 415.7.2.9, 415.7.3, 415.7.3.3.3, 415.7.3.5, 415.7.4, 415.8, 415.9.1, 415.9.2.7, 415.9.5.1, 415.9.7.2, 704.8.2, 706.1, 901.2, 901.3, 901.5, 901.6.2, 903.2.6.1, 903.2.11, Table 903.2.13, 903.5, 904.2.1, 905.1, 906.1, 907.2.5, 907.2.12.2,

Florida Codes- continued

	907.2.14, 907.2.16, 907.19, 909.20, 910.2.3, Table 910.3, 1001.3, 1203.4.2, 1203.5, 2702.2.8, 2702.2.10, 2702.2.11, 2702.2.12, 2702.3, 3102.1, 3103.1, 3309.2
FBC-FG—07	Florida Building Code, Fuel Gas 101.4.2, 109.3, 201.1, 201.3, 415.7.3, 424.2.1.2, 424.2.15, 425.3.7, 426.6.1, 426.3.6.2, 2113.11.1.2, 2113.15, 2801.1
FBC-M—07	Florida Building Code, Mechanical 101.4.3, 201.3, 202, 307.9, 406.4.2, 406.6.3, 406.6.5, 409.3, 412.4.6, 414.1.2, 414.1.2.1, 414.1.2.2, 414.3, 415.7.1.4, 415.7.2, 415.7.2.8, 415.7.3, 415.7.4, 415.9.11.1, 416.3, 603.1, 707.2, 716.2.2, 716.5.4, 716.6.1, 716.6.2, 716.6.3, 717.5, 719.1, 903.2.12.1, 904.2.1, 904.11, 908.6, 909.1, 909.10.2, 1014.5, 1016.4.1, 1203.1, 1203.2.1, 1203.4.2, 1203.4.2.1, 1203.5, 1209.3, 2304.5, 3004.3.1
FBC-P 07	Florida Building Code, Plumbing 101.4.4, 109.3, 201.3, 415.7.4, 419.3.13.1, 421.3.8.1, 424.2.1.2, 424.2.3, 424.2.8.1, 424.2.13.2, 425.4.2, 426.3.1.2, 426.3.2.1, 427.1.4.1.2, 430.6.1, 603.1.2, 717.5, 903.3.5, 1206.3.3, 1503.4, 1503.4.3, 151.4.2, 1514.4.3, 1807.4.3, 2901.1, 2902.1.1, 3305.1
61C-5	Rule 61C, Florida Administrative Code (Bureau of Elevator Safety Regulations), ... 3001.1
64E	Rule 64E, Florida Administrative Code (Sewage Disposal). 101.4.4, 2901.1
FBC-R—07	Florida Building Code, Residential 101.2, 308.3, 308.5, 310.1, 1706.1.1
FBC-TPHVHZ—07	Florida Building Code, Test Protocols for High Velocity Hurricane Zones
	RAS 109 . . . . . 1521.18, 1523.6.2.1
	RAS 111 1503.3, 1504.5, 1514.2, 1514.2.1, 1514.2.2, 1514.2.3, 1514.2.4, 1514.2.5.2, 1514.3, 1514.4.1.1, 1515.2.3.2, 1517.6.1, 1517.6.2.1, 1517.6.2.3, 1517.6.2.5, 1518.5.3, 1518.6.2, 1518.7.3.4, 1518.9.5, 1519.8, 1519.10, 1519.13, 1523.6.5.2.14, 1519.16.5, 1523.6.5.2.14
	RAS 115 . . . . . 1518.7
	RAS 117 1519.7, 1519.11, 1520.4, 1520.5, 1521.7.1, 1521.14.3, 1523.6.5.29
	RAS 118 . . . . . 1518.8.1
	RAS 119 . . . . . 1518.8.1
	RAS 120 . . . . . 1518.8.1
	RAS 127 . . 1518.8.5, 1518.8.6, 1523.6.5.2, 1523.6.5.2.2.2, 1523.6.5.2.2.3, 1523.6.5.2.3.2, 1523.6.5.2.3.3, 1523.6.5.2.6.2, 1525
	RAS 128 1525
	RAS 130 . . . . . 1518.10
	RAS 133 . . . . . 1519.9.2
	RAS 150 . . . . . 1519.1
	TAS 100. . . . . 1523.6.5, 1523.6.5.1, 1523.6.5.2, 1523.6.5.2.4, 1523.6.5.2.4.1, 1523.6.5.2.5, 1523.6.5.2.6, 1523.6.5.2.7
	TAS 100A 1523.6.5.2.13
	TAS 101 . . . . . 1523.6.5.22.2 1523.6.2.22, 1523.6.5.2.2.3
	TAS 102 . . . . . 1523.6.5.2.3, 1523.6.5.2.3.2, 1523.6.5.2.3.3, 1523.6.5.2.6.2, 1523.6.5.2.6.3
	TAS 102A. 1523.6.5.2.3, 1523.6.5.2.3.2, 1523.6.5.2.3.3, 1523.6.5.2.6.2, 1523.6.5.2.6.3
	TAS 103 . . . . . 1523.6.5.2.1
	TAS 104 . . . . . 1523.6.5.2.1
	TAS 105. . . . . 1513.1, 1519.7.1, 1521.7, 1521.11
	TAS 106 . . . . . 1512.4.2.4, 1523.6.5.2.2.4, 1523.6.5.2.3.4, 1523.6.5.2.6.4
	TAS 107. . . . . 1507.2.10, Table 1507.2.10, 1523.6.5.1
	TAS 108 . . . . . 1523.6.5.2.2.1, 1523.6.5.2.2.2, 1523.6.5.2.2.3, 1523.6.5.2.3.1, 1523.6.5.2.3.2, 1523.6.5.2.3.3, 1523.6.5.2.6.1, 1523.6.5.2.6.2, 1523.6.5.2.6.3, 1715.2, 1715.2.2
	TAS 110 . . . . . 1515.1.4, 1515.2.5, 1520.1, 1520.4, 1523.1.1, 1523.6.2, 1523.6.2.1, 1523.6.3, 1523.6.5.2.4.1, 1523.6.5.2.6, 1523.6.5.2.7, 1523.6.5.2.8, 1523.6.5.2.9, 1523.6.5.2.12, 1523.6.5.2.13.1, 1523.6.5.2.14, 1523.6.5.2.15, 1523.6.5.2.16, 1523.6.5.2.17
	TAS 110A. 1523.6.5.2.13
	TAS 111A. 1523.6.5.2.14
	TAS 111B 1523.6.5.2.14
	TAS 111C 1523.6.5.2.14
	TAS 112. . . . . 1523.6.5.2
	TAS 113. . . . . 1518.8.1.1
	TAS 114 1513.1, 1515.1.1, 1515.2.4, 1517.5.1, 1519.5.1, 1520.4, 1523.6.2, 1523.6.2.1, 1523.6.3, 1523.6.5.2.9, 1523.6.5.2.10, 1523.6.5.2.11
	TAS 115. . . . . 1523.6.5.2.6.3
	TAS 116 . . . . . 1513.1, 1523.6.5.2.2.1, 1523.6.5.2.3.1, 1523.6.5.2.6.1

Florida Codes- continued

TAS 121	1523.6.5.2.12
TAS 123	1518.8.1.1, 1523.6.5.2.15, 1523.6.5.2.17
TAS 123A	1523.6.5.2.16
TAS 124	1521.10, 1523.6.4
TAS 125	1518.9.1, 1523.6.5.2.4.1
TAS 126	1521.12
TAS 135	1523.6.5.2.6
TAS 201	202, 1609.1.4
TAS 202	1609.1.4, 1008.1.6, 1714.5.2.1, 1714.5.2.1.1, 1714.5.3, 1714.6
TAS 203	202, 1609.1.4
TAS 301	1515.1.3

FM

Factory Mutual
Standards Laboratories Department
1151 Boston-Providence Turnpike
Norwood, MA 02062

Standard reference number	Title	Referenced in code section number
4450 (1992)	Approval Standard for Class 1 Insulated Steel Deck Roofs—with Supplements through July 1992	1504.3.1, 1508.1, 2603.3, 2603.4.1.5, 2612.3.2.5.2
* 4470 (1992)	Approval Standard for Class 1 Roof Covers	1504.3.1, 1504.7, 1515.1.1
4471	Approval Standard for Class I Panel Roofs	1515.1.1
4880 (2001)	American National Standard for Evaluating Insulated Wall or Wall and Roof/Ceiling Assemblies, Plastic Interior Finish Materials, Plastic Exterior Building Panels, Wall/Ceiling Coating Systems, Interior and Exterior Finish Systems	2603.4, 2603.9

FRSA

Florida Roofing, Sheet Metal and
Air Conditioning Contractors Association
4111 Metric Drive
Winter Park, Florida 32792

Standard reference number	Title	Referenced in code section number
FRSA/TRI 07320/8-05	Concrete and Clay Roof Tile Installation Manual, Fourth Edition	1507.3.3, 1507.3.7, 1507.3.8, 1507.3.9

GA

Gypsum Association
810 First Street N.E. #510
Washington, DC 20002-4268

Standard reference number	Title	Referenced in code section number
GA 216—04	Application and Finishing of Gypsum Board	Table 2508.1, 2509.2
GA 600—03	Fire-Resistance Design Manual, 17th Edition	Table 720.1(1), Table 720.1(2), Table 720.1(3)

GSA

General Services Administration
1800 F Street, NW
Washington, DC 20405

Standard reference number	Title	Referenced in code section number
DD-G-451D (1977)	Glass, Flat and Corrugated for Glazing Mirrors and Other Uses	2411.1.2

HPVA

Hardwood Plywood Veneer Association
1825 Michael Faraday Drive
Reston, VA 20190-5350

Standard reference number	Title	Referenced in code section number
HP-1—2000	The American National Standard for Hardwood and Decorative Plywood	2303.3, 2304.6.2

ICC

International Code Council
500 New Jersey Avenue, NW
Washington, D.C. 20001

Standard reference number	Title	Referenced in code section number
IBHS-05	Guideline for Hurricane Resistant Residential Construction with errata for the first printing.	1609.1.1, 1609.1.1.1, 2308.2.1
ICC/ANSI A117.1—03	Accessible and Usable Buildings and Facilities	406.2.2, 907.9.1.4,1007.6.5, 1010.1, 1010.6.5, 1010.9, 1011.3, 1101.2, 1102.1, 1103.2.14, 1106.7, 1107.2, 1108.2.2, 1109.1, 1109.2, 1109.2.1.1, 1109.2.2, 1109.3, 1109.4, 1109.8, 3001.3, 3409.6, 3409.8.2, 3409.8.3
ICC 300—02	ICC Standard on Bleachers, Folding and Telescopic Seating and Grandstands	1025.1.1, 3401.1
SBCCI SSTD 11—97	Test Standard for Determining Wind Resistance of Concrete or Clay Roof Tiles	1715.2.1, 1715.2.2
SBCCI SSTD 12—99	Standard for Determining the Wind Resistance from Windborne Debris	423.25.4, 423.25.4.1, 1609.1.2

ISO

International Standards Organization
ISO Central Secretariat1, rue de Varembee, Case postale 56
CH-1211 Geneva 20, Switzerland

Standard reference number	Title	Referenced in code section number
ISO 8115—86	Cotton Bales–Dimensions and Density	Table 415.8.2.1.1

NAAMM

National Association of Architectural
Metal Manufacturers
8 South Michigan Ave
Chicago, IL 60603

Standard reference number	Title	Referenced in code section number
FP 1001—97	Guide Specifications for Design of Metal Flag Poles	1609.1.1

NCMA

National Concrete Masonry Association
2302 Horse Pen Road
Herndon, VA 22071-3499

Standard reference number	Title	Referenced in code section number
TEK 5-84 (1996)	Details for Concrete Masonry Fire Walls	Table 720.1(2)

NFPA

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269-9101

Standard reference number	Title	Referenced in code section number
10–02	Standard for Portable Fire Extinguisher	419.4.2.10.2, 420.4.2.10.1.2, 423.28.2.14
11—2005	Low Expansion Foam	904.7
12—2005	Carbon Dioxide Extinguishing Systems	904.8, 904.11 903.3.5.1.1, 904.11, 907.8, 1621.3.10.1, 2121.2.12.8, 3104.5, 3104.9
12A–04	Halon 1301 Fire Extinguishing Systems	904.9
13–02	Installation of Sprinkler Systems	707.3, 903.3.1.1, 903.3.2, 903.3.5.1.1, 903.3.5.2,

NFPA- continued

		904.11, 905.3.4, 907.8, 3104.5, 3104.9
	13D—02	Installation of Sprinkler Systems in One- and Two-family Dwellings and Manufactured Homes 903.3.1.3, 903.3.5.1.1
	13R—02	Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height 903.3.1.2, 903.3.5.1.1, 903.3.5.1.2, 903.4
	14—03	Installation of Standpipe and Hose System 905.2, 905.3.4, 905.4.2, 905.8
	16—03	Installation Foam-water Sprinkler and Foam-water Spray Systems 904.7, 904.11
	17—02	Dry Chemical Extinguishing Systems 904.6, 904.11
	17A—02	Wet Chemical Extinguishing Systems 904.5, 904.11
||	30—03	Flammable and Combustible Liquids Code 415.3, 423.20.4.1
	31—01	Installation of Oil-burning Equipment 2113.15
*	32—04	Dry Cleaning Plants 415.6.4
	40—01	Storage and Handling of Cellulose Nitrate Film. 409.1
||	61—02	Prevention of Fires and Dust Explosions in Agricultural and Food Product Facilities 415.7.1, 423.7.7
**	70—08	National Electric Code (Excluding Article 80). 2701.1
||||	72—02	National Fire Alarm Code 423.7.7, 436.7.1.1, 436.7.1.3, 416.7.2, 436.10.5.1, 436.10.5.2, 505.4, 901.6, 903.4.1, 904.3.5, 907.2, 907.2.1, 907.2.1.1, 907.2.10, 907.2.10.4, 907.2.11.2, 907.2.11.3, 907.2.12.2.3, 907.2.12.3, 907.4, 907.5, 907.9.2, 907.10, 907.14, 907.16, 907.17, 911.1, 1008.1.3.7.4, 3002.8, 3006.5
	80—99	Fire Doors and Fire Windows 508.2.2.1, 715.4, 715.4.5, 715.4.6.1, 715.4.7.2, 715.5, 1008.1.3.3
	85—04	Boiler and Combustion System Hazards Code . . . . . 415.6.1 (Note: NFPA 8503 has been incorporated into NFPA 85)
	92B—05	Smoke Management Systems in Malls, Atria and Large Spaces 909.8
||	91—99	Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists and NonCombustible Particulate Solids . . 423.20.4.1
*	96—04	Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations 436.6.2
*	99—05	Standard for Health Care Facilities 4203.18.1, 420.3.20.2, 420.3.25.1,419.3.18, 419.3.18.8
||	101—06	Life Safety Code. 420.3.3.6, 423.6.1, 423.14.2.1, 423.27.9.1, 423.27.10.1, 427.2.2.1.1.1, 427.1.4.13.2, 427.1.4.2.13, 427.1.4.1.1.2, 427.1.3.1.1.2, 903.6.2
	105—03	Standard for the Installation of Smoke Door Assemblies 405.4.2, 715.4.3.1, 909.20.4.1
|||	110—05	Emergency and Standby Power Systems 419.3.18, 419.3.18.8, 420.3.25, 1006.2.33, 421.3.13.1 1006.2.3.3, 2702.1
||	111—05	Stored Electrical Energy Emergency and Standby Power Systems 1006.2.3.3, 2702.1
*	120—04	Coal Preparation Plants 415.6.1
	211—03	Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances 2112.5
	230—03	Standard for the Fire Protection of Storage. 507.3
	252—03	Standard Methods of Fire Tests of Door Assemblies 715.3, 715.4.1, 715.4.2, 715.4.3, 715.4.4.1
||	253—06	Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source 402.11.1, 406.6.4, 804.2, 804.3
	257—00	Standard for Fire Test for Window and Glass Block Assemblies 715.3, 715.4.3.2, 715.5, 715.5.1, 715.5.2, 715.5.8.1
*	259—03	Test Method for Potential Heat of Building Materials 2603.4.1.10, 2603.5.3, 2612.3.2.4.4
	265—02	Method of Fire Tests for Evaluating Room Fire Growth Contribution of Textile Wall Coverings on Full Height Panels and Walls 803.6.2, 803.6.2.1
	268—01	Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source 1406.2.1, 1406.2.1.1, 1406.2.1.2, 2603.5.7
	285—98	Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Nonload-bearing Wall Assemblies Containing Combustible Components 1407.10.4, 2603.5.5
*	286—06	Standard Method of Fire Test for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth 402.15.4, 803.2, 803.2.1, 803.5, 803.6.3, 2603.4, 2603.9
	288—01	Standard Methods of Fire Tests of Floor Fire Door Assemblies in Fire-resistance-rated Floor Systems. 711.8, 712.4.1.5
||	303—06	Fire Protection Standards for Marinas and Boatyards 905.3.7
*	409—04	Aircraft Hangars 412.2.6, 412.4.5
	418—01	Standard for Heliports 412.5.5
*	484—06	Combustible Metals, Metal Powders and Metal Dust 415.6.1
||	654—06	Prevention of Fire & Dust Explosions from the Manufacturing, Processing and Handling of Combustible Particulate Solids 415.6.1
	655—01	Prevention of Sulfur Fires and Explosions. 415.6.1
	664—02	Prevention of Fires Explosions in Wood Processing and Woodworking Facilities 415.6.1
||	701—04	Standard Methods of Fire Tests for Flame-propagation of Textiles and Films 402.11.1, 410.3.6, 801.1.2, 806.1, 806.1.2, 806.2

NFPA- continued

		3102.3, 3102.3.1, 3102.6.1.1, 3105.4
704—01	Standard System for the Identification of the Hazards of Materials for Emergency Response	414.7.2, 415.2
780—04	Installation of Lighting Systems	419.3.19, 420.3.26.1, 423.17.7
1124—06	Manufacture, Transportation, and Storage of Fireworks and Pyrotechnic Articles.	415.3.1
2001—04	Clean Agent Fire Extinguishing Systems	904.10

NRCA

National Roofing Contractors Association
10255 W. Higgins Road, Suite 600
Rosemont, IL 60018

Standard reference number	Title	Referenced in code section number
P0405	Roofing and Waterproofing Manual, 5th Edition	1513.1

NSF

NSF International
789 Dixboro Road
Ann Arbor, MI 48105

Standard reference number	Title	Referenced in code section number
50—07	Circulation System Components and Related Materials for Swimming Pools, Spas/Hot Tubs	424.1, 424.1.6.5.16, 424.1.6.5.16.5.2, 424.1.6.5.16.6.2, 424.1.10.1.3, 424.1.6.5.1
60—05	Drinking Water Treatment Chemicals Health Effects.	424.1.2.1

PCA

Portland Cement Association
5420 Old Orchard Road
Skokie, IL 60077

Standard reference number	Title	Referenced in code section number
EB008-9	Concrete Masonry Handbook.	2119.1.1

PCI

Precast Prestressed Concrete Institute
209 West Jackson Boulevard, Suite 500
Chicago, IL 60606-4938

Standard reference number	Title	Referenced in code section number
MNL 124—89	Design for Fire Resistance of Precast Prestressed Concrete.	721.2.3.1
MNL 128—01	Recommended Practice for Glass Fiber Reinforced Concrete Panels	1903.2

PTI

Post-Tensioning Institute
1717 W. Northern Avenue, Suite 114
Phoenix, AZ 85021

Standard reference number	Title	Referenced in code section number
PTI—2004	Standard Requirements for Analysis of Shallow Concrete Foundations on Expansive Soils, First Edition	1805.8.2
PTI—2004	Standard Requirements for Design of Shallow Post-tensioned Concrete Foundation on Expansive Soils	1805.8.2

RCSC

Research Council on Structural Connections
c/o Stanley D. Lindsey & Assoc. Ltd.
2244 Metro Center Blvd., Suite 208
Nashville, TN 37228-1320

Standard reference number	Title	Referenced in code section number
RCSC—88	Specification for Structural Joints Using ASTM A 325 or A 490 Bolts	2214.3

RMI

Rack Manufacturers Institute
8720 Red Oak Boulevard, Suite 201
Charlotte, NC 28217

Standard reference number	Title	Referenced in code section number
RMI (2002)	Specification for Design, Testing and Utilization of Industrial Steel Storage Racks	2208.1
10100	Manual of Safety Practices - A Code of Practices for the Use of Industrial and Commercial Steel Storage Racks	2214.3
10150	Industrial Steel Storage Racks Manual	2214.3
10083	Specification for the Design, Testing and Utilization of Industrial Steel Storage Racks	2208.1

SDI

Steel Deck Institute
PO Box 25
Fox River Grove, IL 60021

Standard reference number	Title	Referenced in code section number
DDP	Deck Damage and Penetrations	2214.3
DDM—02	Diaphragm Design Manual	2214.3, 2222.4
Number 30	Design Manual For Composite Decks, Form Decks and Roof Decks	2214.3
MOC1	Manual of Construction with Steel Deck	2214.3
SPD2	Standard Practice Details	2214.3

SDI

Steel Door Institute
c/o Wherry Associates
30200 Detroit Road,
Cleveland, Ohio 44145-1967

Standard reference number	Title	Referenced in code section number
ANSI A250.13—03	Testing and Rating of Severe Windstorm Resistant Components For Swinging Door Assemblies	1609.1.4.2, 1714.5.3.3.2

SFPA

Southern Forest Products Association
PO Box 641700
Kenner, LA 70064-1700

Standard reference number	Title	Referenced in code section number
2001	Permanent Wood Foundations: Design and Construction Guide (Replaces AF&PA Technical Report No. 7)	2314.4.7

SFPE

Society of Fire Protection Engineers
7315 Wisconsin Avenue, Suite 620E
Bethesda, MD 20814

Standard reference number	Title	Referenced in code section number
SFPE	Engineering Guide to Performance-Based Fire Protection Analysis and Design of Buildings	104.11

SJI

Steel Joist Institute
3127 10th Avenue, North
Myrtle Beach, SC 29577-6760

Standard reference number	Title	Referenced in code section number
JG-1.1—05	Standard Specification for Joist Girders	1604.3.3, 2206.1
K-1.1—05	Standard Specification for Open Web Steel Joists, K-Series	1604.3.3, 2206.1
LH/DLH-1.1—05	Standard Specification for Longspan Steel Joists, LH Series and Deep Longspan Steel Joists, DLH Series	1604.3.3, 2206.1
	SJI- continued	
SJI—71	Structural Design of Steel Joist Roofs to Resist Ponding Loads, Technical Digest No. 3	2214.3
SJI—88	Vibration of Steel Joist-Concrete Slab Floors, Technical Digest No. 5	2214.3
SJI—03	Structural Design of Steel Joist Roofs to Resist Uplift Loads, Technical Digest No. 6	2214.3
SJI—83	Welding of Open Web Steel, Technical Digest No. 8	2214.3
SJI—87	Handling and Erection of Steel Joists and Joist Girders, Technical Digest No. 9	2214.3
SJI—02	Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders	1604.3.3, 2206, 2214.3
SJI—03	75-Year Steel Joist Manual	2214.3

SMA

Storage Equipment Manufacturers Association
8720 Red Oak Blvd, Suite 201
Charlotte, NC 28217

Standard reference number	Title	Referenced in code section number
ANSI/SMA MH281—97	Specification of Industrial Grade Steel Shelving	2214.3

SMACNA

Sheet Metal and Air Conditioning Contractors' National Association
8224 Old Courthouse Rd.
Vienna, VA 22180

Standard reference number	Title	Referenced in code section number
SMACNA—2003	Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems	419.2.1.3, 420.2.3, 421.2.1.3
	Metal Roof and Wall Systems	RAS 133-9.2

SPRI

Single-Ply Roofing Institute
77 Rumford Ave.
Suite 3-B
Walthem, MA 02453

Standard reference number	Title	Referenced in code section number
ES-1—03	Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems	1503.3, 1504.5
RP-4—02	Wind Design Guide for Ballasted Single-ply Roofing Systems	1504.4

SSPC

The Society for Protective Coatings
40 24th Street, 6th Floor
Pittsburgh PA 15222-4656

Standard reference number	Title	Referenced in code section number
SSPC - Paint 15	Steel Joist Shop Paint	2214.3
SSPC/AISC	Guide to the Shop Painting of Structural Steel	2214.3

STI

Steel Tube Institute
522 Westgate Tower
Cleveland, OH 44116

Standard reference number	Title	Referenced in code section number
STI	Manual of Cold-Formed Welded Structural Steel Tube	2214.3

TECO

Timber Company, Inc.
2402 Daniels Street
Madison, WI 53704

Standard reference number	Title	Referenced in code section number
TECO PRP-133	Performance Standards and Policies for Structural Use Panels	2314.4.8, 2315.1.2

TIA

Telecommunications Industry Association
2500 Wilson Boulevard
Arlington, VA 22201-3834

Standard reference number	Title	Referenced in code section number
ANSI/TIA/EIA-222-G—05	Structural Standards for Steel Antenna Towers and Antenna Supporting Structures	1609.1.1, 3108.4

TMS

The Masonry Society
3970 Broadway, Unit 201-D
Boulder, CO 80304-1135

Standard reference number	Title	Referenced in code section number
0216—97	Standard Method for Determining Fire Resistance of Concrete and Masonry Construction Assemblies	Table 720.1(2), 721.1
402—05	Building Code Requirements for Masonry Structures	1405.5, 1405.5.2, 1405.9, 1604.3.4, 1704.5, 1704.5.1, Table 1704.5.1, 1704.5.2, 1704.5.3, Table 1703.4.5.3, 1708.1.1, 1708.1.2, 1708.1.3, 1708.1.4, 1805.5.2, 1812.7, 2101.2.2, 2101.2.3, 2101.2.4, 2101.2.5, 2101.2.6, 2103.1.3.6, 2106.1, 2106.1.1, 2106.1.1.1, 2106.1.1.2, 2106.1.1.3, 2106.3, 2106.4, 2106.5, 2106.6, 2107.1, 2107.2,2107.3, 2107.4, 2107.5, 2107.6, 2107.7, 2107.8, 2108.1, 2108.2, 2108.3, 2108.4, 2109.1, 2109.2.3.1, 2109.7.3
602—05	Specification for Masonry Structures	1405.5.1, Table 1704.5.1, Table 1704.5.3, 2103.13.7, 2104.1, 2104.1.1, 2104.3, 2104.4

TPI

Truss Plate Institute
583 D'Onofrio Drive, Suite 200
Madison, WI 53719

Standard reference number	Title	Referenced in code section number
TPI 1—2002	National Design Standards for Metal-plate-connected Wood Truss Construction	2303.4, 2306.1, 2314.4.9, 2319.17.2.1.1, 2319.17.2.2.8
TPI/WTCA BCSI-06	Building Component Safety Information Guide to Good Practice for Handling, Installing, Restraining and Bracing of Metal Plate Connected Wood Trusses [A Joint publication with WTCA representing the Structural Building Components Industry]	2314.4.9, 2319.17.2.4.1, 2319.17.2.4.3

UL

Underwriters Laboratories, Inc.
333 Pfingsten Road
Northbrook, IL 60062-2096

Standard reference number	Title	Referenced in code section number
9—00	Standard For Fire Tests of Window Assemblies	2121.2.12.8
10A—98	Tin Clad Fire Doors—with Revisions through March 2003	715.4

UL- continued

10B—97	Fire Tests of Door Assemblies—with Revisions through October 2001	715.4.2
10C—98	Positive Pressure Fire Tests of Door Assemblies—with Revisions through November 2001	715.4.1, 715.4.3
14B—98	Sliding Hardware for Standard Horizontally Mounted Tin Clad Fire Doors—with Revisions through July 2000	715.4
14C—99	Swinging Hardware for Standard Tin Clad Fire Doors Mounted Singly and in Pairs	715.4
94—96	Test for Flammability of Plastic Materials for Parts in Devices and Appliances	402.11.1
103—01	Factory-built Chimneys, for Residential Type and Building Heating Appliances	717.2.5
127—96	Factory-built Fireplaces—with Revisions through November1999	717.2.5, 2111.11
181—96	Standard for Factory-Made Air Ducts and Air Connectors	419.3.11.6 ‖
199E—04	Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers	904.11.4.1
217—97	Single and Multiple Station Smoke Alarms—with revisions through January 2004	907.2.10
268—96	Smoke Detectors for Fire Protective Signaling Systems—with Revisions through January 1999	407.6, 907.2.6.2
300—96	Fire Testing of Fire Extinguishing Systems for Protection of Restaurant Cooking Areas — with Revisions through December 1998	904.11
555—99	Fire Dampers—with Revisions through January 2002	716.3
555C—96	Ceiling Dampers	716.3, 716.6.2
555S—99	Smoke Dampers—with Revisions through January 2002	716.3, 716.3.1.1
580—94	Test for Uplift Resistance of Roof Assemblies—with Revisions through February 1998	1504.3.1, 1504.3.2, 2214.3, 2222.4.6 ‖
641—95	Type L Low-temperature Venting Systems—with Revisions through April 1999	2113.11.1.4
710B—2004	Recirculating Systems	904.11
790—04	Tests for Fire Resistance of Roof Covering Materials—with Revisions through July 1998	1505.1, 1513.1, 1516.1, 1523.1.2, 2314.4.10, 2603.6, 2610.2, 2610.3 ‖
793—97	Standards for Automatically Operated Roof Vents for Smoke and Heat	910.3.1
864—03	Standards For Control Units and Accessories for Fire Alarm Systems—with Revisions through October 2003	909.12
924	Standard for Emergency Lighting and Power Equipment	1006.3.6 ‖
1040—96	Fire Test of Insulated Wall Construction—with Revisions through April 2001	1407.10.3, 2603.4, 2603.9
1256—02	Fire Test of Roof Deck Construction – with Revisions through March 2000	1508.1, 2603.3, 2603.4.1.5, 2612.3.2.5.2 ‖
1479—94	Fire Tests of Through-penetration Fire stops—with Revisions through August 2000	712.3.1.2, 712.4.1.1.2, 712.5
1482—98	Solid-fuel Type Room Heater—with Revisions through January 2000	2112.2, 2112.5
1715—97	Fire Test of Interior Finish Material—with Revisions through October 2002	1407.10.2, 1407.10.3, 2603.4, 2603.9
1777—04	Chimney Liners—with Revisions through July 1998	2113.11.1, 2113.19
1784—2001	Air Leakage Tests of Door Assemblies	707.14.1, 710.5.2, 715.4.3.1, 715.4.5.1, 715.4.5.3
1897—98	Uplift Tests for Roof Covering Systems—with Revisions through November 2002	1504.3.1
1975—96	Fire Test of Foamed Plastics Used for Decorative Purposes	402.10, 402.11.1, 402.15.5
2017—2000	Standards for General-purpose Signaling Devices and Systems—with Revisions through June 2004	3109.4.1.8
ANSI/UL 2034—96	Standard for Single and Multiple Station CO Alarms	202 ‖*
UL 2075—04	Gas and Vapor Detector Sensor	202 ‖*
2079—98	Tests for Fire Resistance of Building Joint Systems	702.1, 713.3, 713.6
2200—98	Stationary Engine Generator Assemblies (Revisions through July 2004)	2702.1.1
2390—04	Test Method for Measuring the Wind Uplift Coefficients for Asphalt Shingles	1504.2.1, 1609.5.2

ULC

Underwriters Laboratories of Canada
7 Crouse Road
Scarborough, Ontario, Canada M1R3A9

Standard reference number	Title	Referenced in code section number
CAN/ULC S102.2—1988	Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies with 2000 Revisions	719.4

USC

United States Code
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
18 USC Part 1, Ch.40	Importation, Manufacture, Distribution and Storage of Explosive Materials	307.2

WDMA

Window and Door Manufacturers Association
1400 East Touhy Avenue #470
Des Plaines, IL 60018

Standard reference number	Title	Referenced in code section number
101/I.S.2/A440—05	Specifications for Windows, Doors and Unit Skylights	1714.5.1, 2405.5

WPPC

Wood Products Promotional Council
c/o Florida Wood Council
1300 Limit Avenue
Mount Dora, FL 32758

Standard reference number	Title	Referenced in code section number
WWPC—97	Guide to Wood Construction in High Wind Areas	1609.1.1, 1609.1.1.1

WRI

Wire Reinforcement Institute, Inc.
203 Loudon Street, S.W.
2nd Floor, Suite 203C
Leesburg, VA 22075

Standard reference number	Title	Referenced in code section number
WRI/CRSI—81	Design of Slab-on-ground Foundations—with 1996 Update	1805.8.2