CHAPTER 13

ENERGY EFFICIENCY

SUBCHAPTER 13-1
ADMINISTRATION AND ENFORCEMENT

SECTION 13-100
GENERAL

13-100.1 Title. This chapter shall be known as the *Florida Energy Efficiency Code for Building Construction,* and may be cited as such. It will be referred to herein as "the code" or "this code."

13-100.2 Intent. The provisions of this code shall regulate (1) the design of building envelopes for adequate thermal resistance and low air leakage and (2) the design and selection of mechanical, electrical, and illumination systems and equipment which will enable the effective use of energy in new building construction, additions, alterations or any change in building configuration.

It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques to achieve effective utilization of energy. These provisions are structured to permit compliance with the intent of this code by the following design paths as applicable for the type of construction and date permitted.

1. Subchapter 13-4, Commercial Building Compliance Methods.
2. Subchapter 13-6, Residential Building Compliance Methods.

Compliance with these paths meets the intent of this chapter as allowed by Sections 13-101.1 and 13-101.2 of this chapter.

This code is not intended to abridge any safety or health requirements mandated under any other applicable codes or ordinances.

SECTION 13-101
SCOPE

13-101.0 General. This code is a statewide uniform code and shall not be made more stringent or lenient by local government. The code provides for a uniform standard of energy efficiency by, at a minimum, setting forth minimum requirements for exterior envelopes, lighting, electrical distribution, and selection of heating, lighting, ventilating, air conditioning and service water heating systems. It shall apply to all new buildings, to additions to existing buildings and manufactured homes, to renovations to existing buildings, both public and private, with certain exceptions, to changes of occupancy type, to the site-installed components and features of manufactured homes at their first set-up, and to the installation or replacement of building systems and components with new products for which thermal efficiency standards are set by this code. New buildings, with the exception of those exempted below, and in accordance with the specific exceptions of individual sections shall be designed to comply with Subchapter 13-4 or 13-6 of this code.

13-101.1 Commercial buildings.

13-101.1.1 New construction.

Subchapter 13-4, Commercial building compliance methods. Commercial buildings of any size and multiple-family residential buildings greater than three stories shall comply with Subchapter 13-4 of the code. This chapter contains two compliance methods:

Method A: Whole Building Performance Method

Method B: Building Prescriptive Method

13-101.1.2 Additions. Additions to existing commercial buildings are considered new building construction and shall comply with Method A of Subchapter 13-4 of this code as allowed in Section 13-101.1.1.

Additions to existing nonresidential buildings that are unable to comply with code requirements for the addition alone may comply with the code by bringing the entire building into compliance with the requirements for new buildings.

13-101.1.3 Renovations. Renovated commercial buildings shall, when applicable (see Section 13-202), comply with Method B of Subchapter 13-4 for insulation, HVAC systems, lighting, water heating systems and exterior envelope components being retrofitted or replaced.

13-101.1.4 Buildings with multiple occupancy types. When a building contains more than one occupancy type, each portion of the building shall conform to the requirements for the occupancy housed therein.

Exceptions:

1. Where minor occupancy use does not occupy more than 5 percent of the floor area of the building, the major use shall be considered the building occupancy.
2. Residential dwelling units such as congregate living facilities that are part of a larger commercial occupancy type and are three stories or less may comply with Subchapter 13-4.

13-101.1.5 Limited or special use buildings. Buildings determined by the Florida Building Commission to have a limited energy use potential based on size, configuration or time occupied, or to have a special use requirement shall be considered limited or special use buildings and shall comply with the code by Method B of Subchapter 13-4. Code com-

pliance requirements shall be adjusted by the commission to handle such cases when warranted.

13-101.1.6 Shell buildings. Nonresidential buildings that are permitted prior to design completion or which will be finished in sections at a time after construction of the shell shall comply with either Method B (envelope prescriptive requirements only) or Method A of Subchapter 13-4 of the code prior to granting of a permit to build. If Method A is used, all assumptions made about features not installed until later that are not on the building plans shall be listed and appended to the compliance form submitted to the building department. Unless the building is completed as per all assumptions made in the original code compliance submittal, a revised code submittal(s) using Method A shall be submitted when completion of the building (or part of the building) is permitted. If Method B is used, a code submittal(s) using Method A shall be submitted when completion of the building (or part of the building) is permitted.

13-101.2 Residential buildings.

13-101.2.1 New construction. New residential construction shall comply with this code by using the following compliance methods.

Subchapter 13-4, Commercial buildings compliance methods. Multiple-family buildings greater than three stories shall comply with Subchapter 13-4 of the code.

Subchapter 13-6, Residential buildings compliance methods. Single-family residential buildings and Multiple-family buildings of three stories or less shall comply with this chapter of the code. This subchapter contains two compliance methods:

Method A: Whole Building Performance Method

Method B: Component Prescriptive Method

13-101.2.2 Additions. Additions to existing residential buildings shall be considered new building construction and shall comply with the requirements of either Method A or B of Subchapter 13-6, as applicable. Additions to residential buildings over three stories shall comply by Subchapter 13-4.

Additions to existing residential buildings that are unable to comply with code requirements for the addition alone may comply with the code by bringing the entire building into compliance with the requirements for new buildings given in Section 13-101.4.2.

13-101.2.3 Renovations. Renovated buildings shall, when applicable (see Section 13-202), meet the prescriptive requirements contained in Method B of Subchapter 13-6 for residential applications of the code for insulation, HVAC systems, lighting, water heating systems and exterior envelope for those components being retrofitted or replaced.

13-101.2.4 Manufactured homes. Site-installed components of manufactured homes and residential manufactured buildings shall meet the prescriptive requirements contained in Method B of Subchapter 13-6 for those components.

13-101.2.5 Buildings permitted together.

13-101.2.5.1 Residences in which two buildings are permitted together that are not connected by conditioned space shall be considered separate residences for the purposes of compliance with this code if the following conditions apply:

1. The secondary building has its own bathroom and kitchenette or bar; and
2. The secondary building is heated and/or cooled by a separate heating and/or cooling system.

13-101.2.5.2 Conditioned workrooms, exercise rooms, play rooms, pool rooms and similar types of rooms that are separated from the main residence and do not meet the conditions in Section 13-101.2.5.1 shall use Subchapter 13-4 to demonstrate compliance with this code.

Exception: If a workroom or other room is separated from the main residence only by enclosed unconditioned space and is heated or cooled by the same system(s) as the primary building, it shall comply with this code as part of the primary building.

13-101.3 Changes of occupancy type.

13-101.3.1 Buildings having a change of occupancy type that were permitted prior to March 15, 1979, shall meet the requirements for renovations in Section 13-101.1.3 or Section 13-101.2.3, as appropriate, for those components which are being retrofitted or replaced.

13-101.3.2 Buildings having a change of occupancy that were permitted after March 15, 1979, shall comply with the requirements of Subchapter 13-4 for commercial applications and multiple-family residential buildings greater than three stories or Subchapter 13-6 for residential applications of three stories or less. Where the efficiency of a building component is unknown, it shall be determined in accordance with the criteria specified in Section 13-101.4.2.1.

13-101.4 Existing buildings.

13-101.4.1 Existing buildings not previously conditioned.

13-101.4.1.1 Previously unconditioned existing buildings which were permitted prior to March 15, 1979 to which heating or cooling systems are added shall meet the prescriptive requirements contained in Method B of Subchapter 13-4 for commercial applications and Method B of Subchapter 13-6 for residential applications of the code for insulation, HVAC system(s), water heating system and/or exterior envelope for those components which are being retrofitted or replaced.

13-101.4.1.2 Existing buildings which were permitted after March 15, 1979 as unconditioned space to which comfort conditioning is added shall be considered additions and shall be brought into full compliance with this code.

13-101.4.2 Nonexempt existing buildings. Existing buildings not exempt from the provisions of this code (see Section 13-101.5.1), for either the entire building or an addition to the building, that are unable to meet one or more current prescriptive code minimum requirements may be exempt

from those minimum requirements if the entire building is brought into compliance with the following chapters and the assumptions in Section 13-101.4.2.1 are used:

1. Commercial buildings and residential buildings greater than three stories: Method A of Subchapter 13-4.
2. Single-family residential buildings and multiple-family buildings of three or less stories: Method A of Subchapter 13-6.

13-101.4.2.1 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 13-407.AB.3 or 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 13-407.AB.3.2A through 13-407.AB.3.2D, 13-408.AB.3.2E and 13-408.AB.3.2F for commercial occupancies and 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 for residential occupancies. Existing equipment efficiencies not meeting the values given in Tables 13-407.AB.3.2A through 13-407.AB.3.2D, 13-408.AB.3.2E and 13-408.AB.3.2F for commercial occupancies shall utilize the cooling or heating system multipliers provided by the EnergyGauge Summit Fla/Com computer program. Existing residential equipment not meeting the efficiencies in Tables 13-607.AB.3.2A, 13-607.AB.3.2.B, 13-607.AB.3.2D, 13-608.AB.3.2E and 13-608.AB.3.2F shall utilize the cooling or heating system multipliers provided in Tables 13-C4.1.1A to 13-C4.1.1B of Appendix C to this chapter.
5. Any nonvertical roof glass shall be calculated as horizontal glazing.

13-101.5 Exempt buildings. Buildings exempt from compliance with this chapter include those described in Sections 13-101.5.1 through 13-101.5.7.

13-101.5.1 Existing buildings except those considered renovated buildings, changes of occupancy type, or previously unconditioned buildings to which comfort conditioning is added.

13-101.5.2 Any building or portion thereof whose peak design rate of energy usage for all purposes is less than 1 watt (3.4 British thermal units per hour) per square foot of floor area for all purposes.

13-101.5.3 Any building which is neither heated nor cooled by a mechanical system designed to control or modify the indoor temperature and powered by electricity or fossil fuels. Such buildings shall not contain electrical, plumbing or mechanical systems which have been designed to accommodate the future installation of heating or cooling equipment.

13-101.5.4 Any building for which federal mandatory standards preempt state energy codes.

13-101.5.5 Any historical building as described in Section 267.021, *Florida Statutes*.

13-101.5.6 Any building of less than 1,000 square feet (93 m^2) whose primary use is not as a principal residence and which is constructed and owned by a natural person for hunting or similar recreational purposes; however, no such person may build more than one exempt building in any 12-month period.

13-101.5.7 Any building where heating or cooling systems are provided which are designed for purposes other than general space comfort conditioning. Buildings included in this exemption include:

1. Buildings containing a system(s) designed and sold for dehumidification purposes only and controlled only by a humidistat. No thermostat shall be installed on systems thus exempted from this code. The provisions of Section 13-413 shall apply.
2. Commercial service areas where only ceiling radiant heaters or spot coolers are to be installed which will provide heat or cool only to a single work area and do not provide general heating or cooling for the space.
3. Buildings heated with a system designed to provide sufficient heat only to prevent freezing of products or systems. Such systems shall not provide heating above 50°F (10°C).
4. Pre-manufactured freezer or refrigerated storage buildings and areas where the temperature is set below 40°F (4°C) and in which no operators work on a regular basis.
5. Electrical equipment switching buildings which provide space conditioning for equipment only and in which no operators work on a regular basis except that the provisions of Section 13-413 shall apply.

13-101.6 Building systems. Thermal efficiency standards are set for the following building systems where new products are installed or replaced in existing buildings, and for which a permit must be obtained. Such systems shall meet the minimum efficiencies allowed for that system on Form 400B for commercial buildings and on Form 1100B for residential buildings.

1. Heating, ventilating or air conditioning systems;
2. Service water or pool heating systems;
3. Electrical systems and motors;
4. Lighting systems.

Exceptions:

1. Where part of a functional unit is repaired or replaced. For example, replacement of an entire HVAC system is not required because a new compressor or other part does not meet code when installed with an older system. If the unit being replaced is itself a functional unit, such as a condenser, it does not constitute a repair. Outdoor and indoor units that are not designed to be operated together must meet the U.S. Department of Energy certification requirements contained in Section 13-607.AB.3.1.1. Matched systems are required; this match may be verified by any one of the following means:
    1. ARI (AHRI) data
    2. Accredited laboratory (example ARL labs)
    3. Manufacturer's letter
    4. Letter from registered P.E. State of Florida
2. Where existing components are utilized with a replacement system, such as air distribution system ducts or electrical wiring for lights, such components or controls need not meet code if meeting code would require that component's replacement.
3. Replacement equipment that would require extensive revisions to other systems, equipment or elements of a building where such replacement is a like-for-like replacement, such as through-the-wall condensing units and PTACs, chillers, and cooling towers in confined spaces.
4. HVAC equipment sizing calculations are not required for systems installed in existing buildings not meeting the definition of renovation in Section 13-202.

SECTION 13-102
MATERIALS AND EQUIPMENT

13-102.1 Efficiency and maintenance information. An operating and maintenance manual shall be provided to the building owner for all commercial buildings. The manual shall include basic data relating to the design, operation and maintenance of HVAC systems and equipment. Required routine maintenance actions shall be clearly identified. Where applicable, HVAC controls information such as diagrams, schematics, control sequence descriptions, and maintenance and calibration information shall be included. Operations manuals shall be available for inspection by the building official upon request. See Sections 13-413.AB.2.2 and 13-410.AB.4.2.

13-102.2 Alternate materials–Method of construction, design or insulating systems. The provisions of this code are not intended to prevent the use of any material, method of construction, design or insulating system not specifically prescribed herein, provided that such construction, design, or insulating system has been approved by the building official and the Florida Building Commission as meeting the intent of the code. This clause shall not allow disregard of any provision(s) of the code by building departments, nor shall it prevent uniform statewide implementation of the code as required by Florida law (see Section 553.901, *Florida Statutes*).

13-102.3 Air conditioners sold or installed in Florida. All air conditioners installed in new or renovated buildings in the State of Florida shall comply with requirements set forth in Subchapters 13-4 or 13-6, as applicable.

SECTION 103
CODE COMPLIANCE AND PERMITTING

13-103.0 General. Code compliance for all buildings shall be certified by use of approved forms for the compliance method chosen that are specific to the climate zone in which the building will be located (see Figure 13-1).

The only software approved for determining compliance with this code shall be the software developed and maintained by the Florida Building Commission or its designated representative.

Worst-case calculations may be submitted for identical buildings facing different cardinal directions; however, original code certification signatures shall be provided for each building.

13-103.1 Certification of compliance. Code compliance for nonresidential and multiple-family residential applications (except for duplexes, townhouses, or other buildings identified in Sections 481.229 and 471.003, *Florida Statutes*) shall be certified by the owner, project architect (registered in the state of Florida), or other officially designated agent allowed in Section 13-103.2.

13-103.1.1 Code compliance preparation. The person preparing the compliance calculation shall certify that the plans and specifications covered by the calculation, or amendments thereto, are in compliance with Chapter 13 of the *Florida Building Code, Building.*

13-103.1.1.1 Commercial applications. Completion of procedures demonstrating compliance with this code for commercial buildings shall be signed and sealed by an architect or engineer licensed to practice 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.

Design professionals responsible under Florida law for the design of lighting, electrical, mechanical, and plumbing systems and the building shell, shall certify compliance of those building systems with the code by signing and providing their professional registration number on the energy code form provided as part of the plans and specifications to the building department.

13-103.1.1.2 Residential applications.

13-103.1.1.2.1 Single-family residential, duplexes, townhouses. No license or registration is required to prepare the code compliance form for single-family residential dwellings, duplexes and townhouses.

13-103.1.1.2.2 Multiple-family residential. Form preparation for multiple-family dwellings except duplexes and townhouses shall be 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*, by state of Florida certified commercial building energy raters.

13-103.1.2 Code compliance certification. The building's owner, the owner's architect, or other authorized agent legally designated by the owner shall certify that the building is in compliance with the code, as per Section 553.907, *Florida Statutes*, 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 its 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.

13-103.2 Details, plans and specifications. Plans and specifications shall be submitted with each application for a building permit. Energy code calculations shall be made a part of the plans and specifications of the building. The building official shall require, subject to the exceptions in Section 481.229, *Florida Statutes*, and Section 471.003, *Florida Statutes*, that plans and specifications be prepared by an engineer or architect licensed to practice in the state of Florida. The plans and specifications, including the energy code calculations, shall show, in sufficient detail, all pertinent data and features of the building and the equipment and systems as herein governed including, but not limited to: design criteria, exterior envelope component materials, *U*-values of the envelope systems, *R*-values of insulating materials, size and type of apparatus and equipment, equipment and systems controls and other pertinent data to indicate conformance with the requirements of the code.

13-103.3 Building permits. Prior to receiving the permit to begin construction or renovation, owners, or an agent duly designated by the owner, of all buildings shall certify energy code compliance to the designated local enforcement agency. If, during the building construction or renovation, alterations are made in the design, materials, or equipment which would diminish the energy performance of the building, an amended copy of the compliance certifications shall be submitted to the local enforcement agency on or before the date of final inspection by the building owner or his or her agent.

Building officials or their officially designated representatives shall assure that the compliance forms are complete and without gross errors.

SECTION 13-104
INSPECTIONS

13-104.1 General. All construction or work for which a permit is required shall be subject to inspection by the building official or his or her officially designated representative.

13-104.2 Approvals required. No work shall be done on any part of the building or structure beyond the point indicated in each successive inspection without first obtaining the written approval of the building official. No construction shall be concealed without inspection approval.

13-104.3 Inspections required. There shall be a final inspection for code compliance on all buildings when completed and ready for occupancy.

13-104.4 Information cards required.

13-104.4.1 Energy performance level (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 the building for occupancy. Florida law (Section 553.9085, *Florida Statutes*) requires the EPL display card to be included as an addendum to each sales contract executed after January 1, 1994, for both presold and nonpresold residential buildings.

The EPL display card contains information indicating the energy performance level and efficiencies of components installed in a dwelling unit. The building official shall verify that the EPL display card completed and signed by the builder accurately reflects the plans and specifications submitted to demonstrate code compliance for the building.

13-104.4.2 HVAC efficiency card. The building official shall require that a completed HVAC efficiency card signed by a representative of the heating and cooling equipment contractor be posted in a prominent location on the cabinet of the indoor air handler or furnace of each heating or heating and cooling system installed in the building at the time of installation. Where single package units are installed, the card shall be posted on the unit itself. The card shall be durable, readable and shall contain the following information:

1. Manufacturer's name(s);
2. Brand name(s);
3. Model numbers of the furnace, compressor unit, and air handler (and evaporator coil, if the air handler can be equipped with more than one coil) for each system installed;
4. Efficiency ratings of the combined equipment for each system actually installed;

5. Name and address of the heating and or cooling company installing the equipment;
6. Signature line and date line, preceded by the statement, "With the authorization of the installing contractor I certify that the information entered on this card accurately represents the system installed."
7. Signature line and date line, preceded by the statement, "As the building official or the representative of the building official I certify that the information entered on this card accurately represents the system installed."

Exceptions:

1. If the information required above has been previously submitted and is included on the plans required at the building site, the HVAC efficiency card need not be provided. However, the plans shall be signed by a representative of the heating and cooling company installing the equipment and shall be available for inspection by building inspectors and by prospective buyers until the time of title transfer.
2. The Federal Trade Commission's energy guide label may be used to fulfill this requirement.

13-104.4.3 Insulation certification card. In cases where the *R*-value of insulation installed in either walls, ceilings or floors is not readily apparent, the local building official shall require that an *R*-value certification card signed by the insulation contractor be posted in a prominent location at the time of installation. The card shall contain, at a minimum, the following information:

1. Insulation manufacturer's name;
2. Insulation type;
3. *R*-value of insulation installed;
4. Thickness of insulation installed;
5. Location of insulation installed;
6. Indication that the installation has been checked and does not block attic ventilation.
7. Name and address of the contractor installing the insulation;
8. Date of installation.

13-104.4.4 Energy guide labels. Energy guide labels required by the U.S. Federal Trade Commission for heating and cooling systems, water heaters and other appliances covered by federal law shall remain on those appliances until time of title transfer.

13-104.4.5 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 y 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.

Where the specified energy performance (*U*-factor or SHGC) of the fenestration product is not labeled nor readily apparent, the default procedures outlined in Tables B-6, B-7 and B-8 of Appendix 13-B for *U*-factor and SHGC shall be used to determine code compliance for commercial applications and in Table 13-C2.1.1 of Appendix 13-C for residential applications. 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.

U-factors (thermal transmittances) of fenestration products (windows, doors and skylights) shall be determined by an accredited, independent laboratory in accordance with NFRC 100: *Procedure for Determining Fenestration Product U-Factors.* The SHGC for glazed fenestration products (windows, glazed doors and skylights) shall be determined in accordance with NFRC 200: *Procedure for Determining Fenestration Product Solar Heat Gain Coefficients at Normal Incidence.*

SECTION 13-105
REPORTING

13-105.0 Reporting to the Department of Community Affairs. A reporting form shall be submitted to the local building department by the owner or owner's agent with the submittal certifying compliance with this code. Reporting forms shall be a copy of the front page of the form applicable for the code chapter under which compliance is demonstrated.

13-105.1 Reporting schedule. It shall be the responsibility of the local building official to forward the reporting section of the proper form to the Department of Community Affairs on a quarterly basis as per the reporting schedule in Table 13-105.1.

TABLE 13-105.1
REPORTING SCHEDULE

	Group I*	Group II*	Group III*
Quarter 1	12/31	1/31	2/28
Quarter 2	3/31	4/30	5/31
Quarter 3	6/30	7/31	8/31
Quarter 4	9/30	10/31	11/30

*See Appendix 13-A of this chapter for group designations.

13-105.2 Jurisdiction numbers. For data collection purposes, all permitting jurisdictions in the state of Florida have been assigned a six-digit jurisdiction number. The jurisdiction number is required on all energy code forms. Jurisdiction numbers are listed by county in Appendix 13-A.

SECTION 13-106
VALIDITY

13-106.0 Validity. If any section, subsection, sentence, clause, or phrase of this code is, for any reason, held to be invalid for any reason, such decision shall not affect the validity of the remaining portions of this code.

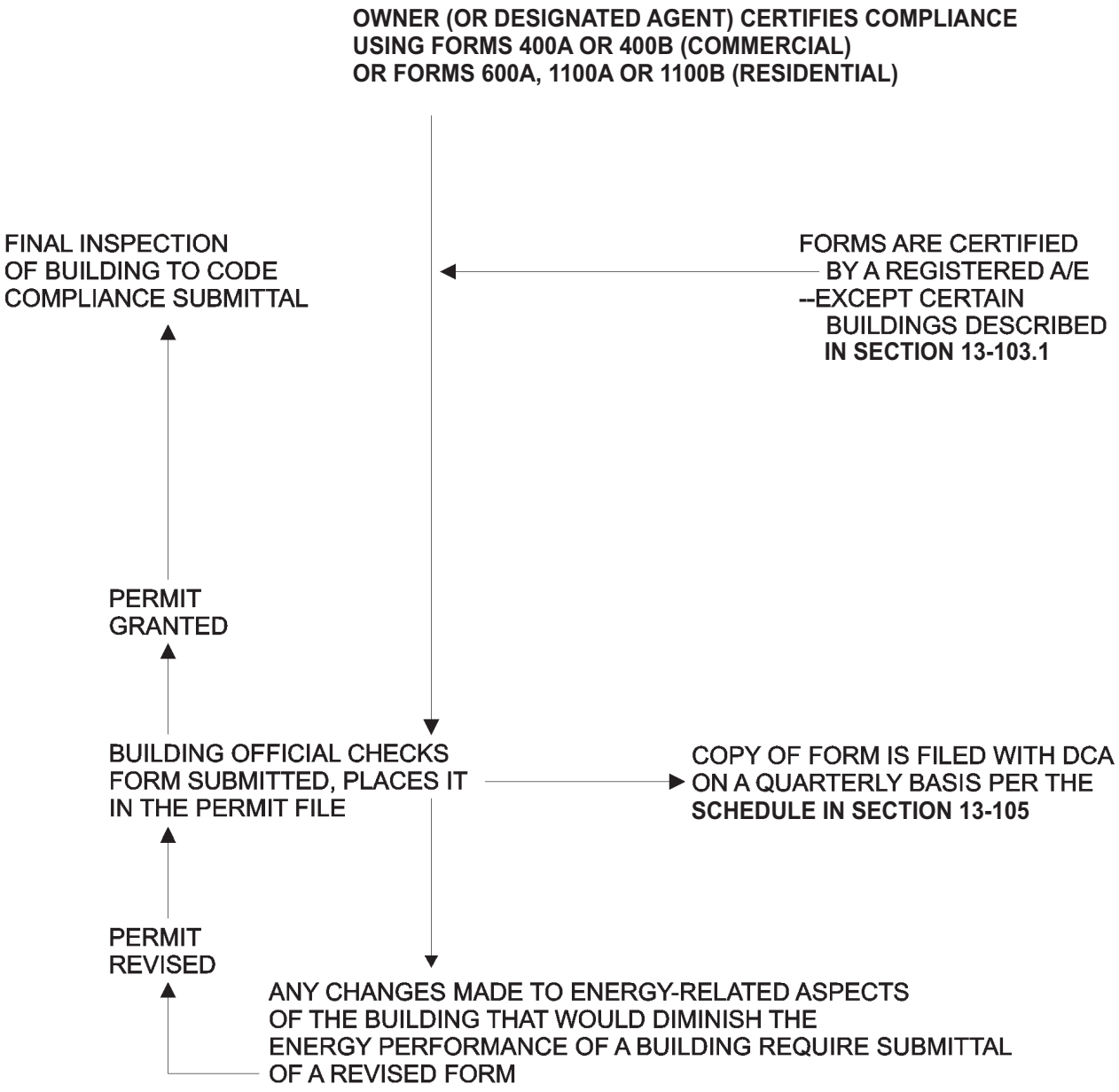


FIGURE 13-1
CODE COMPLIANCE CHART

SUBCHAPTER 13-2

DEFINITIONS

SECTION 13-201
GENERAL

13-201.1 Application of terms. For the purpose of this code, certain abbreviations, terms, phrases, words, and their derivatives, shall be construed as set forth in this chapter.

13-201.2 Words not defined. Words not defined herein shall have the meanings stated in the *Webster's Ninth New Collegiate Dictionary*, as revised.

SECTION 13-202
DEFINITIONS

ABOVE-GRADE WALL. See "Wall."

ACCESS HATCH. See "Door."

ACCESSIBLE (as applied to equipment). Admitting close approach; not guarded by locked doors, elevation or other effective means (see "Readily accessible").

ADDITION. An extension or increase in conditioned floor area or height of a building or structure.

ADJACENT WALL, CEILING or FLOOR. A wall, ceiling or floor of a structure that separates conditioned space from enclosed but unconditioned space, such as an unconditioned attached garage, storage or utility room.

ADJUSTED LIGHTING POWER (ALP). Lighting power, assigned to a luminaire(s), that has been reduced by deducting a lighting power control credit based on use of an automatic control device(s).

AEROSOL SEALANT. A closure product for duct and plenum systems, which is delivered internally to leak sites as aerosol particles using a pressurized air stream.

* **ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE).** The ratio of annual output energy to annual input energy including any nonheating season pilot input loss.

AIR BARRIER. Relating to air distribution systems, a material object(s) which impedes or restricts the free movement of air under specified conditions. For fibrous glass duct, the air barrier is its foil cladding; for flexible nonmetal duct, the air barrier is the nonporous core; and for sheet metal duct and air handling units, the air barrier is the metal in contact with the air stream. For mechanical closets, the air barrier may be a uniform panelized material such as gypsum wall board which meets ASTM C 36, or it may be a membrane which alone acts as an air barrier which is attached to a panel, such as the foil cladding of fibrous glass duct board.

Relating to the building envelope, air barriers comprise the planes of primary resistance to air flow between the interior spaces of a building and the outdoors and the planes of primary air flow resistance between adjacent air zones of a building, including planes between adjacent conditioned and unconditioned air spaces of a building. To be classed as an air barrier, a building plane must be substantially leak free; that is, it shall have an air leakage rate not greater than 0.5 cfm/ft^2 when subjected to an air pressure gradient of 25 pascal. In general, air barriers are made of durable, nonporous materials and are sealed to adjoining wall, ceiling or floor surfaces with a suitable long-life mastic. House wraps and taped and sealed drywall may constitute an air barrier but dropped acoustical tile ceilings (T-bar ceilings) may not. Batt insulation facings and asphalt-impregnated fiberboard and felt paper are not considered air barriers.

AIR CONDITIONING. The process of treating air to control its temperature, humidity, cleanliness and distribution to meet requirements of the conditioned space.

AIR DISTRIBUTION SYSTEMS. Include all building elements (duct systems, air handling units, cavities of the building structure and mechanical closets) through which air is delivered to or from the conditioned spaces.

AIR DUCT. A passageway for conducting air to or from heating, cooling, air conditioning, or ventilating equipment, but not including the plenum. For material requirements see local mechanical codes.

AIR-HANDLING UNIT. The fan unit of a furnace and the fan-coil unit of a split-system, packaged air conditioner or heat pump.

AIR INFILTRATION. See "Infiltration."

AIR POROSITY. The ability to transmit air through minute openings in a substance or material.

ALTERATION. Replacement or addition to a building or its systems and equipment; routine maintenance, repair, and service or a change in the building's use classification or category shall not constitute an alteration.

ANNUAL FUEL UTILIZATION EFFICIENCY (AFUE). * Efficiency descriptor of the ratio of annual output energy to annual input energy as developed in accordance with the requirements of U.S. Department of Energy (DOE) 10CFR Part 430.

APPLICATION PART-LOAD VALUE (APLV). A single number part-load efficiency figure of merit calculated in accordance with the method described in ARI 550 or 590 referenced to modified rating conditions described in those standards.

AS-BUILT. Building components to be actually installed in a structure. In some cases, this may be a worst-case condition (see "Worst case").

ASHRAE CLIMATE ZONE 1. Broward, Miami-Dade and Monroe Counties.

ASHRAE CLIMATE ZONE 2. All of Florida except Broward, Miami-Dade and Monroe Counties.

ATTIC. An enclosed unconditioned space located immediately below an uninsulated roof and immediately above the ceiling of a building. For the roof to be considered insulated, roof insulation shall be at least the *R*-value required to meet section 13-404.AB.1 in Subchapter 4 and Section 13-604.AB.1 in Subchapter 6 (see "Under Attic;" "Roof").

ATTIC RADIANT BARRIER. See "Radiant barrier."

AUTHORITY HAVING JURISDICTION. The agency or agent responsible for enforcing this standard.

AUTOMATIC. Self-acting, operating by its own mechanism when actuated by some nonmanual influence, such as a change in current strength, pressure, temperature, or mechanical configuration (see "Manual").

AUTOMATIC CONTROL DEVICE. A device capable of automatically turning loads off and on without manual intervention.

BALANCING, AIR SYSTEM. adjusting air flow rates through air distribution system devices, such as fans and diffusers, by manually adjusting the position of dampers, splitter vanes, extractors, etc., or by using automatic control devices, such as constant air volume or variable air volume boxes.

BALANCING, HYDRONIC. Adjusting water flow rates through hydronic distribution system devices, such as pumps and coils, by manually adjusting the position valves, or by using automatic control devices, such as automatic flow control valves.

BALLAST. A device used in conjunction with an electric discharge lamp to cause the lamp to start and operate under the proper circuit conditions of voltage, current, wave form, electrode heat, etc.

(a) **Electronic ballast**: A ballast constructed using electronic circuitry.

(b) **Hybrid ballast:** A ballast constructed using a combination of magnetic core and insulated wire winding and electronic circuitry.

(c) **Magnetic ballast:** A ballast constructed with magnetic core and a winding of insulated wire.

BASELINE. Building component performance target or the total building performance target which is compared with the as-built building performance.

BEDROOM. Any residential 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. For the purposes of this code, the number of "main" bedrooms for homes of three bedrooms or more is the total number of bedrooms less one. In one and two bedroom homes, all bedrooms are "main" bedrooms.

BELOW-GRADE WALL. See "Wall."

BOILER. A self-contained low-pressure appliance for supplying steam or hot water.

BOILER CAPACITY. The rate of heat output in Btu/h of the boiler, at the design inlet and outlet conditions and rated fuel or energy input, measured at the boiler outlet, at the design pressure and/or temperature, and rated fuel input.

BOILER, PACKAGED. A boiler that is shipped complete with heating equipment, mechanical draft equipment and automatic controls usually in one or more sections. A packaged boiler includes factory-built boilers manufactured as a unit or system, disassembled for shipment, and reassembled at the site.

BRANCH CIRCUIT. The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s); the final wiring run to the load.

BUDGET (Baseline). Building design: a computer representation of a hypothetical design based on the actual proposed building design. This representation is used as the basis for calculating the Method A energy cost budget.

BTU (British Thermal Unit). The standard unit for measuring heat energy, such as the heat content of fuel. It is the amount of heat energy necessary to raise the temperature of one pound of water one degree Fahrenheit. 1 BTU per minute = 17.6 watts.

BTU. Per kilowatt hour (see "Heat rate").

BUILDING. Any structure that includes provision for any of the following or any combination of the following: a space heating system, a space cooling system, or a service water heating system. For each purpose of this code each portion of a building separated from other portions by a rated fire wall shall be considered as a separate building. The term "building" shall be construed as if followed by the words "or part thereof."

BUILDING CONSTRUCTION. Any new building or structure or addition to any existing building or structure.

BUILDING ENTRANCE. Any doorway, set of doors, turnstiles, or other form of portal that is ordinarily used to gain access to the building by its users and occupants.

BUILDING ENVELOPE. The exterior plus the semiexterior portions of a building. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Building envelope, exterior:** The elements of a building that separate conditioned spaces from the exterior.

(b) **Building envelope, semiexterior:** The elements of a building that separate conditioned space from unconditioned space or that enclose semiheated spaces through which thermal energy may be transferred to or from the exterior, or to or from unconditioned spaces, or to or from conditioned spaces.

BUILDING EXIT. Any doorway, set of doors, or other form of portal that is ordinarily used only for emergency egress or convenience exit.

BUILDING GROUNDS LIGHTING. Lighting provided through a building's electrical service for parking lot, site, roadway, pedestrian pathway, loading dock and security applications.

BUILDING MATERIAL. Any element of the building envelope through which heat flows and that is included in the component *U*-factor calculations other than air films and insulation.

BUILDING OFFICIAL. The officer or other designated representative authorized to act on behalf of the authority having jurisdiction.

BUILDING SYSTEMS. See "System."

C-FACTOR (Thermal conductance). Time rate of steady state heat flow through unit area of a material or construction, induced by a unit temperature difference between the body surfaces. Units of C are Btu/h·ft²·°F. Note that the C-factor does not include soil or air films.

CIRCUIT BREAKER. A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically at a predetermined overcurrent without damage to itself when properly applied within its rating.

CLASS OF CONSTRUCTION. For the building envelope, a subcategory of roof, above-grade wall, below-grade wall, floor, slab-on-grade floor, opaque door, vertical fenestration, or skylight (see "Roof," "Wall," "Floor," "Slab-on-grade floor," "Door" and "Fenestration").

CLERESTORY. That part of a building that rises clear of the roofs or other parts and whose walls contain windows for lighting the interior.

CODE OFFICIAL. See "Building official."

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

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

COMBUSTION APPLIANCE, DIRECT VENT. A system consisting of: (1) an appliance for indoor installation; (2) combustion air connections between the appliance and the outdoor atmosphere; (3) flue gas connections between the appliance and the vent cap; and (4) vent cap for installation outdoors, supplied by the manufacturer and constructed so that all air for combustion is obtained from the outdoor atmosphere and all flue gases are discharged to the outdoor atmosphere.

COMFORT CONDITIONING. Treating air to control its temperature, relative humidity, cleanliness, and distribution to meet the comfort requirements of the occupants of the conditioned space.

COMFORT ENVELOPE. The area on a psychrometric chart enclosing all those conditions described as being comfortable in Figure 1, ASHRAE Standard 55, *Thermal Environmental Comfort Conditions for Human Occupancy.*

COMMON CEILING. The ceiling/floor assembly separating conditioned tenancies, one above the other.

COMMON WALL. A wall separating conditioned tenancies, one next to the other.

CONDITIONED FLOOR AREA. The horizontal projection (outside measurements) of that portion of space which is conditioned directly or indirectly by an energy-using system (see "Floor area;" "Gross floor area".)

CONDITIONED SPACE. See "Space, (a) conditioned space.

CONDUCTANCE. See "Thermal conductance."

CONSTRUCTION. The fabrication and erection of a new building or any addition to or alteration of an existing building.

CONSTRUCTION DOCUMENTS. Drawings and specifications used to construct a building, building systems, or portions thereof.

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

CONTROL. To regulate the operation of equipment.

CONTROL DEVICE. A specialized device used to regulate the operation of equipment.

CONVENTIONAL ATTIC. Traditionally, the space directly below the roof and above the ceiling of the upper story of a building.

COOL DOWN. Reduction of space temperature down to occupied set point after a period of shutdown or setup.

COOLED SPACE. See "Space."

COOLING DEGREE DAY. See "Degree-day."

COOLING DESIGN TEMPERATURE. The outdoor dry-bulb temperature equal to the temperature that is exceeded 1 percent of the number of hours during a typical weather year.

COOLING DESIGN WET-BULB TEMPERATURE. The outdoor wet bulb temperature for sizing cooling systems and evaporative heat rejection systems such as cooling towers.

DEAD BAND. The range of values within which a sensed variable can vary without initiating a change in the controlled process.

DECORATIVE LIGHTING. See "Lighting, decorative."

DEGREE DAY. The difference in temperature between the outdoor mean temperature over a 24-hour period and a given base temperature. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) Cooling degree day base 50°F (10°C), CDD 50: for any one day, when the mean temperature is more than 50°F (10°C), there are as many degree days as degrees Fahrenheit temperature difference between the mean temperature for the day and 50°F (10°C). Annual cooling degree days (CDDs) are the sum of the degree-days over a calendar year.

(b) Heating degree day base 65°F (18°C), HDD 65: for any one day, when the mean temperature is less than 65°F (18°C), there are as many degree days as degrees Fahrenheit temperature difference between the mean temperature for the day and 65°F (18°C). Annual heating degree days (HDDs) are the sum of the degree days over a calendar year.

DEMAND. The highest amount of power (average Btu/h over an interval) recorded for a building or facility in a selected time frame.

DESIGN CAPACITY. Output capacity of a system or piece of equipment at design conditions.

DESIGN CONDITIONS. Specified environmental conditions, such as temperature and light intensity, required to be produced and maintained by a system and under which the system must operate.

DESIGN ENERGY COST. The annual energy cost calculated for a proposed design.

DESIGN PROFESSIONAL. An architect or engineer licensed to practice in accordance with applicable state licensing laws.

DIRECT DIGITAL CONTROL (DDC). A type of control where controlled and monitored analog or binary data (e.g., temperature, contact closures) are converted to digital format for manipulation and calculations by a digital computer or microprocessor, then converted back to analog or binary form to control physical devices.

DISCONNECT. A device or group of devices or other means by which the conductors of a circuit can be disconnected from their source of supply.

DISTRIBUTION SYSTEM. Conveying means, such as ducts, pipes, and wires, to bring substances or energy from a source to the point of use. The distribution system includes such auxiliary equipment as fans, pumps, and transformers.

DOOR. All operable opening areas (which are not fenestration) in the building envelope, including swinging and roll-up doors, fire doors, and access hatches. Doors that are more than one-half glass are considered fenestration. (See "Fenestration"). For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Nonswinging**. Roll-up, sliding, and all other doors that are not swinging doors.

(b) **Swinging.** All operable opaque panels with hinges on one side and opaque revolving doors.

DOOR AREA. Total area of the door measured using the rough opening and including the door slab and the frame (see "Fenestration area").

DRAWBAND. A fastener which surrounds and fastens a duct fitting with either the inner lining or the outer jacket of flexible ducts. Tension ties, clinch bands, draw ties, and straps are considered drawbands.

DUCT FITTING. Couplings that join sections of ducting together or to other air distribution system components. When used to join sections of flexible nonmetal duct, duct fittings are typically metal or other rigid material and have a raised bead or indented groove against which the drawband is secured. Terminal fittings join ducting to supply outlets and return inlets at the end of the distribution system and include register and return boots and register and return boxes. Intermediate fittings join flexible nonmetal duct to other sections of flexible nonmetal duct, to sections of other types of ducting, and to mechanical equipment and include collars, take-offs, tap-ins, sleeves, and the supply and return ends of air handlers and furnaces (see "Integral flange duct collar fitting").

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. See Appendix 13-C, C5.1.

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

ECONOMIZER, AIR. A duct and damper arrangement and automatic control system that together allow a cooling system to supply outside air to reduce or eliminate the need for mechanical cooling during mild or cold weather.

ECONOMIZER, WATER. A system by which the supply air of a cooling system is cooled indirectly with water that is itself cooled by heat or mass transfer to the environment without the use of mechanical cooling.

EFFECTIVE AIR SPACE EMITTANCE. The radiation heat transfer property E of an air space determined by the emissivity of the surfaces bounding that air space (see the 2001 ASHRAE *Handbook of Fundamentals*, Chapter 38, Table 3).

EFFICIENCY. Performance at specified rating conditions.

EFFICIENCY, HVAC SYSTEM. The ratio of useful energy output (at the point of use) to the energy input in consistent units for a designated time period, expressed in percent.

ELECTRIC METER. A mechanical/electrical device that can measure electric power.

ELECTRIC SUPPLIER. An agency that sells and/or distributes electric power.

EMERGENCY POWER SYSTEM. A system that is required by codes or other laws to automatically supply illumination or power or both in the event of failure of the normal supply or in the event of accidents to such systems. Such systems may also include standby loads incidental to system operations but shall not include systems for optional standby loads only.

EMISSIVITY. The ratio of the total radiant flux emitted by a body to that emitted by an ideal black body at the same temperature.

EMITTANCE. The ratio of the radiant heat flux emitted by a specimen to that emitted by a blackbody at the same temperature and under the same conditions.

ENCLOSED SPACE. A volume substantially surrounded by solid surfaces such as walls, floors, roofs and openable devices such as doors and operable windows.

ENCLOSED SUPPORT PLATFORM. A framed enclosure located inside or outside the conditioned space, which supports a furnace or central heating/air conditioning air handler and which may contain and protect a return duct section of the air distribution system.

ENCLOSURE. The case or housing of an apparatus, or the fence or walls surrounding an installation, to prevent personnel from accidentally contacting energized parts or protect equipment from physical damage.

ENERGY. The capacity for doing work. It takes a number of forms that may be transformed from one into another such as thermal (heat), mechanical (work), electrical, and chemical. Customary measurement units are British thermal units (Btu).

ENERGY COST BUDGET. The annual energy cost for the budget building.

ENERGY EFFICIENCY RATIO (EER). The ratio of net cooling capacity in Btu/h to total rate of electric input in watts under designated operating conditions [see "Coefficient of performance (COP) —cooling"].

ENERGY FACTOR (EF). A measure of water heater overall efficiency.

ENERGY MANAGEMENT SYSTEM. A control system designed to monitor the environment and the use of energy in a facility and to adjust the parameters of local control loops to conserve energy while maintaining a suitable environment.

ENERGY PERFORMANCE LEVEL. An indicator of the energy-related performance of a building, including, but not limited to, the levels of insulation, the amount and type of glass, and the HVAC and water heating system efficiencies.

ENERGY, RECOVERED. See "Recovered energy."

ENVELOPE PERFORMANCE FACTOR. The trade-off value for the building envelope performance compliance option calculated using the procedures specified in Appendix 13-B for Compliance Methods B and C. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Base envelope performance factor:** The building envelope performance factor for the base design.

(b) **Proposed envelope performance factor:** The building envelope performance factor for the proposed design.

EQUIPMENT. Devices for comfort conditioning, electric power, lighting, transportation, or service water heating including, but not limited to, furnaces, boilers, air conditioners, heat pumps, chillers, water heaters, lamps, luminaires, ballasts, elevators, escalators or other devices or installations.

EXISTING BUILDING. A building or portion thereof that was previously occupied or approved for occupancy by the authority having jurisdiction.

EXISTING EQUIPMENT. Equipment previously installed in an existing building.

EXISTING SYSTEM. A system or systems previously installed in an existing building.

EXFILTRATION. Uncontrolled outward air leakage from inside a building including leakage through cracks and interstices around windows and doors and through any other exterior partition or penetration.

EXTERIOR BUILDING ENVELOPE. See "Building envelope."

EXTERIOR LIGHTING POWER ALLOWANCE. See "Lighting power allowance."

EXTERIOR WALL. A wall of a structure that is exposed to outdoor climate conditions and which forms a boundary between a conditioned and an outdoor space (see "Adjacent wall").

FACADE AREA. Area of the facade, including overhanging soffits, cornices, and protruding columns, measured in elevation in a vertical plane parallel to the plane of the face of the building. Nonhorizontal roof surfaces shall be included in the calculation of vertical facade area by measuring the area in a plane parallel to the surface.

F-FACTOR. The perimeter heat loss factor for slab-on-grade floors, expressed in Btu/h·ft·°F.

FACTORY-SEALED AIR HANDLING UNIT. A furnace, or an air conditioner or heat pump fan-coil unit which is certified by its manufacturer to withstand, without leakage, an air pressure of 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 design CFM discharge.

FAN SYSTEM ENERGY DEMAND (or FAN SYSTEM POWER). The sum of the nominal power demand (nameplate horsepower) of motors of all fans that are required to operate at design conditions to supply air from the heating or cooling source to the conditioned space(s) and return it to the source or exhaust it to the outdoors.

FEEDER CONDUCTORS. The wires that connect the service equipment to the branch circuit breaker panels.

FENESTRATION. All areas (including the frames) in the building envelope that let in light, including windows, plastic panels, clerestories, skylights, glass doors that are more than one-half glass, and glass block walls (see "Building envelope" and "Door").

(a) **Skylight:** A fenestration surface having a slope of less than 60 degrees from the horizontal plane. Other fenestration, even if mounted on the roof of a building, is considered vertical fenestration.

(b) **Vertical fenestration:** All fenestration other than skylights. Trombe wall assemblies, where glazing is installed within 12 inches (305 mm) of a mass wall, are considered walls, not fenestration.

FENESTRATION AREA. Total area of the fenestration measured using the rough opening and including the glazing, sash, and frame. For doors where the glazed vision area is less than 50 percent of the door area, the fenestration area is the glazed vision area. For all other doors, the fenestration area is the door area (see "Door area").

FENESTRATION, VERTICAL. See "Fenestration;" "Skylight."

FIRE WALL. Fire-resistant wall, having protective openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

FIXTURE. The component of a luminaire that houses the lamp or lamps, positions the lamp, shields it from view, and distributes the light. The fixture also provides for connection to the power supply, which may require the use of a ballast.

FLEXIBLE NONMETAL DUCT. A type of flexible air duct comprised of a wire-reinforced core (usually plastic), an insulation layer and an outer jacket (usually a durable reinforced plastic).

FLOODLIGHTING. A lighting system designated to light an area using projector-type luminaries usually capable of being pointed in any direction.

FLOOR, ENVELOPE. That lower portion of the building envelope, including opaque area and fenestration, that has conditioned or semiheated space above and is horizontal or tilted at an angle of less than 60 degrees from horizontal but excluding slab-on-grade floors. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Mass floor:** A floor with a heat capacity that exceeds (1) 7 Btu/ft^2·°F or (2) 5 Btu/ft^2·°F provided that the floor has a material unit mass not greater than 120 pound per cubic foot (lb/ft^3)(1922 kg/m^3)

(b) **Steel joist floor:** A floor that (1) is not a mass floor and (2) that has steel joist members supported by structural members.

(c) **Wood framed and other floors:** All other floor types, including wood joist floors (see "Building envelope," "Fenestration," "Opaque area," and "Slab-on-grade floor").

FLOOR AREA, GROSS. The sum of the floor areas of the spaces within the building including basements, mezzanine and intermediate-floored tiers, and penthouses with headroom height of 7.5 feet (2286 mm) or greater. It is measured from the exterior faces of exterior walls or from the centerline of walls separating buildings, but excluding covered walkways, open roofed-over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, and similar features.

(a) **Gross building envelope floor area:** The gross floor area of the building envelope, but excluding slab-on-grade floors.

(b) **Gross conditioned floor area:** The gross floor area of conditioned spaces.

(c) **Gross lighted floor area:** The gross floor area of lighted spaces.

(d) **Gross semiheated floor area:** The gross floor area of semiheated spaces (see "Building envelope," "Floor," "Slab-on-grade floor" and "Space").

FLUE DAMPER. A device in the flue outlet or in the inlet of or upstream of the draft control device of an individual, automatically operated, fossil fuel-fired appliance that is designed to automatically open the flue outlet during appliance operation and to automatically close the flue outlet when the appliance is in a standby condition.

FOSSIL FUEL. Fuel derived from a hydrocarbon deposit such as petroleum, coal or natural gas derived from living matter of a previous geologic time.

FUEL. A material that may be used to produce heat or generate power by combustion.

GASKETING. A compressible, resilient elastic packing, made of foam rubber or of a synthetic foam polymer. A gasket is distinct from the components being joined and must be capable of closing all air leakage pathways between the air barriers of the joint and of creating an air-tight seal.

GENERAL LIGHTING. See "Lighting, general."

GENERALLY ACCEPTED ENGINEERING STANDARD. A specification, rule, guide, or procedure in the field of engineering, or related thereto, recognized and accepted as authoritative.

GLAZED WALL SYSTEM. A category of site-assembled fenestration products, which includes, but is not limited to, curtainwalls and solariums.

GLAZING. Sunlight-transmitting fenestration, including the area of a sash, curbing or other framing elements, that enclose a conditioned space. Glazing includes the area of sunlight-transmitting fenestration assemblies in walls bounding conditioned basements.

GRADE. The finished ground level adjoining a building at all exterior walls.

GROSS FLOOR AREA. The sum of the floor areas of the conditioned spaces including basements, mezzanine and intermediate-floored tiers and penthouses of headroom height 7.5 feet (2286 mm) or greater. It is measured from the exterior faces of exterior walls or from the centerline of walls separating buildings.

GROSS LIGHTED AREA (GLA). See "Floor area, gross;" "Gross lighted floor area."

GROSS ROOF AREA. See "Roof area, gross."

GROSS WALL AREA. See "Wall area, gross."

HEAT. The form of energy that is transferred by virtue of a temperature difference or a change in the state of a material.

HEAT CAPACITY (HC): The amount of heat necessary to raise the temperature of a given mass 1°F (-17°C). Numerically, the sum of the products of the mass per unit area of each individual material in the roof, wall, or floor surface multiplied by its individual specific heat (Btu/ft^2·°F).

HEAT TRACE. A heating system where the externally applied heat source follows (traces) the object to be heated, e.g., water piping.

HEAT PUMP. A mechanical refrigeration-cycle system which has been designed to accomplish space heating, water heating or both and, when the evaporator and condenser effects are reverse, may be used for space air conditioning or water chilling.

HEAT TRAP. A device or arrangement of the hot water piping leaving the water heater, constructed to counteract the convective forces of the heated water (thermosyphoning) during stand-by periods.

HEATED BUILDING. Any building with heating equipment installed at the time of construction, or designed for the future installation of heating equipment, using electricity or fossil fuels.

HEATED SLAB. A floor, usually constructed of concrete, that has heat energy supplied into the slab to provide heating to an interior space.

HEATED SPACE. See "Space."

HEATING DESIGN TEMPERATURE. The outdoor dry-bulb temperature equal to the temperature that is exceeded

at least 99.6 percent of the number of hours during a typical weather year.

HEATING DEGREE DAY. See "Degree day."

HEATING SEASONAL PERFORMANCE FACTOR (HSPF). The total heating output of a heat pump during its normal annual usage period for heating (in Btu) divided by the total electric energy input during the same period.

HISTORIC. A building or space that has been specifically designated as historically significant by the adopting authority or is listed in the National Register of Historic Places or has been determined to be eligible for listing by the U.S. Secretary of the Interior.

HOME INSULATION. Any material, mainly insulation, used to retard the flow of heat through the building envelope that is tested and labeled with an installed *R*-value as required by the Federal Trade Commission rules, 16 U.S. Code of Federal Regulations (CFR) Part 460.

HORSEPOWER (HP). Unit of power; work done at a rate equal to 745.7 Watts, 550 foot pound per second or 33,000 foot pound per minute.

HOT WATER SUPPLY BOILER. A boiler used to heat water for purposes other than space heating.

HUMIDISTAT. An automatic control device used to maintain humidity at a fixed or adjustable set point.

HVAC. Heating, ventilating and air conditioning.

HVAC SYSTEM. The equipment, distribution systems, and terminals that provide, either collectively or individually, the processes of heating, ventilating, or air conditioning to a building or portion of a building.

INDIRECTLY CONDITIONED SPACE. See "Space."

INDOOR. Within the conditioned building envelope.

INFILTRATION. The uncontrolled inward air leakage through cracks and crevices in any building element and around windows and doors of a building caused by pressure differences across these elements due to factors such as wind, inside and outside temperature differences (stack effect), and imbalance between supply and exhaust air systems.

INFILTRATION BARRIER. A product or system designed to limit the free passage of air through a building envelope component (wall, ceiling or floor). Such products and systems are sealed together to form a continuous barrier against air infiltration.

INSTALLED INTERIOR LIGHTING POWER. The power in watts of all permanently installed general, task, and furniture lighting systems and luminaires.

INSULATION. Material mainly used to retard the flow of heat (see "Home insulation").

INSULATION BAFFLE. A device installed at the eave of an attic to prevent insulation from blocking the air flow channel between the soffits and attic.

INSULATION CHUTE. See "Insulation baffle."

INSULATION DAMS. A flexible device used between rafters at the eave line of roof systems that holds loose fill insulation away from soffit ventilation areas and prevents blockage of natural ventilation flow.

INTEGRAL-FLANGE DUCT COLLAR FITTING. A type of duct collar fitting having a flange that is secured to and sealed to the cylinder or sleeve of the fitting. A function of this flange is to provide a surface which can be sealed to rigid ductboard.

INTEGRATED PART-LOAD VALUE (IPLV). A single-number figure of merit based on part-load EER, COP, or kW/ton expressing part-load efficiency for air-conditioning and heat pump equipment on the basis of weighted operation at various load capacities for the equipment.

INTERIOR LIGHTING POWER ALLOWANCE (ILPA). See "Lighting power allowance."

ISOLATION DEVICES. Devices that isolate HVAC zones so that they can be operated independently of one another. Isolation devices include, but are not limited to, separate systems, isolation dampers, and controls providing shutoff at terminal boxes.

JOIST, STEEL. Any structural steel member of a building or structure made of hot-rolled or cold-rolled solid or open-web sections.

KILOVOLT-AMPERE (kVA). Where the term "kilovoltampere" (kVA) is used in this standard, it is the product of the line current (amperes) times the nominal system voltage (kilovolts) times 1.732 for three-phase currents. For single-phase applications, kVA is the product of the line current (amperes) times the nominal system voltage (kilovolts).

KILOWATT (kW). The basic unit of electric power, equal to 1000 W.

KNEE WALLS. Vertical walls which separate conditioned space from the attic.

LABELED. Devices, appliances, assemblies or materials included in a list published by an approved testing laboratory, inspection agency or other organization concerned with product evaluation that maintains periodic inspection of production of listed equipment, appliances, assemblies or material, and whose listing states either that the equipment, appliances, assemblies, or material meets nationally recognized standards or has been tested and found suitable for use in a specified manner.

LAMP. A generic term for a man-made light source often called a bulb or tube.

(a) **Compact fluorescent lamp:** A fluorescent lamp of a small compact shape, with a single base that provides the entire mechanical support function.

(b) **Fluorescent lamp:** A low-pressure electric discharge lamp in which a phosphor coating transforms some of the ultraviolet energy generated by the discharge into light.

(c) **General service lamp:** A class of incandescent lamps that provide light in virtually all directions. General service lamps are typically characterized by bulb shapes such as A, standard; S, straight side; F, flame; G, globe; and PS, pear straight.

(d) **High-intensity discharge (HID) lamp:** An electric discharge lamp in that light is produced when an electric arc is discharged through a vaporized metal such as mercury or sodium. Some HID lamps may also have a phosphor coating that contributes to the light produced or enhances the light color.

(e) **Incandescent lamp:** A lamp in which light is produced by a filament heated to incandescence by an electric current.

(f) **Reflector lamp:** A class of incandescent lamps that have an internal reflector to direct the light. Reflector lamps are typically characterized by reflective characteristics such as R, reflector; ER, ellipsoidal reflector; PAR, parabolic aluminized reflector; MR, mirrorized reflector; and others.

LIGHTING, DECORATIVE. Lighting that is purely ornamental and installed for aesthetic effect. Decorative lighting shall not include general lighting.

LIGHTING, GENERAL. Lighting that provides a substantially uniform level of illumination throughout an area. General lighting shall not include decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialized application or feature within such area.

LIGHTING SYSTEM. A group of luminaires circuited or controlled to perform a specific function.

LIGHTING POWER ALLOWANCE.

(a) Interior lighting power allowance: The maximum lighting power in watts allowed for the interior of a building.

(b) Exterior lighting power allowance: The maximum lighting power in watts allowed for the exterior of a building.

LIGHTING POWER DENSITY (LPD). The maximum lighting power per unit area of a building classification of space function.

LISTED. Equipment, materials or services included in a list published by an organization acceptable to the building official and concerned with evaluation of products or services that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services and whose listing states either that the equipment, material or service meets identified standards or has been tested and found suitable for a specified purpose.

LOW-RISE RESIDENTIAL. Single-family houses, multiple-family structures of three stories or fewer above grade, manufactured houses (mobile homes), and manufactured houses (modular).

LUMINAIRE. A complete lighting unit consisting of a lamp or lamps together with the housing designed to distribute the light, position and protect the lamps, and connect the lamps to the power supply.

MANUAL (NONAUTOMATIC). Requiring personal intervention for control. Nonautomatic does not necessarily imply a manual controller, only that personal intervention is necessary (see "Automatic").

MANUFACTURED BUILDING. A closed structure, building assembly, or system of subassemblies, which may include structural, electrical, plumbing, heating, ventilating, or other service systems manufactured for installation or erection, with or without other specified components, as a finished building or as part of a finished building, which shall include, but not be limited to, residential, commercial, institutional, storage, and industrial structures.

MANUFACTURED HOME. As defined by the U.S. Department of Housing and Urban Development, residential units constructed in accordance with Federal Mobile Construction and Safety Standards, pursuant to 42 USC 55.5401, et. seq. and 24 CFR 3282 and 3283.

MANUFACTURER. The company engaged in the original production and assembly of products or equipment or a company that purchases such products and equipment manufactured in accordance with company specifications.

MASS FLOOR. See "Floor."

MASS WALL. See "Wall."

MASTIC. A thick, pliable substance that adheres well to specific materials and is used for sealing different building components together. Mastics are often used in conjunction with fibrous or mesh fabric.

MASTIC RIBBONS. Malleable, putty-like packings which are used in applications akin to those of gasketing; but, they do not have elasticity of gasketing. Such mastics contain nearly 100 percent solids, require no curing in air, and are used without reinforcing fabric.

MEAN TEMPERATURE. One-half the sum of the minimum daily temperature and maximum daily temperature.

MECHANICAL CLOSET. For the purposes of this code, a closet used as an air plenum which contains the blower unit or air handler of a central air conditioning or heating unit.

MECHANICAL EQUIPMENT PLENUM CHAMBER. In an air-distribution system, that part of the casing, or an air chamber furnace, to or from which the air duct system delivers conditioned air.

MECHANICAL HEATING. Raising the temperature of a gas or liquid by use of fossil fuel burners, electric resistance heaters, heat pumps, or other systems that require energy to operate.

MECHANICAL COOLING. Reducing the temperature of a gas or liquid by using vapor compression, absorption, desiccant dehumidification combined with evaporative cooling, or another energy-driven thermodynamic cycle. Indirect or direct evaporative cooling alone is not considered mechanical cooling.

MECHANICAL VENTILATION. The process of supplying or removing air by mechanical means to or from any space.

METAL BUILDING. A complete integrated set of mutually dependent components and assemblies that form a building, which consists of a steel-framed superstructure and metal skin.

METAL BUILDING ROOF. See "Roof."

METAL BUILDING WALL. See "Wall."

METERING. Instruments that measure electric voltage, current, power, etc.

MOTOR POWER, RATED. The rated output power from the motor.

MULTIPLE-FAMILY RESIDENCE. Any residential dwelling unit that is attached to another such unit by a common wall, ceiling or floor such as a duplex, townhouse, condominium or similar unit, regardless of ownership.

MULTIZONE SYSTEM(S). One or more HVAC system(s) designed to supply conditioned air to more than one independently serviced area of a building. Each zone must have separate thermostats and be separated by walls or closable doors not exceeding 40 square feet (4 m^2) between zones.

NAMEPLATE RATING. The design load operating conditions of a device as shown by the manufacturer on the nameplate or otherwise marked on the device.

NEW ENERGY. Energy, other than recovered energy, used for the purpose of heating or cooling (See "Energy").

NONAUTOMATIC. See "Manual."

NONDEPLETABLE ENERGY SOURCES. Sources of energy derived from incoming solar radiation, including photosynthetic processes, wind, waves, and tides, lake or pond thermal differences and energy derived from the internal heat of the earth, including nocturnal thermal exchanges.

NONRECIRCULATING SYSTEM. A domestic or service hot water distribution system that is not a recirculating system.

NONRENEWABLE ENERGY. Energy derived from a fossil fuel source.

NONRESIDENTIAL. All occupancies other than residential (see "Residential").

NONSTANDARD PART LOAD VALUE (NPLV). A single number part-load efficiency figure of merit calculated and referenced to conditions other than IPLV conditions, for units that are not designed to operate at ARI Standard Rating Conditions.

NONSWINGING DOOR. See "Door."

NORTH ORIENTED. Facing within 45 degrees of true north (northern hemisphere).

OCCUPANCY. The purpose for which a building, or part thereof, is used or intended to be used. For the purposes of determining changes of occupancy for this code, the occupancy shall be considered the major occupancy group designations established by the locally adopted building code.

OCCUPANT SENSOR. A device that detects the presence or absence of people within an area and causes lighting, equipment, or appliances to be regulated accordingly.

OPAQUE. All areas in the building envelope, except fenestration and building service openings such as vents and grilles (see "Building envelope" and "Fenestration").

OPERABLE APERTURE AREAS. Areas of windows, sliding glass doors and screened entry doors that provide access to incoming breezes in their fully extended open position.

OPTIMUM START CONTROLS. Controls that are designed to automatically adjust the start time of an HVAC system each day with the intention of bringing the space to desired occupied temperature levels immediately before scheduled occupancy.

ORIENTATION. The direction an envelope element faces, i.e., the direction of a vector perpendicular to and pointing away from the surface outside of the element. For vertical fenestration, the two categories are north oriented and all other (see "North oriented").

OUTDOOR. The environment exterior to the building structure.

OUTDOOR (OUTSIDE) AIR. Air that is outside the building envelope or is taken from outside the building that has not been previously circulated through the building.

OUTSIDE. The environment exterior to the conditioned space of the building and may include attics, garages, crawlspaces, etc., but not return air plenums.

OVERCURRENT. Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload, short circuit or ground fault.

OVERHANG HEIGHT. The vertical measure of the distance from the bottom of a window to the bottom of the overhang.

OVERHANG LENGTH. The horizontal measure of how far a window overhang projects out from the glass surface.

OVERHANG SEPARATION. The vertical measure of the distance from the top of a window frame to the bottom of an overhang.

PACKAGED TERMINAL AIR CONDITIONER (PTAC). A factory selected wall sleeve and separate unencased combination of heating and cooling components, assemblies or sections. It may include heating capability by hot water, steam, or electricity and is intended for mounting through the wall to serve a single room or zone.

PACKAGED TERMINAL HEAT PUMP (PTHP). A PTAC capable of using the refrigerating system in a reverse cycle or heat pump mode to provide heat.

PARTY WALL. A fire wall on an interior lot line used or adapted for joint service between two buildings.

PERMANENTLY INSTALLED. Equipment that is fixed in place and is not portable or movable.

PLENUM. A compartment or chamber to which one or more ducts are connected, that forms a part of the air distribution system, and that is not used for occupancy or storage. A plenum often is formed in part or in total by portions of the building.

POOL. Any structure, basin, or tank containing an artificial body of water for swimming, diving, or recreational bathing. The term includes, but is not limited to, swimming pool, whirlpool, spa, or hot tub.

POOL COVER. Sheet of material, typically plastic, designed to cover the water which may prevent water or heat loss through convection, radiation and evaporation.

POSITIVE INDOOR PRESSURE. A positive pressure condition within a conditioned space caused by bringing in more outside air than the amount of air that is exhausted and/or lost through air leakage.

POST OR PIER CONSTRUCTION. Raised wood floor supported above grade on posts or piers with unenclosed space beneath.

POWER. In connection with machines, power is the time rate of doing work. In connection with the transmission of energy of all types, power refers to the rate at which energy is transmitted. It is measured in watts (W) or British thermal units per hour (Btu/h). See "Horsepower".

PRESSURE ENVELOPE. The primary air barrier of a building; that part of the envelope that provides the greatest resistance to air flow to or from the building.

PRESSURE-SENSITIVE TAPE. Tape used for sealing duct system components and air barriers which adheres when pressure is applied and is not heat activated.

PRIMARY AIR SYSTEM. The central air-moving heating and cooling equipment that serves multiple zones through mixing boxes, VAV boxes, or reheat coils.

PRIMARY LIVING AREA. A family room or great room, or a living room if no family room or great room is present. Formal living rooms, where a family room or great room is present, dining rooms and kitchens are not considered primary living areas.

PROCESS ENERGY. Energy consumed in support of a manufacturing, industrial, or commercial process other than conditioning spaces and maintaining comfort and amenities for the occupants of a building.

PROCESS LOAD. The load on a building resulting from the consumption or release of process energy.

PROJECTION FACTOR (PF). The ratio of the horizontal depth of the external shading projection divided by the sum of the height of the fenestration and the distance from the top of the fenestration to the bottom of the farthest point of the external shading projection, in consistent units.

PROPOSED DESIGN. A computer representation of the actual proposed building design or portion thereof used as the basis for calculating the design energy cost.

PUBLIC FACILITY RESTROOM. A restroom used by the transient public.

PUMP SYSTEM ENERGY DEMAND (PUMP SYSTEM POWER). The sum of the nominal power demand (nameplate horsepower) of motors of all pumps that are required to operate at design conditions to supply fluid from the heating or cooling source to all heat transfer devices (e.g., coils, heat exchanger) and return it to the source.

RADIANT BARRIER SYSTEM (RBS). A building construction consisting of a low emittance (normally 0.1 or less) surface (usually aluminum foil) bounded by an open air space. A RBS is used for the sole purpose of limiting heat transfer by radiation and is not specifically intended to reduce heat transfer by convection or conduction.

RADIANT HEATING SYSTEM. A heating system that transfers heat to objects and surfaces within the heated space primarily (greater than 50 percent) by infrared radiation.

RATED LAMP WATTAGE. See "Lamp wattage, rated."

RATED MOTOR POWER. See "Motor power rated."

RATED *R*-VALUE OF INSULATION. The thermal resistance of the insulation alone as specified by the manufacturer in units of $h \cdot ft^2 \cdot °F/Btu$ at a mean temperature of 75°F (24°C). Rated *R*-value refers to the thermal resistance of the added insulation in framing cavities or insulated sheathing only and does not include the thermal resistance of other building materials or air films (see "Thermal resistance").

READILY ACCESSIBLE. Capable of being reached quickly for operation, renewal, or inspections without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc. In public facilities, accessibility may be limited to certified personnel through locking covers or by placing equipment in locked rooms.

RECIRCULATING SYSTEM. A domestic or service hot water distribution system that includes a closed circulation circuit designed to maintain usage temperatures in hot water pipes near terminal devices (e.g., lavatory faucets, shower heads) in order to reduce the time required to obtain hot water when the terminal device valve is opened. The motive force for circulation is either natural (due to water density variations with temperature) or mechanical (recirculation pump).

RECOOLING. Lowering the temperature of air that has been previously heated by a mechanical heating system.

RECORD DRAWINGS. Drawings that record the conditions of the project as constructed. These include any refinements of the construction or bid documents.

RECOVERED ENERGY. Energy utilized which would otherwise be wasted from an energy utilization system.

REFLECTANCE. The ratio of the light reflected by a surface to the light incident upon it.

REHEAT. The application of sensible heat to supply air that has been previously cooled below the temperature of the conditioned space by either mechanical refrigeration or the introduction of outdoor air to provide space cooling.

REHEATING. Raising the temperature of air that has been previously cooled either by mechanical refrigeration or an economizer system.

RENOVATION. Any structural repair, reconstruction or restoration to a structure, the costs of which equals or exceeds, over a one-year period, a cumulative total of 30 percent of the assessed value of the structure when that value is assessed, either:

1. Before the improvement or repair is started; or
2. Before the damage occurred, if the structure has been damaged.

For the purposes of this code, renovation occurs when the first alteration of any wall, ceiling, floor, or other structural part or mechanical system of the building commences, whether or not that alteration affects the external dimensions of the structure.

REPAIR. The reconstruction or renewal of any part of an existing building for the purpose of its maintenance.

REPLACEMENT. The installation of part or all of an existing mechanical or electrical system in an existing building.

RESET. Automatic adjustment of the controller set point to a higher or lower value.

RESISTANCE, ELECTRIC. The property of an electric circuit or of any object used as part of an electric circuit that determines for a given circuit the rate at which electric energy is converted into heat or radiant energy and that has a value such that the product of the resistance and the square of the current gives the rate of conversion of energy.

RESIDENTIAL. (Subchapter 13-4 applications only.) Spaces in buildings used primarily for living and sleeping. Residential spaces include, but are not limited to, dwelling units, hotel/motel guest rooms, dormitories, nursing homes, patient rooms in hospitals, lodging houses, fraternity/sorority houses, hostels, prisons and fire stations**.**

RETROFIT. Modification of existing equipment or systems to incorporate improved performance of operation.

ROOF. The upper portion of the building envelope, including opaque areas and fenestration, that is horizontal or tilted at an angle of less than 60 degrees from horizontal. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Attic and other roofs:** All other roofs, including roofs with insulation entirely below (inside of) the roof structure (i.e., attics, cathedral ceilings, and single-rafter ceilings), roofs with insulation both above and below the roof structure, and roofs without insulation but excluding metal building roofs.

(b) **Metal building roof:** a roof that is constructed with (a) a metal, structural, weathering surface, (b) has no ventilated cavity, and (c) has the insulation entirely below deck (i.e., does not include composite concrete and metal deck construction nor a roof framing system that is separated from the superstructure by a wood substrate) and whose structure consists of one or more of the following configurations: (1) metal roofing in direct contact with the steel framing members; (2) insulation between the metal roofing and the steel framing members; or (3) insulated metal roofing panels installed as described in (1) or (2).

(c) **Roof with insulation entirely above deck:** A roof with all insulation (1) installed above (outside of) the roof structure and (2) continuous (i.e., uninterrupted by framing members).

(d) **Single-rafter roof:** A subcategory of attic roofs where the roof above and the ceiling below are both attached to the same wood rafter and where insulation is located in the space between these wood rafters.

ROOF AREA, GROSS. The area of the roof measured from the exterior faces of walls or from the centerline of party walls (see "Roof;" "Wall").

ROOF ASSEMBLY. All components of the roof/ceiling envelope through which heat flows, thereby creating building heat loss or gain, where such assembly is exposed to outdoor air and encloses a conditioned space. The gross area of a roof assembly consists of the total interior surface of such assembly, including skylights exposed to the conditioned space.

ROOM AIR CONDITIONER. An encased assembly designed as a unit to be mounted in a window or through a wall, or as a console. It is designed primarily to provide direct delivery of conditioned air to an enclosed space, room, or zone. It includes a prime source of refrigeration for cooling and dehumidification and a means for circulating and cleaning air. It may also include a means for ventilating and heating.

ROOM CAVITY RATIO (RCR). A factor that characterizes room configuration as a ratio between the walls and ceiling and is based upon room dimensions.

SEAL or SEALING–AIR DUCT. The use of closure products either welds, mastic, mastic plus embedded fabric, adhesives, caulking, gaskets, pressure sensitive tapes, heat-activated tapes or combinations thereof as allowed by specific sections of this code, to close cracks, joints, seams, and other openings in the air barriers of air duct, air handling units, and plenum chambers for the purpose of preventing air leakage. No joint or opening from which a closure product is absent shall be considered sealed unless considered otherwise in specific cases identified by this code. Closeness of fit between mated parts alone shall not be considered a seal.

SEASONAL COEFFICIENT OF PERFORMANCE – COOLING (SCOPC). The total cooling output of an air conditioner during its normal annual usage period for cooling divided by the total electric energy input during the same period in consistent units (analogous to the SEER but for IP or other consistent units).

SEASONAL COEFFICIENT OF PERFORMANCE – HEATING (SCOPH). The total heating output of a heat pump during its normal annual usage period for heating divided by the total electric energy input during the same period in consistent units (analogous to the HSPF but for IP or other consistent units).

SEASONAL ENERGY EFFICIENCY RATIO (SEER). The total cooling output of an air conditioner during its normal annual usage period for cooling (in Btu) divided by the total electric energy input during the same period (in Wh).

SEMIEXTERIOR BUILDING ENVELOPE. See "Building envelope."

SEMIHEATED FLOOR AREA. See "Floor area."

SEMIHEATED SPACE. See "Space."

SEQUENCE. A consecutive series of common events.

SERVICE. The equipment for delivering energy from the supply or distribution system to the premises served.

SERVICE AGENCY. Agency capable of providing calibration, testing, or manufacture of equipment, instrumentation, metering, or control apparatus, such as a contractor, laboratory, or manufacturer.

SERVICE EQUIPMENT. The necessary equipment, usually consisting of a circuit breaker or switch and fuses and accessories, located near the point of entrance of supply conductors to a building or other structure (or an otherwise defined area) and intended to constitute the main control and means of cutoff of the supply. Service equipment may consist of circuit breakers or fused switches provided to disconnect all undergrounded

conductors in a building or other structure from the service-entrance conductors.

SERVICE WATER HEATING. Heating water for domestic or commercial purposes other than space heating and process requirements.

SETBACK. Reduction of heating (by reducing the set point) or cooling (by increasing the set point) during hours when a building is unoccupied or during periods when lesser demand is acceptable.

SET POINT. Point at which the desired temperature (°F) of the heated or cooled space is set.

SHADING COEFFICIENT (SC). The ratio of solar heat gain at normal incidence through glazing to that occurring through $^1/_8$-inch (3.2 mm) thick clear, double-strength glass. Shading coefficient, as used herein, does not include interior, exterior, or integral shading devices.

SHELL BUILDING. A commercial building that is permitted prior to design completion or which will be finished in sections at a time after construction of the shell.

SIMULATION PROGRAM. A computer program that is capable of simulating the energy performance of building systems.

SINGLE-LINE DIAGRAM. A simplified schematic drawing that shows the connection between two or more items. Common multiple connections are shown as one line.

SINGLE PACKAGE VERTICAL AIR CONDITIONER (SPVAC). A type of air-cooled small or large commercial package air conditioning and heating equipment; factory assembled as a single package having its major components arranged vertically, which is an encased combination of cooling and optional heating components; it is intended for exterior mounting on, adjacent interior to, or through an outside wall; and is powered by single or three-phase current. It may contain separate indoor grille(s), outdoor louvers, various ventilation options, indoor free air discharge, ductwork, wall plenum or sleeve. Heating components may include electrical resistance, steam, hot water, gas or no heat but may not include reverse cycle refrigeration as a heating means.

SINGLE PACKAGE VERTICAL HEAT PUMP (SPVHP). An SPVAC that utilizes reverse cycle refrigeration as its primary heat source, with secondary supplemental heating by means of electrical resistance, steam, hot water or gas.

SINGLE-RAFTER ROOF. See "Roof."

SINGLE-ZONE SYSTEM. An HVAC system serving a single HVAC zone.

SINGLE ASSEMBLY. A roof and ceiling structure that is constructed as one unit with no attic space in between.

SINGLE-FAMILY RESIDENCE. Detached residential building suited for tenancy by one family unit.

SITE-INSTALLED COMPONENTS AND FEATURES. Equipment, materials, measures, practices and features which are affixed to a new manufactured home at its first set-up that are not initially installed by the manufacturer.

SITE-RECOVERED ENERGY. Waste energy recovered at the building site that is used to offset consumption of purchased fuel or electrical energy supplies.

SITE-SOLAR ENERGY. Thermal, chemical, or electrical energy derived from direct conversion of incident solar radiation at the building site and used to offset consumption of purchased fuel or electrical energy supplies. For the purposes of applying this standard, site-solar energy shall not include passive heat gain through fenestration systems.

SKYLIGHT. See "Fenestration."

SKYLIGHT WELL. The shaft from the skylight to the ceiling.

SLAB-ON-GRADE FLOOR. That portion of a slab floor of the building envelope that is in contact with the ground and that is either above grade or is less than or equal to 24 inches (610 mm) below the final elevation of the nearest exterior grade.

(a) **Heated slab-on-grade floor:** A slab-on-grade floor with a heating source either within or below it.

(b) **Unheated slab-on-grade floor:** A slab-on-grade floor that is not a heated slab-on-grade floor.

SOLAR ENERGY SOURCE. Source of thermal, chemical, or electrical energy derived from direct conversion of incident solar radiation at the building site.

SOLAR ENERGY SYSTEM. A complete set of coordinated components, which may be comprised of collectors, piping, pumps, heat exchangers, photovoltaic (PV) arrays, wiring, controls, power converters, and applicable storage, the design of which is intended to convert and utilize incident solar radiation to either heat water for hot water or space conditioning needs or to produce photovoltaic (PV) power for electrical needs.

SOLAR FRACTION (SF). Reserved.

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

SPACE. An enclosed space within a building. The classifications of spaces are as follows for the purpose of determining building envelope requirements.

(a) **Conditioned space:** A cooled space, heated space, indirectly conditioned space or unvented attic assembly defined as follows:

(1) Cooled space: an enclosed space within a building that is cooled by a cooling system whose sensible output capacity exceeds 5 Btu/h·ft^2 of floor area.

(2) Heated space: an enclosed space within a building that is heated by a heating system whose output capacity relative to the floor area is greater than or equal to 5 Btu/h·ft^2.

(3) Indirectly conditioned space: an enclosed space within a building that is not a heated space or a cooled space, which is heated or cooled indirectly by being connected to adjacent space(s) provided (a) the product of the *U*-factor(s) and

surface area(s) of the space adjacent to connected space(s) exceeds the combined sum of the product of the *U*-factor(s) and surface area(s) of the space adjoining the outdoors, unconditioned spaces, and to or from semiheated spaces (e.g., corridors) or (b) that air from heated or cooled spaces is intentionally transferred (naturally or mechanically) into the space at a rate exceeding three air changes per hour (ACH) (e.g., atria).

(4) Unvented attic assembly: as defined in Section R806.4 of the *Florida Building Code, Residential*. These spaces shall not require supply or return outlets.

(b) **Semiheated space:** An enclosed space within a building that is heated by a heating system whose output capacity is greater than or equal to 3.4 Btu/h·ft^2 of floor area but is not a conditioned space.

(c) **Unconditioned space:** An enclosed space within a building that is not a conditioned space or a semiheated space. Crawl spaces, attics, and parking garages with natural or mechanical ventilation are not considered enclosed spaces.

SPACE-CONDITIONING CATEGORY. (Subchapter 4 applications only). (1) Nonresidential conditioned space, (2) residential conditioned space and (3) nonresidential and residential semiheated space (see "Nonresidential," "Residential" and "Space").

SPACE CONSTRAINED PRODUCT. A central air conditioner or heat pump:

1. that has rated cooling capabilities no greater than 30,000 BTU/h;
2. that has an outdoor or indoor unit having at least two overall exterior dimensions or an overall displacement that
   (a) is substantially smaller than those of other units that are either currently usually installed in site-built single-family homes, and of a similar cooling and, if heat pump, heating capacity; and
   (b) if increased, would certainly result in a considerable increase in the usual cost of installation or would certainly result in a significant loss in the utility of the product to the consumer; and
3. is of a product type that was available for purchase in the United States as of December 1, 2000.

SPACE PERMITTING – INSULATION. Where an enclosed space exists in which insulation can be placed without the creation of space for that purpose only; e.g. dropped ceiling below a floor deck or space between joists.

SPACE TYPE. Descriptor of the visual activity to take place in a space; space types are those used for the FLA/COM calculation.

SPLIT SYSTEM. Air-conditioning system or heat pump with compressor and air handler in separate cabinets with the compressor typically located exterior to conditioned space.

STACK LOSSES. Unused heat energy escaping through a flue or chimney to the outdoors in a combustion heating system.

STEADY-STATE CONDITIONS (for gas- or oil-fired heating equipment). Equilibrium conditions as indicated by temperature variations of not more than 3°F (1.7°C) in the stack gas temperature for units equipped with integral draft diverters, or not more than 5°F (2.8°C) in flue gas temperature for units equipped with draft hoods, barometric draft regulators, or direct vent systems, in three successive temperature readings taken 15 minutes apart.

STEEL-FRAMED WALL. See "Wall."

STEEL-JOIST FLOOR. See "Floor."

STEM WALL CONSTRUCTION. A type of raised floor system consisting of a wood floor supported above grade by a continuous stem wall around its perimeter.

STORY. Portion of a building that is between one finished floor level and the next higher finished floor level or the roof, provided, however, that a basement or cellar shall not be considered a story

STRUCTURE. That which is built or constructed.

SUBSTANTIAL CONTACT. A condition where adjacent building materials are placed so that proximal surfaces are contiguous, being installed and supported so they eliminate voids between materials without compressing or degrading the thermal performance of either product.

SUN SPACE. A totally enclosed, unconditioned space which is built substantially of glass, attached to the conditioned space of the building, and designed primarily for winter space heating.

SUPPLEMENTARY HEAT. Heat provided, generally electric resistance heat, to make up the difference between heat provided by the refrigeration cycle of a heat pump and that required to meet the heating load at low temperatures. Supplementary heat shall not be construed as the heat required to provide 100-percent backup in case of system failure.

SWINGING DOOR. See "Door."

SYSTEM. A combination of equipment and auxiliary devices (e.g., controls, accessories, interconnecting means, and terminal elements) by which energy is transformed so it performs a specific function, such as HVAC, service water heating or lighting.

SYSTEM, EXISTING. A system or systems previously installed in an existing building.

TANDEM WIRING. Pairs of luminaires operating with lamps in each luminaire powered from a single ballast contained in one of the luminaires.

TASK LIGHTING. Lighting designed to provide illumination over a relatively small task area without providing significant general surrounding lighting.

TERMINAL. A device by which energy from a system is finally delivered, e.g., registers, diffusers, lighting fixtures, faucets, etc.

THERMAL BLOCK. A collection of one or more HVAC zones grouped together for simulation purposes. Spaces need not be contiguous to be combined within a single thermal block.

THERMAL CONDUCTANCE. See "C-factor."

THERMAL EFFICIENCY. For the purposes of this code, Thermal Efficiency shall be defined as included in the American National Standard Institute, Inc. standard ANSI Z 21.10.3.

THERMAL ENVELOPE. The primary insulation layer of a building; that part of the envelope that provides the greatest resistance to heat flow to or from the building.

THERMAL MASS. Materials with mass heat capacity and surface area capable of affecting building loads by storing and releasing heat as the interior and/or exterior temperature and radiant conditions fluctuate. See "Wall heat capacity".

THERMAL MASS WALL INSULATION POSITION

1. **Exterior insulation position:** A wall having all or nearly all of its mass exposed to the room air with the insulation on the exterior of that mass.
2. **Integral insulation position:** A wall having mass exposed to both room and outside air with substantially equal amounts of mass on the inside and outside of the insulation layer.
3. **Interior insulation position:** A wall not meeting either of the above definitions, particularly a wall having most of its mass external to an insulation layer.

THERMAL RESISTANCE (R-VALUE). The reciprocal of the time rate of heat flow through a unit area induced by a unit temperature difference between two defined surfaces of material or construction under steady-state conditions. Units of R are $h \cdot ft^2 \cdot °F/Btu$.

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

THERMOSTATIC CONTROL. An automatic control device or system used to maintain temperature at a fixed or adjustable set point.

THROUGH-THE-WALL AIR CONDITIONER and HEAT PUMP. A central air conditioner or heat pump that is designed to be installed totally or partially within a fixed-size opening in an exterior wall; and

1. Is manufactured prior to January 23, 2010;
2. Is not weatherized;
3. Is clearly and permanently marked for installation-only through an exterior wall;
4. Has a rated cooling capacity no greater than 30,000 BTU/h;
5. Exchanges all of its outdoor air across a single surface of the equipment cabinet, and;
6. Has a combined outdoor air exchange area of less than 800 square inches (0.516 m^2) (split systems) or less than 1,210 square inches (0.780 m^2) (single packaged systems) as measured on the surface described in 5 above.

TINTED. As applied to fenestration: bronze, green, blue, or gray coloring that is integral with the glazing material. Tinting does not include surface applied films such as reflective coatings, applied either in the field or during the manufacturing process.

TOWNHOUSE. A single-family dwelling unit constructed in a series or group of attached units with property lines separating such units. For the purpose of this code, townhouses shall be considered multiple-family dwellings.

TRANSFER GRILLE. A louvered or perforated covering for an opening in an air passage through a wall or door allowing transport of return air from a separated conditioned space of a building to the space containing the air distribution system's primary return.

TRANSFORMER. A piece of electrical equipment used to convert electric power from one voltage to another voltage.

(a) **Dry-type transformer:** A transformer in which the core and coils are in a gaseous or dry compound.

(b) **Liquid-immersed transformer:** A transformer in which the core and coils are immersed in an insulating liquid.

***U*-FACTOR (THERMAL TRANSMITTANCE).** Heat transmission in unit time through unit area of a material or construction and the boundary air films, induced by unit temperature difference between the environments on each side. Units of U are $Btu/h \cdot ft^2 \cdot °F$.

UNCONDITIONED SPACE. See "Space."

UNDER ATTIC. Location of ceiling area in residential occupancies where the roof assembly and ceiling assembly are separated by a continuous ventilated unconditioned space spanning the ceiling area. Scissors truss structures are considered under attic where a ventilated air space is provided.

UNENCLOSED SPACE. A space that is not an enclosed space.

UNIT ENERGY COSTS. Costs for units of energy or power purchased at the building site. These costs may include energy costs as well as costs for power demand as determined by the adopting authority.

UNITARY COOLING EQUIPMENT. One or more factory-made assemblies that normally include an evaporator or cooling coil and a compressor and condenser combination. Units that perform a heating function are also included.

UNITARY HEAT PUMP. One or more factory-made assemblies that normally include an indoor conditioning coil, compressor(s), and an outdoor refrigerant-to-air coil or refrigerant-to-water heat exchanger. These units provide both heating and cooling functions.

VARIABLE AIR VOLUME (VAV) SYSTEM. HVAC system that controls the dry-bulb temperature within a space by varying the volumetric flow of heated or cooled supply air to the space.

VENT DAMPER. A device intended for installation in the venting system of an individual, automatically operated, fossil fuel-fired appliance in the outlet or downstream of the appliance draft control device, which is designed to automatically open the venting system when the appliance is in operation and to automatically close off the venting system when the appliance is in a standby or shutdown condition.

VENTILATION. The process of supplying or removing air by natural or mechanical means to or from any space. Such air is not required to have been conditioned.

VENTILATION AIR. That portion of supply air which comes from outdoors, plus any cleaned recirculated air to maintain the desired quality of air within a designated space (see "Outdoor air").

VERTICAL FENESTRATION. See "Fenestration."

VISIBLE TRANSMITTANCE (VT). Transmittance of glazing material over the visible portion of solar spectrum.

VOLTAGE DROP. A decrease in voltage caused by losses in the lines connecting the power source to the load.

WALL. That portion of the building envelope, including opaque area and fenestration, that is vertical or tilted at an angle of 60 degress from horizontal or greater. This includes above and below-grade walls, between floor spandrels, peripheral edges of floors, and foundation walls. For the purposes of determining building envelope requirements, the classifications are defined as follows:

(a) **Above-grade wall:** A wall that is not a below-grade wall.

(b) **Below-grade wall:** That portion of a wall in the building envelope that is entirely below the finish grade and in contact with the ground.

(c) **Mass wall:** A wall with a heat capacity exceeding (1) 7 Btu/ft^2·°F or (2) 5 Btu/ft^2·°F provided that the wall has a material unit weight not greater than 120 lb/ft^3 (1922 kg/m^3).

(d) **Metal building wall:** A wall whose structure consists of metal spanning members supported by steel structural members (i.e., does not include spandrel glass or metal panels in curtain wall systems).

(e) **Steel-framed wall:** A wall with a cavity (insulated or otherwise) whose exterior surfaces are separated by steel framing members (i.e., typical steel stud walls and curtain wall systems).

(f) **Wood-framed and other walls:** All other wall types, including wood stud walls.

WALL AREA, GROSS. The area of the wall measured on the exterior face from the top of the floor to the bottom of the roof.

WARM-UP. Increase in space temperature to occupied set point after a period of shutdown or setback.

WATER HEATER. Vessel in which water is heated and is withdrawn for use external to the system.

WATT. The electrical unit of power or rate of doing work. One watt = 0.00134 h.p.

WHOLE-HOUSE FAN. A mechanical ventilation system usually installed in the ceiling of a residence which is used to exhaust air from the interior of a building to an attic space with sufficient venting area to transfer the air to the outside.

WING WALLS. An architectural projection which is designed to create positive pressure over one window and negative over another that redirects natural winds in through windows or doors.

WORST CASE. A unit of a residential structure with the same general layout and percent glass which generates the highest as-built points in a Method A, Subchapter 6 calculation procedure.

The worst case unit will have the largest amount of glass facing east and west (primary orientation) and south (secondary orientation).

ZONE, HVAC. A space or group of spaces within a building with heating and cooling requirements that are sufficiently similar so that desired conditions (e.g. temperature) can be maintained throughout using a single sensor (e.g. thermostat or temperature sensor).

SUBCHAPTER 13-3

REFERENCED STANDARDS AND ORGANIZATIONS

SECTION 13-301
REFERENCED STANDARDS

13-301.0 General. The standards (Std), and portions thereof, which are referred to in various parts of this code shall be part of Chapter 13 of the *Florida Building Code* and are hereby declared to be a part of this code. Section numbers shall read as if prefaced by 13-.

AABC

Associated Air Balance Council,
1518 K Street, Suite 503,
Washington, DC 20005

Standard reference number	Title	Referenced in code section number
AABC, 1989	Associated Air Balance Council National Standard	410.AB.4.3

AAMA

American Architectural Manufacturers Association
1827 Walden Office Square, Suite 104
Schaumburg, IL 60173-4268

Standard reference number	Title	Referenced in code section number
AAMA/WDMA/CSA 101/I.S. 2-05	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors.	406.AB.1.1, 606.AB.1.1

ACCA

Air Conditioning Contractors of America
2800 Shirlington Road, Suite 300
Arlington, VA 22206

Standard reference number	Title	Referenced in code section number
ACCA Manual D-1995	Residential Duct Systems	410.AB.2, 610.AB.1
ACCA Manual J-2003	Residential Load Calculation, Eighth Edition with posted updates/errata.	607.AB.1
ACCA Manual N-2005	Commercial Load Calculation.	607.AB.1, Appendix 13-B B-3.1.1

ADC

Air Diffusion Council
1000 E. Woodfield Rd., Suite 102
Schaumburg, IL 60173-5921

Standard reference number	Title	Referenced in code section number
ADC 2003	Flexible Duct Performance & Installation Standards, Fourth Edition.	410.AB.2.2, 610.AB.2.2

AHAM

Association of Home Appliance Manufacturers
20 North Wacker Dr.
Chicago, IL 60606

Standard reference number	Title	Referenced in code section number
ANSI/AHAM RAC1-03	Room Air Conditioners.	Table 407.AB.3.2D, Table 607.AB.3.2D

AMCA

Air Movement and Control Association International
30 West University Drive
Arlington Heights, IL 60004-1806

Standard reference number	Title	Referenced in code section number
AMCA 500-1989	Test Methods for Louvers, Dampers, and Shutters	409.AB.3.4

ANSI

American National Standards Institute, Inc.
25 West 43rd Street, Fourth Floor
New York, N.Y.10036.

Standard reference number	Title	Referenced in code section number
ANSI A112.18.1M-1999	Finished and Rough Brass Plumbing Fixture Fittings.	412.AB.2.5.1, 612.AB.2.4
ANSI Z21.10.3-2004	Gas Water Heater, Volume 3, Storage, with Input Ratings above 75,000 Btu/h, Circulating and Instantaneous Water Heaters	Table 412.AB.3, 612.AB.3.1.2
ANSI Z21.40.4-96	American National Standard for Performance Testing and (with Addenda 1) Rating of Gas-Fired, Air-Conditioning and Heat Pump Appliances.	607.AB.3.1
ANSI Z21.47a-04	Gas-Fired Central Furnaces	Table 408.AB.3.2E, Table 608.AB.3.2E
ANSI Z21.56-2006	Gas-Fired Pool Heaters.	412.AB.3.5, 612.AB.2.3.1
ANSI Z21.66-1996 (R2001)	Automatic Vent Damper Devices for Use with Gas-Fired Appliances	408.AB.3.2.1
ANSI Z83.8/CGA 2.6 -2006	Gas Unit Heaters and Gas-Fired Duct Furnaces	Table 408.AB.3.2E, Table 608.AB.3.2E

ARDM

Association of Refrigerant Desuperheater Manufacturers, Inc,
c/o Doucette Industries
4151 112 Terrace N
Clearwater, FL 33762

Standard reference number	Title	Referenced in code section number
ARDM-88	Residential Heat Recovery Installation Guide, First Edition	600.2.1, 612.A.3

AHRI

Air-Conditioning, Heating and Refrigeration Institute (formerly ARI)
Suite 500
2111 Wilson Boulevard
Arlington, VA 22201

Standard reference number	Title	Referenced in code section number
210/240-2006	Unitary Air-Conditioning and Air-Source Heat Pump Equipment	Table 407.AB.3.2A, Table 407.AB.3.2B, Table 607.AB.3.2A, Table 607.AB.3.2B, 607.AB.3.1, 608.AB.3.1
310/380-2004	Packaged Terminal Air-Conditioners and Heat Pumps.	Table 407.AB.3.2D, Table 607.AB.3.2D
340/360-2004	Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment	Table 407.AB.3.2A, Table 407.AB.3.2B, Table 607.AB.3.2A, Table 607.AB.3.2B
365-2002	Commercial and Industrial Unitary Air-Conditioning Condensing Units	Table 407.AB.3.2A, Table 607.AB.3.2A
390-2003	Performance Rating of Single Packaged Vertical Air Conditioners and Heat Pumps	Table 410.AB.3.2D, 610.AB.3.2D
460-2005	Performance Rating of Remote Mechanical Draft Air-Cooled Refrigerant Condensers	Table 407.AB.3.2G
550/590-2003	Water Chilling Packages Using the Vapor Compression Cycle	202, 407.AB.3.2.2, Table 407.AB.3.2C
560-2000	Absorption Water Chilling and Water Heating Packages	Table 407.AB.3.2C
1160-2004	Performance Rating of Heat Pump Pool Heaters.	Table 412.AB.3, 612.AB.2.3.4

ASHRAE

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle, NE
Atlanta, GA 30329-2305

Standard reference number	Title	Referenced in code section number
ANSI/ASHRAE Std.55-1992	Thermal Environmental Conditions for Human Occupancy.	202, 407.AB.3.3
ANSI/ASHRAE Std. 62.1-2004	Ventilation for Acceptable Indoor Air Quality.	407.AB.2.1, 407.AB.2.4.1, Table 407.AB.3.2.C
ANSI/ASHRAE Std. 90.1-2004	Energy Efficient Design of New Buildings Except Low-Rise Residential Buildings.	413.0
ANSI/ASHRAE 119-1988 (RA 94)	Air Leakage Performance for Detached Single-Family Residential Buildings	Table 13-613.A.1-1
ANSI/ASHRAE 124-1991	Methods of Testing for Rating Combination Space-Heating and Water-Heating Appliances	608.A.3.5, 612.A.1
ANSI/ASHRAE 137-1995 (RA2001)	Methods of Testing for Efficiency of Space-conditioning/Water-Heating Appliances That Include a Desuperheater Water Heater	412.AB.1, 612.A.1
ANSI/ASHRAE 146-1998	Method of Testing for Rating Pool Heaters	Table 412.AB.3
ANSI/ASHRAE 152-2004	Method of Test for Determining the Design and Seasonal Efficiencies of Residential Thermal Distribution Systems	610.A.2, Table 13-613A.1-1
ASHRAE Handbook	Fundamentals, 2005	202, Appendix 13-B B-3.1.1, B-3.1.2, B-3.1.3, Table 13-613A.1-1
ASHRAE Handbook	HVAC Applications, 2003.	412.AB.1, 412.AB.2.1.1
ASHRAE Handbook	Fundamentals, 2005	202, Appendix 13-B B-3.1.1, B-3.1.2, B-3.1.3
ASHRAE Handbook	HVAC Systems & Equipment, 2004.	410.AB.3, 610.AB.3
ASHRAE, 1998	Cooling and Heating Load Calculation Principles.	607.AB.1

ASTM

ASTM International
100 Barr Harbor Dr
West Conshohocken, PA 19428-2959

Standard reference number	Title	Referenced in code section number
ASTM C36/C36M-03	Standard Specification for Gypsum Wallboard	202
ASTM C90-06b	Standard Specification for Loadbearing Concrete Masonry Units	Appendix 13-B B-1.2.3, Appendix 13-B B-2.2.1.1.1
ASTM C 177-04	Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.	410.AB.2.3, 610.AB.2.2, Appendix 13-B B-1.3.4
ASTM C272-01	Test Method for Water Absorption of Core Materials for Structural Sandwich Constructions.	Appendix 13-B B-1.3.3
ASTM C 335-05ae1	Test Method for Steady-State Heat Transfer Properties of Pipe Insulation.	Table 411.AB.2
ASTM C 516-02	Vermiculite Loose Fill Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 518-04	Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.	Appendix 13-C Table C1.2.3
ASTM C 549-06	Perlite Loose Fill Insulation.	Appendix 13-C Table C1.2.3
ASTM C 578-06	Rigid, Cellular Polystyrene Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 665-06	Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing	Appendix 13-C Table C1.2.3
ASTM C 727-01	Standard Practice for Installation and Use of Reflective Insulation in Building Constructions	Appendix 13-C Table C1.2.3
ASTM C 735-05b	Cellulosic Fiber Loose-Fill Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 764-06a	Mineral Fiber Loose-Fill Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 1015-06	Standard Practice for Installation of Cellulosic and Mineral Fiber Loose-Fill Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 1029-05a	Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation	Appendix 13-C Table C1.2.3
ASTM C 1158-05	Standard Practice for Use and Installation of Radiant Barrier Systems (RBS) in Building Construction.	604.A.3, Appendix 13-C Table C1.2.3
ASTM C 1224-03	Reflective Insulation for Building Applications	Appendix 13-C Table C1.2.3
ASTM C 1289-06	Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board	Appendix 13-C Table C1.2.3
ASTM C 1313-05	Sheet Radiant Barriers for Building Construction Applications	604.A.3, Appendix 13-C Table C1.2.3
ASTM C 1320-05	Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light-Frame Construction	Appendix 13-C Table C1.2.3

ASTM—continued

ASTM C 1321-04	Standard Practice for Installation and Use of Interior Radiation Control Coating Systems (IRCC) in Building Construction . . . . . 604.A.3, Appendix 13-C Table C1.2.3
ASTM C 1363-05	Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus . . . . . 602.A.2, Appendix 13-B B-1.1.1, Appendix 13-B B-1.1.2
ASTM C 1371-04a	Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.. . . . . 604.A.4
ASTM C 1549-04	Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflector 604.A.4
ASTM E 84-06a	Test Method for Surface Burning Characteristics of Building Materials. 410.AB.3.0.7, 610.AB.3.0.7
ASTM E 283-04	Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen. . . . . 406.AB, 406.AB.1.1, 606.AB.1.1, 606.AB.1.2.4, Appendix 13-C C3.4.3
ASTM E 903-96	Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres . . . . . 604.A.4, Appendix 13-2C 4.2.1.5
ASTM E 1918-06	Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field 604.A.4

CRRC

Cool Roof Rating Council
1738 Excelsior Avenue
Oakland, CA 94602

Standard reference number	Title	Referenced in code section number
CRRC-1-2006	CRRC-1 Product Rating Program.	604.A.4

CTI

Cooling Technology Tower Institute
2611 FM 1960 West, Suite H-200
Houston, TX 77068-3730.

Standard reference number	Title	Referenced in code section number
CTI ATC-105-(00)2000	Acceptance Test Code for Water Cooling Towers	Table 407.AB.3.2G
CTI Std. 201-2002	Certification Standard for Water Cooling Tower Thermal Performance	Table 407.AB.3.2G

DASMA

Door and Access Systems Manufacturers Association
1300 Sumner Avenue
Cleveland, OH 44115-2851.

Standard reference number	Title	Referenced in code section number
ANSI/DASMA105-1992 (R1998)	Test Method for Thermal Transmittance and Air Infiltration of Garage Doors	406.AB.1.1

DOE

United States Department of Energy
c/o Superintendent of Documents
U.S. Government Printing Office
Washington, DC 20402-9325

Standard reference number	Title	Referenced in code section number
DOE, 10 CFR, Part 430 Subpart B, App. E-1998	Uniform Test Method for Measuring the Energy Consumption of Water Heaters	Tables 408.AB.3.2F, 608.AB.3.2F, 412.AB.3, 612.AB.3.1.1, 612.AB.3.2
Subpart B, App. M	Uniform Test Method for Measuring the Energy Consumption of Central Air Conditioners.	607.AB.3.1
10 CFR, Part 430 Subpart B, App N -1998	Uniform Test Method for Measuring the Energy Consumption of Furnaces.	Tables 408.AB.3.2E, 608.AB.3.2E

DOE—continued

DOE, 10 CFR, Part 430 Subpart B, App O-1998	Uniform Test for Measuring the Energy Consumption of Vented Home Heating Equipment	202
EPACT, 92 42 USC 6831, et seq Public Law 102-486	Energy Policy Act of 1992	407.AB.3.2, 414.AB.1, 607.AB.3.2.1
NAECA, 1987	National Appliance Energy Conservation Act of 1987	Tables 407.AB.3.2A, B; 408.AB.2.2, Table 408.AB.3.2E, 607.AB.3.1, Tables 607.AB.3.2A, B, 608.AB.3.1

Florida Codes

Building Codes and Standards Office
Florida Department of Community Affairs
2555 Shumard Oak Blvd.
Tallahassee, Fl 32399-2100

Standard reference number	Title	Referenced in code section number
FL-1	Florida Standard for Desuperheater/Water Heaters (See Appendix 13-E of this code).	612.A.3 *

FSEC

Florida Solar Energy Center
1679 Clearlake Road
Cocoa, FL 32922-5703

Standard reference number	Title	Referenced in code section number
FSEC-RR-54-00	"The HERS Rating Method and the Derivation of the Normalized Modified Loads Method", October 11, 2000, Fairey, P., J. Tait, D. Goldstein, D. Tracey, M. Holtz, and R. Judkoff. Available online at: http://www2.fsec.ucf.edu/en/publications/html/FSEC-RR-54-00/index.htm	13-613.A.2.1
2008	EnergyGauge USA Fla/Res	13-600.2, 13-600.A.1, 13-600.A.2, 13-601.A, 13-601.A.3, 13-602.A.1, 13-604.A.1, 13-605.A.1, 13-606.A.1, 13-607.A.1, 13-608.A.1, 13-610.A.1, 13-610.A.2, 13-612.A.1, 13-613.A.2 **
2008	EnergyGauge Summit Fla/Com	13-400.0.A, 13-400.2, 13-400.3.AB.1, 13-400.3.AB.2, 13-400.3.A, 13-400.3.B, Table 13-400.3.AB.3, 13-401.A, 13-401.B, 13-402.A, 13-402.B, 13-403.A, 13-403.B, 13-404.AB.1, 13-404.A, 13-404.B, 13-405.A, 13-405.B, 13-407.A, 13-408.A, 13-410.A, 13-412.A, 13-415.A, 13-415.B, 13-415.B.1 **

FTC

U.S. Federal Trade Commission
Sixth Street and Pennsylvania Avenue, N.W.
Washington, DC 20580

Standard reference number	Title	Referenced in code section number
FTC, 16 CFR, Part 460, Amended Effective 4/29/96	FTC Labeling and Advertising of Home Insulation	202, Appendix 13-C C-1.2 *

GAMA

Gas Appliance Manufacturers Association
PO Box 9245
Arlington, VA 22209

Standard reference number	Title	Referenced in code section number
GAMA	Consumers' Directory of Certified Efficiency Ratings for Water Heating Equipment	Table 408.AB.3.2F, Table 608.AB.3.2F, 612.AB.3.5, 612.A.1

HI

Hydronics Institute
P.O. Box 218
Berkeley Heights, NH 07922

Standard reference number	Title	Referenced in code section number
H.I., HBS 86-1989	Testing and Rating Standard for Heating Boilers.	Tables 408.AB.3.2F, 608.AB.3.2F

HUD

U.S. Dept. Housing and Urban Development
451 7th Street S.W.
Washington, DC 20410

Standard reference number	Title	Referenced in code section number
HUD, 24 CFR 3282-3283	Manufactured Home Procedural and Enforcement Regulations	202
HUD, 42 CFR 70, s. 5401 (24 CFR 3280)	Manufactured Home Construction and Safety Standards	202
HUD, 42 USC 77, s. 6295	Energy Conservation Standards	202

ISO

International Standards Organization
1, rue de Varembe, Case postale 56,
CH-1211 Geneve 20, Switzerland

Standard reference number	Title	Referenced in code section number
ISO 9806 (1994, 1995)	Test Methods for Solar Collectors	
	Part 1: Thermal Performance of glazed liquid heating collectors including pressure drop, December 1, 1994.	612.AB.3.4
	Part 2: Qualification test procedures, August 15, 1995.	
	Part 3: Thermal performance of unglazed liquid heating collectors (sensible heat transfer only) including pressure drop, December 15, 1995.	
ISO 13256-1 (1998)	Water-Source Heat Pumps—Testing and Rating for Performance—Part 1 Water-to-Air and Brine-to-Air Heat Pumps	Table 407.AB.3.2B, Table 607.AB.3.2B

NAIMA

North American Insulation Manufacturers Association
44 Canal Center Plaza, Suite 310,
Alexandria, VA 22314

Standard reference number	Title	Referenced in code section number
NAIMA 2002	Fibrous Glass Duct Construction Standards, Fifth Edition.	410.AB.3.2, 610.AB.3.2
NAIMA 2002	Fibrous Glass Duct Liner Standard, Third edition	410.AB.2.5, 610.AB.2.4, 610.AB.3

NEBB

National Environmental Balancing Bureau
8575 Grovemont Circle
Gaithersburg, MD 20877-4121

Standard reference number	Title	Referenced in code section number
NEBB, 2005	Procedural Standards For Testing Adjusting Balancing of Environmental Systems, Seventh Edition.	410.AB.4.3

NEMA

National Electrical Manufacturers Association
1300 N 17th Street, Suite 1847
Rosslyn, VA 22209

Standard reference number	Title	Referenced in code section number
NEMA MG 1-2004	Motors and Generators.	202

NFPA

National Fire Prevention Assoc.
Batterymarch Park
Quincy, MA 02269

Standard reference number	Title	Referenced in code section number
NFPA 96-2004	Ventilation Control and Fire Protection of Commercial Cooking Operations.	407.AB.3.5, 409.AB.3.6.1

NFRC

National Fenestration Rating Council, Inc.
8484 Georgia Avenue, Suite 320
Silver Spring, MD 20910

Standard reference number	Title	Referenced in code section number
NFRC 100-2004	Procedure for Determining Fenestration Product *U*-factors	104.4.5, Appendix 13-B B-2.1, B-2.3, Appendix 13-C2.1, C2.1.1
NFRC 200-2004	Procedure for Determining Fenestration Product Solar Heat Gain Coefficients and Visible Transmitttance at Normal Incidence.	104.4.5, Appendix B B-2.1, B-2.3, Appendix C2.1, C2.1.1
NFRC 300-2004	Standard Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems.	Appendix B B-2.1
NFRC 400-2004	Procedure for Determining Fenestration Product *U*-factorsAir Leakage.	406.AB.1.1

SMACNA

Sheet Metal and Air-Conditioning Contractors' National Association, Inc.
4201 Lafayette Center Dr.
Chantilly, VA 20151-1209

Standard reference number	Title	Referenced in code section number
SMACNA, 1985	HVAC Air Duct Leakage Test Manual.	410.AB.3.1.3, 610.AB.3, 610.AB.3.1.3

SRCC

Solar Rating and Certification Corporation
c/o Florida Solar Energy Center
1679 Clearlake Road
Cocoa, FL 32922-5703

Standard reference number	Title	Referenced in code section number
FSEC	Directory of Certified Solar Systems.	612.AB.3.4
SRCC TM-1	Solar Domestic Hot Water System and Component Test Protocol, December 6, 2002.	612.AB.3.4

UL

Underwriters Laboratory, Inc.
333 Pfingsten Rd.
Northbrook, Il. 60062-2096

Standard reference number	Title	Referenced in code section number
UL 181-05	Standard for Factory-Made Air Ducts and Air Connectors with revisions through December 1998.	410.AB.3.0.7, 410.AB.3.7.1, 610.AB.3, 610.AB.3.0.7, 610.AB.3.7.1

UL—continued

UL 181A-05	Closure Systems for Use With Rigid Air Ducts and Air Connectors, with revisions through December 1998	410.AB.3.0.7, 610.AB.3, 610.AB.3.0.7
UL 181B-05	Closure Systems for Use With Flexible Air Ducts and Air Connectors with revisions through May 2000	410.AB.3.0.7, 610.AB.3, 610.AB.3.0.7
UL 723-03	Standard for Test for Surface Burning Characteristics of Building Materials.	410.AB.3.0.7, 610.AB.3.0.7
UL 727-06	Standard for Oil-Fired Central Furnaces.	Table 408.AB.3.2E, Table 608.AB.3.2E
UL 731-95	Standard for Oil-Fired Unit Heaters, with revisions through January 1999	Table 408.AB.3.2E, Table 608.AB.3.2E

WDMA

Window & 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/NAFS-02	Voluntary Performance Specifications for Windows, Skylights and Glass Doors	606.AB.1.1

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[3]	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.

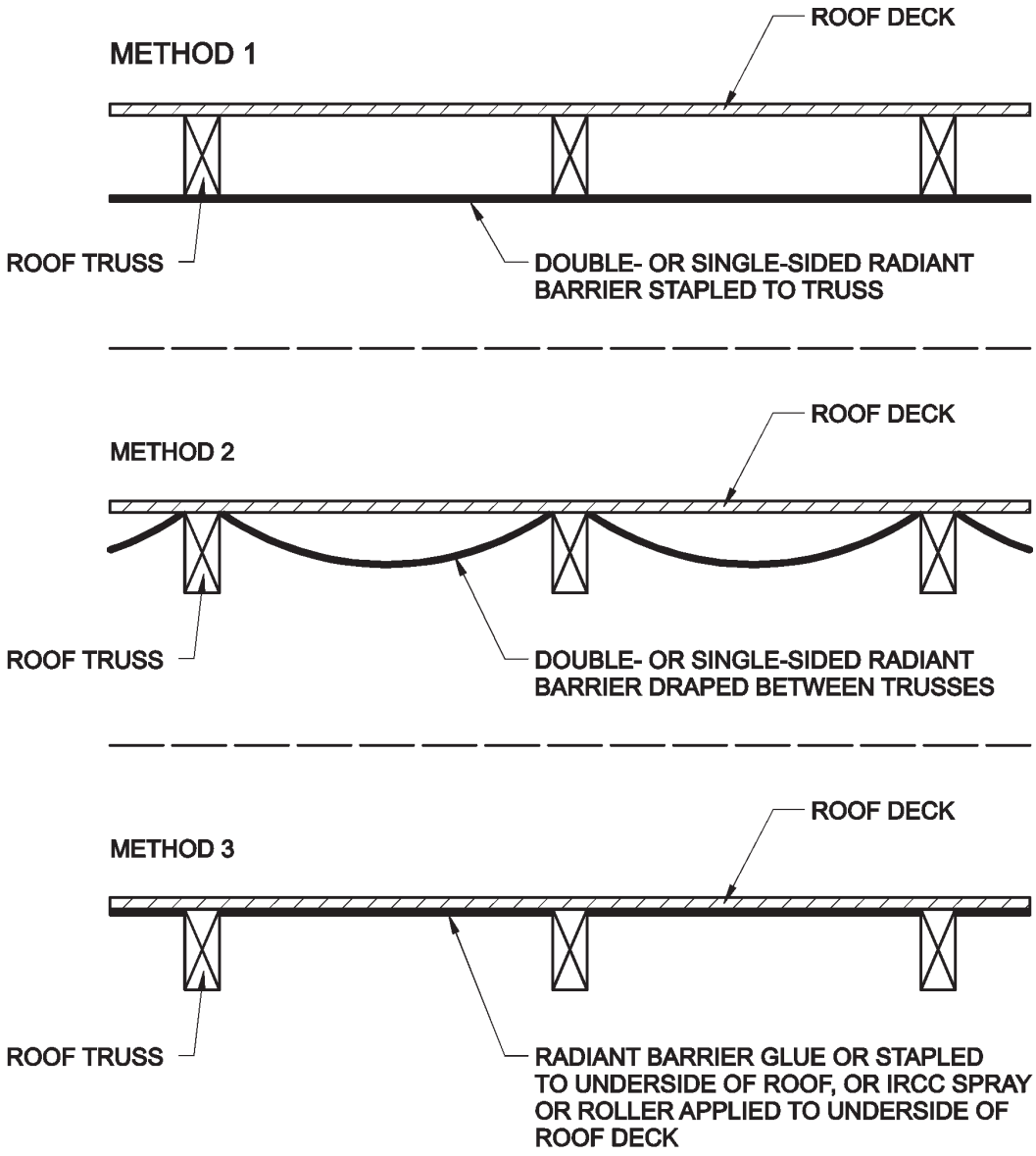


FIGURE 13-604.A.3
ACCEPTABLE ATTIC RADIANT BARRIER CONFIGURATIONS

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.

$$M_i = \frac{M_t - [(R_i - R_t) \times (M_t - M_n)]}{R_n - R_t}$$

(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:

$$PM = A_1 \times SC_o + A_2 \times U_o + A_3 \times (SC_o \times U_o) + A_4 \times SC_o^2 + A_5 \times U_o^2$$

(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:

$$SHGC_t = (A_f \times SHGC_f + A_g \times SHGC_g)/A_w$$

(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:

$$SHGC_f = k \times a \times U_f/h_o$$

(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:

$$SHGC_o = SHGC_t \times ITC$$

(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.

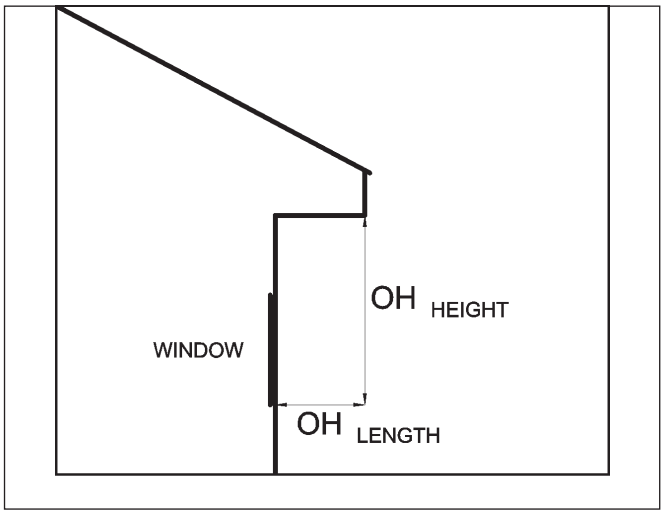


FIGURE 13-2C.2.1.5

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.

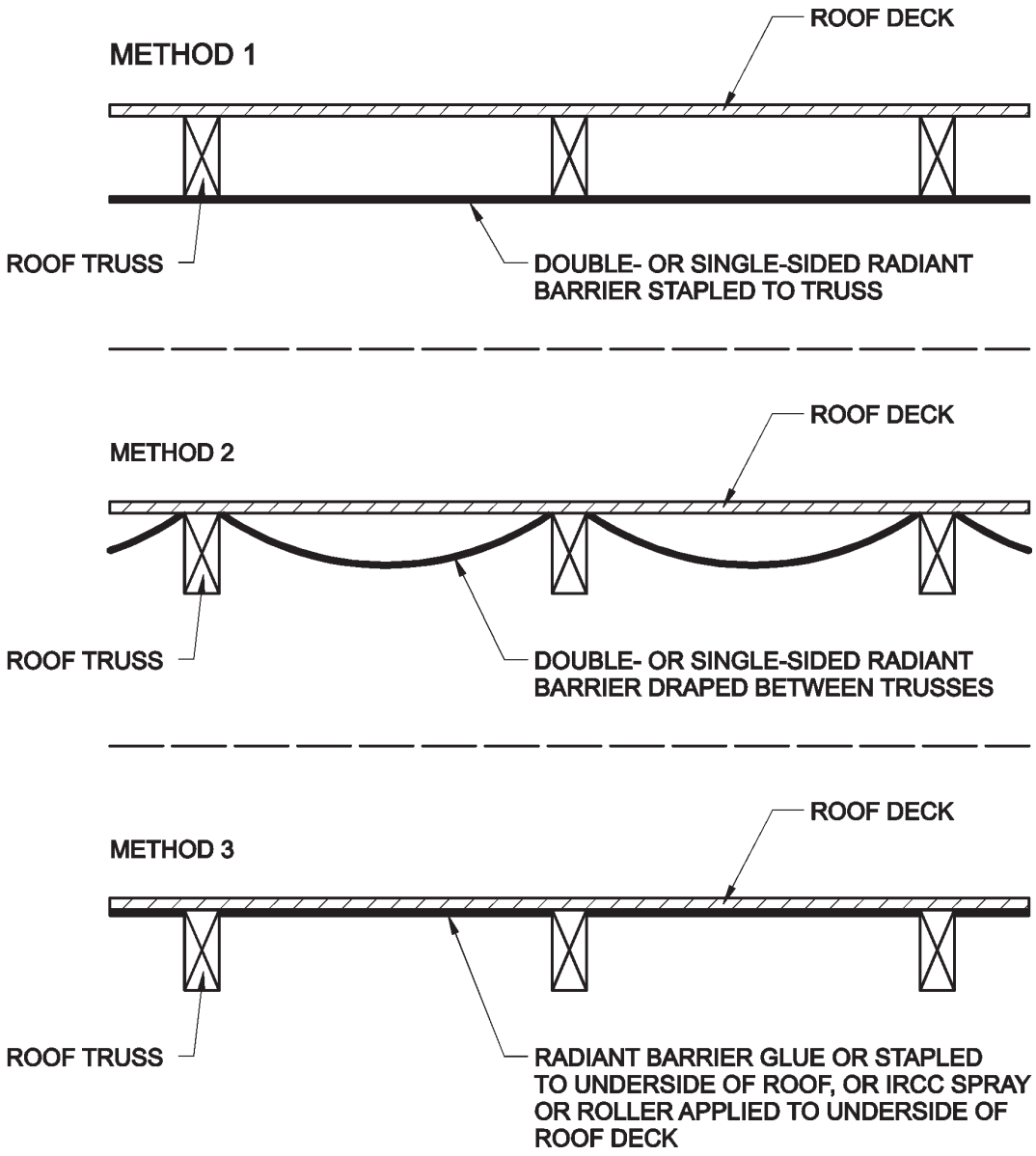


FIGURE 13-2C4.2.1.4
ACCEPTABLE ATTIC RADIANT BARRIER CONFIGURATIONS

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:**	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**		
	a. Heat Recovery (HR)	15a. _____	_____
	b. Dedicated Heat Pump (DHP)	15b. _____	_____
	c. Solar	15c. _____	_____
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.

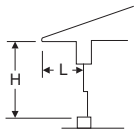
BUILDING OFFICIAL: _____

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 1 2 3

		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			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		

							AS-BUILT GLASS SUBTOTAL
GLASS	.18 X	COND FLOOR AREA	X	WEIGHTED GLASS MULTIPLIER	=	BASE GLASS SUBTOTAL	
	.18			18.59			

	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 ASSEMBLY			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							
COOLING SYSTEM	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
	.325					1.15 or 1.0				
HOT WATER SYSTEM	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		
		2635								

[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

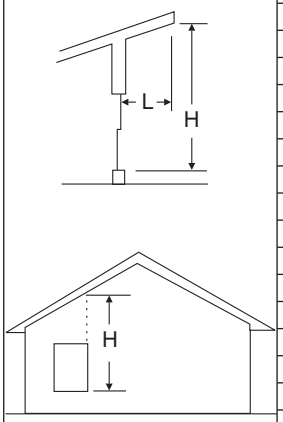
6A-9 COOLING SYSTEM MULTIPLIERS (CSM)

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: _____

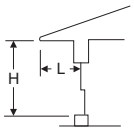
[1] Predominant glass type. For actual glass type and areas, see summer and winter glass output on Pages 2 and 4.

*

SUMMER CALCULATIONS

CLIMATE ZONES 4 5 6

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			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		



OVERHANG RATIO = OH LENGTH / OH HEIGHT

GLASS	.18 X	COND. FLOOR AREA X	WEIGHTED GLASS MULTIPLIER	= BASE GLASS SUBTOTAL	AS-BUILT GLASS SUBTOTAL
	.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 COOL-ING 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	19-25.9	.2	10 & UP	.2	3-6.9	1.1	.8
11-12.9	1.9	.7	3.0	1.0	5-6.9	1.0	.6	.3	26 & UP	.1			7 & UP	.8	.7
13-18.9	1.7	.6	2.8	0.9	7-10.9	.8	.4	.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

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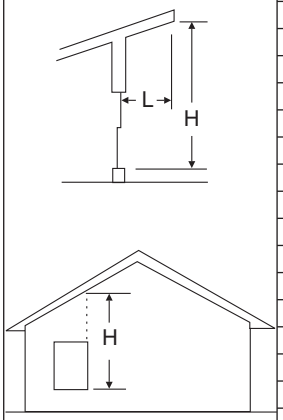
WINTER CALCULATIONS

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	

	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					1.16 or 1.0				

	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)
TOTAL									

[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			
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	*R*-VALUE	EXT	EXT
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	0-2.9	2.2	1.2
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	3-6.9	1.2	.9
13-18.9	1.8	1.6	3.0	2.4	7-10.9	2.3	1.5	1.5	26 & UP	.6			7 & UP	.9	.7
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: _____

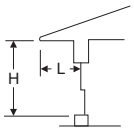
[1] Predominant glass type. For actual glass type and areas, see summer and winter glass output on Pages 2 and 4.

*

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	1.2	1.0
19-25.9	1.6	.6	3.4	1.3	11-18.9	1.0	.6	.3					13 & UP	1.0	.8
26 & UP	1.0	.3	1.9	.7	19-25.9	.5	.3								
					26 & Up	.3	.2								

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

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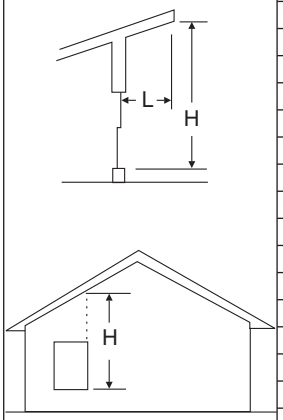
WINTER CALCULATIONS

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	

HEATING SYSTEM	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
	.554					1.14 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 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)			
	WOOD		STEEL			INTERIOR INSULATION		EXT. INSUL.
R-VALUE	EXT	ADJ	EXT	ADJ	*R*-VALUE	EXT	ADJ	EXT
0-6.9	2.5	1.7	3.4	2.2	0-2.9	1.9	.7	1.9
7-10.9	.8	.6	1.5	1.0	3-4.9	1.2	.5	.6
11-12.9	.6	.5	1.1	0.8	5-6.9	.9	.4	.3
13-18.9	.6	.5	1.0	0.7	7-10.9	.7	.4	.2
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	

FACE BRICK				LOG		
R-VALUE	WOOD FR	*R*-VALUE	BLOCK		6 INCH	8 INCH
0-6.9	2.4	0-2.9	.9			
7-10.9	.6	3-6.9	.6	*R*-VALUE	EXT	EXT
11-18.9	.5	7-9.9	.4	0-2.9	.6	.2
19-25.9	.2	10 & UP	.2	3-6.9	.3	.1
26 & UP	.1			7 & UP	.2	.1

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	
R-VALUE	WPM	*R*-VALUE	WPM
19-21.9	.14	10-10.9	.16
22-25.9	.12	11-12.9	.15
26-29.9	.11	13-18.9	.14
30-37.9	.10	19-25.9	.11
38 & UP	.08	26-29.9	.09
RBS Credit	0.850	30 & UP	.08
IRCC Credit	0.899		
White Roof Credit	1.044		

CONCRETE DECK ROOF		
	CEILING TYPE	
R-VALUE	EXPOSED	DROPPED
10-13.9	0.18	0.16
14-20.9	0.13	0.12
21 & UP	0.09	0.08

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

CLIMATE ZONES 7 8 9

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)~~