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* Includes R-3 buildings, as well as R-2 and R-4 buildings three stories or less in height above grade.

INTRODUCTION

Montgomery County has adopted and is currently enforcing the 2006 Edition of the International Residential Code (IRC). IRC allows compliance with either the applicable provisions of the 2006 Edition International Energy Conservation Code (IECC) or Chapter 11 of the IRC. Applicants may evaluate both options and use the one that fits the project best.

Applicability

Existing buildings and historic designated buildings are exempt from these codes. New work in alterations, change of occupancy, renovations or repairs must comply with the requirements of these codes without creating or extending any nonconformity in the existing building related to energy efficiency, including the capacity of the mechanical systems. Unconditioned additions separated from the existing building by building thermal envelope assemblies are exempted from complying with the building envelope requirements. A conditioned addition alone must comply with the code requirements; alternatively, the existing building and addition can comply with code requirements as one building. Section 101.4.3 of IECC lists a few exceptions provided that the energy use of the building is not increased.

Definitions

ABOVE GRADE WALL. A wall more than 50 percent above grade and enclosing conditioned space. This includes between-floor spandrels, peripheral edges of floors, roof and basement knee walls, dormer walls, gable end walls, walls enclosing a mansard roof, and skylight shafts.

BASEMENT WALL. A wall 50 percent or more below grade and enclosing conditioned space.

BUILDING THERMAL ENVELOPE. The basement walls, exterior walls, floor, roof, and any other building element that enclose conditioned space. This boundary also includes the boundary between conditioned space and any exempt or unconditioned space.

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

CONDITIONED SPACE. An area or room within a building being heated or cooled, containing uninsulated ducts, or with a fixed opening directly into an adjacent conditioned space.

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

DEGREE DAY, COOLING. A unit, based on temperature difference and time, used in estimating cooling energy consumption and specifying nominal cooling load of a building in summer. For any one day, when the mean temperature is more than 65°F (18°C), there are as many degree days as there are degrees Fahrenheit (Celsius) difference in temperature between the mean temperature for the day and 65°F (18°C). Annual cooling degree days (CDD) are the sum of the degree days over a calendar year.

DEGREE DAY, HEATING. A unit, based on temperature difference and time, used in estimating cooling energy consumption and specifying nominal heating load of a building in winter. For any one day, when the mean temperature is less than 65°F (18°C), there are as many degree days as there are degrees Fahrenheit (Celsius) difference in temperature between the mean temperature for the day and 65°F (18°C). Annual heating degree days (HDD) are the sum of the degree days over a calendar year.

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

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

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

FENESTRATION. Skylights, roof windows, vertical windows (fixed or moveable), opaque doors, glazed doors, glazed block, and combination opaque/glazed doors. Fenestration includes products with glass and non-glass glazing materials.

MASS WALL. Masonry or concrete walls having a mass greater than or equal to 30 pounds per square foot (146 kg/m²), solid wood having a mass greater than or equal to 20 pounds per square foot (98 kg/m²), and any other walls having a heat capacity greater than or equal to 6 Btu/ft²·°F [266 J/(m²·K)].

PROPOSED DESIGN. A description of the proposed building used to estimate annual energy use for determining compliance based on total building performance.

R-VALUE (THERMAL RESISTANCE). The inverse of the time rate of heat flow through a body from one of its bounding surfaces to the other surface for a unit temperature difference between the two surfaces, under steady state conditions, per unit area (h ft²·°F/Btu) [(m²·K)/W].

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

SKYLIGHT. Glass or other transparent or translucent glazing material installed at a slope of 15 degrees (0.26 rad) or more from vertical. Glazing material in skylights, including unit skylights, solariums, sunrooms, roofs and sloped walls is included in this definition.

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

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

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

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

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

U-FACTOR (THERMAL TRANSMITTANCE). The coefficient of heat transmission (air to air) through a building component or assembly, equal to the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/h ft²·°F) [W/(m²·K)].

Montgomery County Climate Zone

The code establishes many requirements such as wall and roof insulation *R*-values, window and door thermal *U*-factors as well as provisions that affect the mechanical systems based upon the climate where the building is located. Montgomery County is in Climate Zone 4. The table below represents the thermal criteria for Montgomery County:

Climate Zone/Major Climate	Thermal Criteria	
	IP Units	SI Units
4A/Mixed-Humid	CDD50 °F ≤4500 and HDD65 °F ≤5400	CDD10 °C ≤2500 and HDD18 °C 3000

For SI: °C = [°F-32]/1.8

Methods of Compliance

The codes address the design of energy-efficient building envelope (consisting of roof/ceiling, walls, floors, foundation assemblies that surround the conditioned space) and the selection and installation of energy efficient mechanical and service water heating. The building envelope requirements are addressing insulation, fenestration, air leakage, and moisture control requirements.

There are several methods of achieving compliance with the energy conservation provisions of IECC and IRC. For the purpose of this manual, three methods are offered: two prescriptive methods (Methods 1 and 2) and a performance method (Method 3).

Prescriptive Component Methods

These two methods address only building envelope performance and equipment efficiencies (see minimum equipment efficiency below). Methods 1 and 2 allow the builder to select between two different approaches in complying with specific insulation and fenestration requirements based on climate zone. The builder is required to meet or exceed the prescribed requirements.

Method 1

The simplest and the most direct, requires compliance with the section 402.1.2 of IECC and section N1102.1.1 of IRC for R-values (page 7) and section 402.1.3 of IECC and section N1102.1.2 of IRC for U-factor alternative (page 8).

Method 2, Total UA Alternative or building envelope trade-off approach (page 11)

It offers more flexibility than Method 1 and requires compliance on a component by component basis with section 402.1.4 of IECC and section N1102.1.3 of IRC. This method permits the use of REScheck™ computer software to indicate compliance.

To obtain a “short form” indicating compliance with Method 1 based on R-values, click [here](#)

Performance Method

Method 3

Also known as Simulated Performance Alternative offers greatest flexibility and requires compliance with IECC section 404. This method is the most complex and requires that predicted annual energy use of a proposed design is less than or equal to annual energy use of the same home if it has been built to meet the prescriptive criteria in sections 402 and 403 of 2006 IECC (standard design).

The air leakage, moisture control, and systems (mechanical and service water heating) requirements found in sections 402.4, 402.5, 402.6, 403 of IECC and sections N1102.4, N 1102.5, N 1102.5.1, N1103 of IRC are mandatory requirements for all methods.

Mandatory Requirements for ALL Methods

Air Leakage

To be effective, the building thermal envelope seal must be impermeable to air flow, continuous over the entire building envelope, able to withstand the forces that may act on it during and after construction and durable over the expected lifetime of the building. Sections 402.4 of IECC and N1102.4 of IRC contain the provisions for preventing air leakage in the building envelope, fenestration, and around recessed lighting installed in the building envelope.

Moisture control

Section 402.5 of IECC and section N 1102.5 of IRC require installation of vapor retarders in all unventilated framed ceilings, walls and floors to avoid creating conditions of accelerated deterioration from condensation. Unventilated areas are framed cavities without vents or other openings that allow significant amounts of air to move freely through the cavity and insulation.

MAXIMUM FENESTRATION U-FACTOR AND SHGC. The area weighted maximum fenestration U-factor permitted using trade-offs from section 402.1.4 of IECC and section N 1102.5.1 of IRC (Method 2) or section 404 of IECC and section N 1102.5.1 of IRC (Method 3) shall be 0.48 and 0.75 for skylights.

SYSTEMS (HEATING AND COOLING & SERVICE WATER HEATING)

MINIMUM EQUIPMENT EFFICIENCY

New Heating and Air Conditioning Appliances must comply with prevailing Department of Energy (DOE) minimum efficiency (78% and 13 SEER).

Heating and Cooling Equipment

Controls. Each separate space conditioning system shall have a control (Section 403.1 of IECC or N1103.1 of IRC) Special thermostat is required for heat pump systems (Section 403.1.1 of IECC or N1103.1.1 of IRC)

Duct Insulation. Supply and return ducts located outside the thermal building envelope shall be insulated to an R-8. Ducts in floor trusses can be insulated to an R-6 (Section 403.2 of IECC or N1103.2 of IRC)

Duct Sealing. All ducts, air handlers, filter boxes, and building cavities must be sealed (Section 403.2.2 IECC and section N1103.2.2 of IRC). Joints and seams shall comply with and M1601.3.1 IRC.

Mechanical System Piping Insulation. R-2 for piping carrying fluids at > 105 °F or < 55°F is required (Section 403.3 of IECC and N1103.3 of IRC)

Mechanical Ventilation. Outdoor air intakes or exhausts shall have dampers (Section 403.5 of IECC and N1103.5 of IRC)

Service Water Heating

Piping in the circulating hot water system shall be insulated to an R-2 and system to include manual or automatic switch that can turn off the system when it is not used (Section 403.4 of IECC and N1103.4 of IRC). Water heaters with pipe risers shall have heat traps on both inlet and outlet of water heater unless the water heater has integral heat traps or is part of a circulation system. Typical methods used for creating heat traps are “U” or “rams horn” bends in the flexible pipe connectors or installing aftermarket pipe nipples with integral traps.

EQUIPMENT SIZING

Heating and cooling equipment shall be sized based on building loads calculated in accordance with ACCA (Air Conditioning Contractors of America) Manual-J, a simplified method of calculating heating and cooling loads. The Manual-J calculations must be submitted upon application for the mechanical permit only.

Section 302.1 of IECC specifies the interior design temperatures used for heating and cooling load calculations as maximum of 72°F (22°C) for heating and minimum of 75°F (24°C) for cooling.

Compliance Forms

Method 1

**COMPLIANCE WITH PRESCRIPTIVE COMPONENT
REQUIREMENTS**

**Based on R-Values
or
Based on U-factors**

PRESCRIPTIVE Requirements WORKSHEET (U-factors)

Applicant Name _____ Date _____
 Applicant Address _____
 Phone Number _____
 Building Address _____ Permit (A/P) # _____

Criteria	Required	Provided	Assembly Description
Fenestration	.40		
Skylight	.60		
Ceilings	.030		
Frame Wall	.082		
Mass Wall	.141		
Floor	.047		
Basement Wall	.059		
Crawl Space Wall	.065		

GLAZING U-FACTORS must be tested and documented by the manufacturer in accordance with the National Fenestration Rating Council (NFRC) test procedure or taken from the Default Tables 102.1.3(1)>(3) in the 2006 IECC, Chapter 4. Nonfenestration U-factors must be determined from measurement, calculation, or approved sources for each component

I hereby certify that the building design represented in the attached construction documents has been designed to meet the requirements of:

- 2006 Edition International Energy Conservation Code (IECC) or
- Chapter 11 of the 2006 Edition of the International Residential Code (IRC)

 Builder/Designer/Contractor

 Company Name

 Date

OTHER SPECIFIC REQUIREMENTS

INSULATION (Section 402.2 of IECC AND SECTION N1102.2 OF IRC)

Ceilings with attic spaces. Where R-38 Ceiling insulation is required R-30 shall be deemed to satisfy the requirement for R-38 wherever the full height of uncompressed R-30 insulation extends over the wall top plate at the eaves. Ceiling R-values represent the sum of cavity insulation plus insulating sheathing (if used). For ventilated ceilings, insulating sheathing must be placed between the conditioned space and the ventilated portion of the roof.

Ceilings without attic spaces. Where R-38 is required and the roof/ceiling assembly does not allow sufficient space for required insulation, the minimum required insulation shall be R-30. (Limited to 500 ft²).

Mass Walls. The provisions of section 402.1.1 of IECC and section N 1102.2.3 of IRC for mass walls shall be applicable when at least 50 percent of the required insulation R-value is on the exterior of, or integral to, the wall. Walls that do not meet this criterion for insulation placement shall meet the wood frame wall insulation requirements of section 402.1.1 of IECC and section N 1102.2.3 of IRC.

Steel-frame ceilings, walls and floors. Section 402.2.4 of IECC and section N 1102.2.4 of IRC requires steel- frame ceilings, walls and floors to meet the insulation requirements of Table 402.2.4 or shall meet the U-factor requirements in Table 402.1.3 of IECC. The calculation of the U-factor for a steel-frame envelope assembly shall use a series-parallel path calculation method.

Floors. Floors that are a part of the building thermal envelope, such as those over a crawl space or an unconditioned garage are required to meet or exceed the floor R-value requirements listed in Table 402.1.1 of IECC.

Basement Walls. Walls associated with conditioned basements shall be insulated from the top of the basement wall down to 10 feet (3048 mm) below grade or to the basement floor, whichever is less. Walls associated with unconditioned basements shall meet this requirement unless the floor overhead is insulated in accordance with sections 402.1.1 and 402.2.5 of IECC or sections N1102.1 and N1102.2.5 of IRC.

Slab-on-grade Floors with floor surface less than 12" below grade shall be insulated in accordance with Table 402.1.1.

Crawl space walls. As an alternative to insulating floors over crawlspace walls, crawl space walls shall be permitted to be insulated when the crawl space is not vented to the outside. Crawlspace wall insulation shall be permanently fastened to the wall and extend downward from the floor to the finished grade level and then vertically and/or horizontally for at least an additional 24". Exposed earth in unvented crawlspace foundations shall be covered with a continuous vapor retarder. Lap vapor barrier joints 6" minimum and seal or tape.

Masonry veneer. Insulation shall not be required on the horizontal portion of the foundation supporting brick veneer.

Thermally isolated sunroom insulation. The minimum ceiling insulation R- values shall be R-19 and R-13 for walls.

FENESTRATION (Section 402.3 of IECC AND SECTION N 1102.3 OF IRC)

U-Factor. An area weighted average of fenestration products shall be permitted to satisfy U-Factor requirements.

Glazed fenestration SHGC. An area-weighted average of fenestration products more than 50 percent glazed shall be permitted to satisfy the SHGC requirements.

Glazed fenestration exemption. Up to 15 square feet of glazed fenestration per dwelling shall be exempt from the U-Factor requirements in section 402.1.1 of IECC and section N 1102.3.3 of IRC.

Opaque door exemption. One opaque door assembly exempted from the U-factor requirement in section 402.1.1 of IECC and section N 1102.3.4 of IRC.

Thermally isolated sunroom U-factor. The maximum fenestration U factor shall be 0.5 and the maximum skylight U-factor shall be 0.75. New windows and doors separating the sunroom from the conditioned space shall meet the building thermal envelope requirements.

Replacement fenestration. Where some or all of an existing fenestration unit is replaced with new fenestration including sash and glazing, the replacement fenestration shall meet the requirements for U-factor.

Method 2

**COMPLIANCE WITH PRESCRIPTIVE COMPONENT
REQUIREMENTS**

**TOTAL UA ALTERNATIVE
or
BUILDING ENVELOPE TRADE-OFF APPROACH**

Method 2 – Total UA Alternative Worksheet

Applicant Name _____ Date _____
 Applicant Address _____
 Phone Number _____
 Building Address _____ Permit (A/P) # _____

EXTERIOR WALL ASSEMBLY

Component	Description	R-Value	U-Factor U=1/R	Area (ft ²)	AxU
Wall 1					
Wall 2					
Ceiling 1					
Ceiling 2					
Door 1					
Door 2					
Other					
Total					
Uo	Overall Uo for exterior wall = (AxU) total ÷ A total	Uo			

Meets Code Does not meet code

FLOOR ASSEMBLY

Component	Description	R-Value	U-Factor U=1/R	Area (ft ²)	AxU
Floor 1					
Floor 2					
Other					
Total					
Uo	Overall Uo for floor assembly = (AxU) total ÷ A total	Uo			

Meets Code Does not meet code

ROOF/CEILING ASSEMBLY

Component	Description	R-Value	U-Factor U=1/R	Area (ft ²)	AxU
Ceiling 1					
Ceiling 2					
Other					
Total					
Uo	Overall Uo for Roof/Ceiling assembly = (AxU) total ÷ A total	Uo			

Meets Code Does not meet code

BASEMENT WALL ASSEMBLY

Component	Description	R-Value	U-Factor U=1/R	Area (ft ²)	AxU
Basement Wall					

- Meets Code
 Does not meet code

CRAWLSPACE WALL ASSEMBLY					
Component	Description	R-Value	U-Factor U=1/R	Area (ft ²)	AxU
Crawlspace Wall					

- Meets Code
 Does not meet code

OVERALL ENVELOPE CONFORMANCE					
Assembly	U _o	U _{required}	TOTAL AREA	AxU _o	AxU _{required}
Exterior wall					
Floor					
Roof/Ceiling					
Total (AxU _o)					
Total (AxU _{required})					

If the Total AxU_o is less than the Total AxU_{required} the building complies with the IECC even though the individual components do not. Basement and crawl space walls must meet the requirements of the basic requirement table above.

The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials.

I hereby certify that the building design represented in the attached construction documents has been designed to meet the requirements of:

- 2006 Edition International Energy Conservation Code (IECC) or
 Chapter 11 of the 2006 Edition of the International Residential Code (IRC)

Builder/Designer/Contractor

Company Name

Date

REScheck™

Montgomery County accepts REScheck™ program as a tool for energy code compliance. The REScheck™ program can be downloaded at www.energycodes.gov. An online version of REScheck™ (REScheck Web) can be utilized without having to download or install any software on your computer. A Montgomery County approved report can be printed after entering required information. Before printing the report choose the correct code approved by Montgomery County (2006 IECC) and then print.

Method 3

COMPLIANCE WITH PERFORMANCE REQUIREMENTS

SIMULATED PERFORMANCE ALTERNATIVE

Section 404 of IECC includes a performance-based compliance path, which allows users to perform an energy analysis and demonstrate compliance based on equivalence with the prescriptive requirements. To perform these analyses, users must select appropriate weather data for their project's location. The selection of appropriate weather data is straightforward for any project located in or around one of the various weather stations within the United States.

Plan Submittal Requirements

When applying to the county for a building permit, please ensure construction documents, including plans, comply with the plan submittal guidelines for single family dwellings, [click here](#) or additions/alterations [click here](#)

Method 1

1. The exact location of the building thermal envelope shall be marked out on the plans, details, and cross-sections.
2. Provide all insulation R values, materials, and locations to be installed (walls, ceilings, cantilever floors, floors over garage, crawl space, basement walls, etc.).
2. Provide all fenestration U factors for all glazing for each window and door.
3. Provide details on how all areas listed in Section N1102.4.1 will be protected against air leakage.
4. Show all details and locations of vapor retarders (moisture control).
5. Indicate duct insulation R-values.
6. Indicate duct sealing methods.

The information required in points 1 and 2 can be summarized on worksheets located on page 7 for R-values or on page 8 for U-factors and the rest can be captured as on the drawings, in schedules, notes, and other supplementary worksheets or calculations.

When a mechanical permit is required for installation or replacement of HVAC equipment, the applicant for mechanical permit must provide the ACCA Manual J 8th edition calculation package for the HVAC Equipment Sizing.

Method 2

Provide all information as outlined in points 1 to 6 of Method 1. The worksheet starting on page 12 can be used to show compliance.

Alternately, provide a copy of the REScheck calculations. The submitted REScheck printout shall show all of the following specific information: orientation of each individual wall; insulation types, R-values, and whether continuous or cavity; accurate square footage; and accurate window and door sizes and the specific wall in which they are located, along with the U factor and SHGC factor (solar heat gain coefficient) for this glazing.

Builders who have model house plans shall provide the worst case orientation for the REScheck (based on the orientation of the exterior walls). Subsequent submissions will indicate if each proposed building exceeds the worst case scenario or new REScheck calculations shall be provided with the application.

Method 3

The permit applicant shall submit documentation signed and sealed by a licensed design professional registered in Maryland, including

1. Address of residence.
2. Inspection checklist documenting the building component characteristics of the proposed design, see Table 404.5.2(1) of IECC.
3. Accurate square footage
4. Mechanical system features.
5. Name of individual completing report.
6. Name and version of the compliance software tool.
7. Name of individual who will do the field inspections and issue the final rating.

Inspection Requirements

A permanent certificate shall be posted on the electrical distribution panel. The certificate shall be completed by the builder or registered design professional. The certificate shall list the predominant R-Values of the insulation installed in or on ceiling/roof, walls, foundation (slab, basement wall, crawlspace wall, and/or floor) and ducts outside conditioned spaces; U-factors for fenestration; and the solar heat gain coefficient (SHGC) of fenestration. Where there is more than one value for each component, the certificate shall list the value covering the largest area. The certificate shall list the type and efficiency of the heating, cooling and service water heating equipment.

A copy of an acceptable form for the certificate, <http://www.iccsafe.org/images/ps/0726SX1.pdf>, can be purchased at <http://www.iccsafe.org>

Inspectors will not approve the final inspection when an adequate completed certificate is not posted.