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BULLETIN NO. 07-2

BULLETIN

Date: **February 2007**
Supersedes Bulletin No. 03-2
Code Ref. Update: **November 2007**

Subject: **Energy Code Compliance and Residential Prescriptive Packages**

Reference: **N.J.A.C. 5:23-2.15(f)1.vi**
N.J.A.C. 5:23-3.18

The Energy Subcode requires applicants to show compliance as part of the permit application process; this must be done for all heated or cooled buildings. Compliance methods vary dependent on building type. The Energy Subcode defines two classifications of building type: low-rise residential and commercial (which includes all buildings that are not low-rise residential).

Low-rise residential buildings are defined as one- and two-family dwellings or multiple-family buildings three stories or less in height. Compliance for these buildings must be demonstrated in one of four ways [compliance is in accordance with the Energy Subcode and the 2006 International Energy Conservation Code (IECC)]:

1. COMPLIANCE WITH CALCULATIONS: This has been the traditional way that compliance with energy codes has been shown. It involves calculating the "U" value (thermal transmittance) of the various building components (walls, floors, roofs, etc.) and showing that they are less than the code-specified maximum for the components. Guidance on how to perform the calculations can be found in the American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc. (ASHRAE) Handbook of Fundamentals.

2. COMPLIANCE WITH RES*CHECK* SOFTWARE: The software program performs the calculations based on input about the shape and size of the building, and the type of insulation and the type of equipment that the applicant proposes to use. The software is available for free download from the web site: http://www.energycodes.gov. The **2003 IECC** version of the software should be used, rather than the 2006 IECC version. (The 2003 IECC can be selected under "Code" in the menu bar at top.) The software simply requires that you input the areas of the various components, the R value of insulation, and the U value of windows. The software automatically gives tradeoffs. A compliance report is generated by the software program, which can be submitted with the permit application. To be deemed to comply with New Jersey's requirements, the compliance report should exceed the 2003 IECC by **two percent** or more.

The following are the municipalities to be used in the software:

Climate Zone (HDD)	County	Applicable RES*check* Municipality
4500-4999	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Salem	Audubon, NJ
5000-5499	Essex, Hudson, Mercer, Middlesex, Monmouth, Ocean, Union	Lakewood, NJ
5500-5999	Bergen, Hunterdon, Morris, Passaic, Somerset	Maplewood, NJ
6000-6499	Sussex, Warren	Hackettstown, NJ

The above-named municipalities are to be used as a proxy for the climate zone. This will ensure that the software program has the correct climate data for the calculations. The applicant should simply indicate the actual municipality in the "Notes" section of the software in the "Project" tab.

Under the Energy Subcode, applicants are allowed to trade off high-efficiency heating equipment for basement wall insulation. The software allows for the tradeoff. If you are using the tradeoff, do not enter an area for the basement "box" (i.e., walls and ceiling) and do not enter the high-efficiency equipment in the mechanical section. When submitting the printout for the program, the applicant should simply indicate that the tradeoff is being used and that high-efficiency mechanical equipment will be provided throughout the building, and give the specifications (including the efficiency rating) for the equipment to be used. (This tradeoff does not apply to basements above grade.)

3. Compliance with NJ Energy Star Homes: This program is sponsored by the New Jersey Board of Public Utilities through its Clean Energy Program (http://www.njenergystarhomes.com). The program provides incentives for projects that exceed the Energy Subcode. A letter of enrollment (typically the "builder's acknowledgement" letter) from the local utility company (or its consultant) should be submitted with the permit application if the applicant is choosing this compliance option. Inspections for this program are handled by the utility company or its consultant. Upon application for a new home's Certificate of Occupancy, the Home Energy Rating Scale certificate or equivalent (i.e., passing final inspection report) should be submitted.

4. Compliance with Prescriptive Packages: Included in this bulletin are tables that correspond to the four heating degree-day zones in the State. Heating degree-day zones are: 4,500-4,999 for Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, and Salem Counties; 5,000-5,499 for Essex, Hudson, Mercer, Middlesex, Monmouth, Ocean, and Union Counties; 5,500-5,999 for Bergen, Hunterdon, Morris, Passaic, and Somerset Counties; 6,000-6,499 for Sussex and Warren Counties. For each degree-day zone, there is a table for single-family dwellings and a table for multiple-family dwellings. Each

table lists several different combinations of wall insulation, floor insulation, percentage and efficiency of glazing, etc. Applicants are permitted to use one of these packages to show compliance with the code. The applicant need only identify the package that was chosen and show details that correspond to that package on the plans. If a proposed building has window percentages and U values (a measure of the windows' efficiency) that are equal to or lower than the values found on the line in the appropriate chart, and R values and equipment efficiencies that are equal to or higher than those listed in the chart, the building complies.

Applicants may also apply the high-efficiency heating equipment tradeoff for basement wall insulation when using the Prescriptive Packages (see Footnotes). If using the tradeoff, disregard the "basement wall" R value and, for the floor area above the basement, disregard the "floor" R value. When identifying the Prescriptive Package as stated above, the applicant should simply indicate that the tradeoff is being used and that high-efficiency mechanical equipment will be provided throughout the building, and give the specifications (including the efficiency rating) for the equipment to be used. (This tradeoff does not apply to basements above grade.)

Note: The Prescriptive Packages are intended to be used with wood framing. If an applicant chooses to use steel framing or high-mass walls, refer to the pages that follow the Prescriptive Packages for R value and U value equivalents for other than wood framing.

Commercial buildings are defined as all buildings other than low-rise residential buildings and must demonstrate compliance by one of two ways (compliance is in accordance with the Energy Subcode and 2004 ASHRAE Standard 90.1):

1. COMPLIANCE WITH CALCULATIONS: This is very much like the calculations for low-rise residential buildings mentioned above. However, the applicant must also provide information on the type of lighting installed and its usage.

2. COMPLIANCE WITH COM*CHECK* SOFTWARE: This is very much like the RES*check* software mentioned above. However, the applicant must include the type of lighting installed and its usage. The software is available for free download from the web site: http://www.energycodes.gov. The 2004 ASHRAE Standard 90.1 version of the software should be used. (The 2004 ASHRAE can be selected under "Code" in the menu bar at top.) The compliance report should meet or exceed the 2004 ASHRAE. Municipalities should be chosen as per the software program, except that applicants constructing buildings in **Mercer County** should choose "Bordentown, NJ" and indicate the actual municipality in the "Notes" section of the software in the "Project" tab.

Insulation -- With the exception of those homes that are enrolled in the NJ Energy Star Homes Program (where compliance is verified by a third party), inspectors should verify that the insulation levels installed in all buildings match the insulation levels used in the calculations, found in the RES*check* or COM*check* printout, or shown in the Prescriptive Package table, as applicable. Lastly, other Energy Subcode requirements, such as piping and ductwork insulation, are still applicable.

2006 IECC Prescriptive Packages

Detached One- and Two-Family Dwellings @ Heating Degree Days 4500-4999								
		Maximum	Minimum					
Prescriptive Package	Percentage Glazing[1]	Glazing U-factor[2]	Ceiling R-value[3]	Exterior wall R-value[4]	Floor R-value[5,6]	Basement wall R-value[6,7]	Slab perimeter R-value and depth[8]	Crawl space wall R-value[9]
1	8%	0.55	R-30	R-13	R-15	R-8	R-2, 2 ft	R-12
2	12%	0.50	R-38	R-14	R-19	R-9	R-5, 2 ft	R-16
3	15%	0.45	R-38	R-16	R-19	R-9	R-6, 2 ft	R-17
4	18%	0.37	R-38	R-15	R-19	R-9	R-6, 2 ft	R-16
5	20%	0.37	R-38	R-16	R-19	R-9	R-6, 2 ft	R-16
6	25%	0.33	R-38	R-19	R-19	R-9	R-6, 2 ft	R-17

Detached One- and Two-Family Dwellings @ Heating Degree Days 5000-5499								
		Maximum	Minimum					
Prescriptive Package	Percentage Glazing[1]	Glazing U-factor[2]	Ceiling R-value[3]	Exterior wall R-value[4]	Floor R-value[5,6]	Basement wall R-value[6,7]	Slab perimeter R-value and depth[8]	Crawl space wall R-value[9]
1	8%	0.52	R-30	R-13	R-19	R-9	R-7, 2 ft	R-16
2	12%	0.45	R-38	R-16	R-19	R-9	R-6, 2 ft	R-16
3	15%	0.45	R-38	R-18	R-19	R-9	R-6, 2 ft	R-17
4	18%	0.37	R-38	R-16	R-19	R-9	R-7, 2 ft	R-17
5	20%	0.36	R-38	R-19	R-19	R-9	R-6, 2 ft	R-16
6	25%	0.29	R-38	R-19	R-19	R-9	R-6, 2 ft	R-17

Detached One- and Two-Family Dwellings @ Heating Degree Days 5500-5999								
		Maximum	Minimum					
Prescriptive Package	Percentage Glazing[1]	Glazing U-factor[2]	Ceiling R-value[3]	Exterior wall R-value[4]	Floor R-value[5,6]	Basement wall R-value[6,7]	Slab perimeter R-value and depth[8]	Crawl space wall R-value[9]
1	8%	0.45	R-38	R-13	R-19	R-9	R-7, 2 ft	R-16
2	12%	0.45	R-38	R-17	R-19	R-9	R-6, 2 ft	R-16
3	15%	0.40	R-38	R-18	R-21	R-10	R-9, 2 ft	R-19
4	18%	0.37	R-38	R-19	R-19	R-10	R-8, 2 ft	R-17
5	20%	0.33	R-49	R-20	R-19	R-10	R-7, 2 ft	R-17
6	25%	0.27	R-38	R-19	R-21	R-10	R-9, 2 ft	R-22

Detached One- and Two-Family Dwellings @ Heating Degree Days 6000-6499								
		Maximum	Minimum					
Prescriptive Package	Percentage Glazing[1]	Glazing U-factor[2]	Ceiling R-value[3]	Exterior wall R-value[4]	Floor R-value[5,6]	Basement wall R-value[6,7]	Slab perimeter R-value and depth[8]	Crawl space wall R-value[9]
1	8%	0.45	R-38	R-16	R-19	R-10	R-7, 4 ft	R-16
2	12%	0.40	R-38	R-18	R-19	R-10	R-6, 4 ft	R-16
3	15%	0.35	R-38	R-18	R-21	R-10	R-9, 4 ft	R-20
4	18%	0.34	R-49	R-22	R-19	R-10	R-8, 4 ft	R-17
5	20%	0.31	R-49	R-24	R-19	R-10	R-7, 4 ft	R-17
6	25%	0.25	R-49	R-19	R-21	R-10	R-9, 4 ft	R-20

2006 IECC Prescriptive Packages

Multiple-Family Dwellings 3 stories or less @ Heating Degree Days 4500-4999								
		Maximum	Minimum					
Prescriptive Package	Percentage Glazing[1]	Glazing U-factor[2]	Ceiling R-value[3]	Exterior wall R-value[4]	Floor R-value[5,6]	Basement wall R-value[6,7]	Slab perimeter R-value and depth[8]	Crawl space wall R-value[9]
1	20%	0.50	R-26	R-11	R-13	R-6	R-0	R-7
2	25%	0.53	R-30	R-13	R-11	R-5	R-0	R-6
3	30%	0.45	R-38	R-13	R-19	R-9	R-6, 2 ft	R-15

Multiple-Family Dwellings 3 stories or less @ Heating Degree Days 5000-5499								
		Maximum	Minimum					
Prescriptive Package	Percentage Glazing[1]	Glazing U-factor[2]	Ceiling R-value[3]	Exterior wall R-value[4]	Floor R-value[5,6]	Basement wall R-value[6,7]	Slab perimeter R-value and depth[8]	Crawl space wall R-value[9]
1	20%	0.50	R-26	R-13	R-11	R-5	R-0	R-6
2	25%	0.52	R-30	R-13	R-11	R-5	R-0	R-6
3	30%	0.45	R-38	R-13	R-19	R-10	R-8, 2 ft	R-18

Multiple-Family Dwellings 3 stories or less @ Heating Degree Days 5500-5999								
		Maximum	Minimum					
Prescriptive Package	Percentage Glazing[1]	Glazing U-factor[2]	Ceiling R-value[3]	Exterior wall R-value[4]	Floor R-value[5,6]	Basement wall R-value[6,7]	Slab perimeter R-value and depth[8]	Crawl space wall R-value[9]
1	20%	0.50	R-30	R-13	R-11	R-5	R-0	R-6
2	25%	0.51	R-30	R-13	R-11	R-6	R-0	R-6
3	30%	0.44	R-38	R-13	R-19	R-10	R-8, 2 ft	R-18

Multiple-Family Dwellings 3 stories or less @ Heating Degree Days 6000-6499								
		Maximum	Minimum					
Prescriptive Package	Percentage Glazing[1]	Glazing U-factor[2]	Ceiling R-value[3]	Exterior wall R-value[4]	Floor R-value[5,6]	Basement wall R-value[6,7]	Slab perimeter R-value and depth[8]	Crawl space wall R-value[9]
1	20%	0.50	R-26	R-13	R-19	R-9	R-5, 4 ft	R-14
2	25%	0.51	R-30	R-13	R-19	R-10	R-7, 4 ft	R-16
3	30%	0.44	R-38	R-19	R-19	R-10	R-8, 4 ft	R-18

Prescriptive Package Footnotes

1. Glazing area is the ratio of the area of the glazing assemblies (including sliding glass doors, skylights, and basement windows, but excluding opaque doors) to the gross wall area, expressed as a percentage. Up to 1% of the total glazing area may be excluded from the U-value requirement. For example, three ft^2 of decorative glass may be excluded from a building with 300 ft^2 of glazing area.

2. Glazing U-values must be tested and documented by the manufacturer, in accordance with the National Fenestration Rating Council (NFRC) test procedure. Center-of-glass U-values cannot be used.

3. The ceiling R-values do not assume a raised or oversized truss construction. If the insulation achieves the full insulation thickness over the exterior walls, R-30 insulation may be substituted for R-38 and R-38 may be used where R-49 is required. 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.

4. Wall R-values represent the sum of the wall cavity insulation plus the insulating sheathing (if used). Do not include exterior siding, structural sheathing, and interior drywall. For example, an R-19 requirement could be met EITHER by R-19 cavity insulation OR R-13 cavity insulation plus R-6 insulating sheathing. Wall requirements apply to wood-frame or mass (concrete, masonry, log) wall construction, but do not apply to metal-frame construction.

5. The floor requirements apply to floors over unconditioned spaces (such as unconditioned crawl spaces, basements, or garages). Floors over outside air must meet the ceiling requirements.

6. Residential buildings provided with high-efficiency heating equipment (90% AFUE for furnaces, 85% AFUE for boilers, or 8.0 HSPF for air-source heat pumps) shall be exempt from the requirement to insulate basement walls (R-0), including the requirement for floor insulation above basements. All heating equipment installed must meet or exceed the high-efficiency requirements to comply with this exemption.

7. Walls of conditioned basements must be insulated from the top of the basement wall to a depth of 10 ft below ground level or to the level of the basement floor, whichever is less. The entire opaque portion of any individual basement wall with an average depth less than 50% below grade must meet the same R-value requirement as above-grade walls. Windows and sliding glass doors in conditioned basements must be included with the other glazing. Basement doors must meet the door U-value requirement described in Note b below.

8. The R-value requirements are for unheated slabs. Add an additional R-2 for heated slabs. The insulation must extend the total linear distance listed 1) down from the top of the slab; 2) down from the top of the slab to the bottom of the slab and then horizontally underneath the slab; or 3) down from the top of the slab to the bottom of the slab then horizontally away from the slab, with pavement or at least 10 inches of soil covering the horizontal insulation. The top edge of the insulation installed between the exterior wall and the edge of the interior slab shall be permitted to be cut at a 45-degree angle away from the exterior wall.

9. The crawl space wall R-value requirements are for walls of unventilated crawl spaces. The crawl space wall insulation must extend from the top of the wall (including the sill plate) to at least 12 in. below the outside finished grade. If the distance from the outside finished grade to the top of the footing is less than 12 in., the insulation must extend a total vertical plus horizontal distance of 24 in. from the outside finished grade.

Notes:

a) Glazing areas and U-values are maximum acceptable levels. Insulation R-values are minimum acceptable levels. R-value requirements are for insulation only and do not include structural components.

b) Opaque doors in the building envelope must have a U-value no greater than 0.35. Door U-values must be tested and documented by the manufacturer in accordance with the NFRC test procedure. If a door contains glass and an aggregate U-value rating for that door is not available, include the glass area of the door with the windows and use the opaque door U-value to determine compliance of the door. One door may be excluded from this requirement (i.e., may have a U-value greater than 0.35).

c) If a ceiling, wall, floor, basement wall, slab edge, or crawl space wall component includes two or more areas with different insulation levels, the component complies if the area-weighted average R-value is greater than or equal to the R-value requirement for that component. Glazing or door components comply if the area-weighted average U-value of all windows or doors is less than or equal to the U-value requirement (0.35 for doors).

Steel-Framed Wall Equivalent R-Values

Wood-Framed Wall R-value	Equivalent Steel-Framed Wall Cavity and Sheathing R-Value	
	16-Inch O.C.	24-Inch O.C.
R-11	R-0+R-9, R-11+R-4, R-15+R-3, R-21+R-2	R-0+R-9, R-11+R-3, R-15+R-2, R-25+R-0
R-13	R-11+R-5, R-15+R-4, R-21+R-3	R-11+R-4, R-15+R-3, R-21+R-2
R-14	R-11+R-6, R-13+R-5, R-19+R-4	R-11+R-5, R-13+R-4, R-15+R-3, R-21+R-2
R-15	R-11+R-6, R-15+R-5, R-19+R-4	R-11+R-5, R-13+R-4, R-19+R-3, R-21+R-2
R-16	R-11+R-8, R+15+R-7, R-21+R-6	R-11+R-7, R-13+R-6, R-19+R-5, R-25+R-4
R-17	R-11+R-9, R-13+R-8, R-19+R-7	R-11+R-8, R-13+R-7, R-15+R-6, R-21+R-5
R-18	R-11+R-9, R-15+R-8, R-21+R-7	R-11+R-8, R-13+R-7, R-19+R-6, R-25+R-5
R-19	R-11+R-10, R-13+R-9, R-19+R+8, R-25+R-7	R-11+R-9, R-13+R-8, R-15+R-7, R-21+R-6
R-20	R-11+R-10, R-13+R-9, R-19+R-8	R-11+R-9, R-13+R-8, R-19+R-7, R-21+R-6
R-21	R-13+R-10, R-19+R-9, R-25+R-8	R-11+R-9, R-15+R-8, R-21+R-7
R-22	R-13+R-10, R-19+R-9	R-11+R-10, R-13+R-9, R-19+R-8, R-21+R-7
R-24	R-19+R-10, R-25+R-9	R-11+R-10, R-15+R-9, R-19+R-8
R-25	R-19+R-10	R-13+R-10, R-19+R-9, R-21+R-8
R-26	R-19+R-11, R-21+R-10	R-15+R-10, R-19+R-9, R-25+R-8

High-Mass Wall Equivalent R-Values

Wood-Framed Wall R-value	Equivalent High-Mass Wall R-Value			
	Insulation Placed on the Exterior of the Wall or with Integral Insulation		Insulation Placed on the Interior of the Wall	
	HDD 4500 - 5499	HDD 5500 - 6499	HDD 4500 - 5499	HDD 5500 - 6499
R-11	R-7	R-8	R-11	R-11
R-13	R-8	R-9	R-12	R-12
R-14	R-8	R-9	R-12	R-13
R-15	R-8	R-9	R-13	R-14
R-16	R-8	R-9	R-13	R-15
R-17	R-9	R-10	R-14	R-15
R-18	R-9	R-10	R-15	R-19
R-19	R-10	R-11	R-16	R-20
R-20	R-10	R-11	R-16	R-21
R-21	R-10	R-12	R-17	R-21
R-22	R-10	R-12	R-17	R-22
R-23	R-11	R-12	R-18	R-22
R-24	R-11	R-12	R-19	R-22
R-25	R-11	R-13	R-20	R-22
R-26	R-11	R-13	R-21	R-23

Steel-Framed Roof/Ceiling Equivalent Insulation Values

Wood-Framed Wall R-value	Truss Type Cold-Formed Steel Equivalent R-Value 24-inches O.C.[a, b]
R-13	R-19, R-13+R-3
R-19	R-26, R-19+R-3
R-26	R-38, R-26+R-3
R-30	R-38, R-30+R-3
R-38	R-49, R-38+R-5
R-49	Not Applicable

a. This table applies to cold-formed, steel-truss roof framing spaced 24 inches on center where the penetrations of the truss members through the cavity insulation do not exceed three penetrations of the truss members through the cavity insulation for each 4-foot length of the truss.

b. The cavity R-value requirement is listed first, followed by the continuous insulation R-value requirement.

Steel Framing[a]		C-Shaped Cold-Formed Steel U_r-Factors[b]					
	Spacing	R-13	R-19	R-26	R-30	R-38	R-49
Wood Equivalent		0.0773	0.0537	0.0405	0.0355	0.0285	0.0223
2x4	16 inches O.C.	0.1328	0.0530	0.0387	0.0336	0.0265	0.0206
2x6		0.1328	0.0667	0.0456	0.0386	0.0295	0.0223
2x8		0.1328	0.1208	0.0585	0.0475	0.0345	0.0251
2x10		0.1328	0.1208	0.1094	0.1037	0.0398	0.0277
2x12		0.1328	0.1208	0.1094	0.1037	0.0471	0.0311
Wood Equivalent		0.0742	0.0519	0.0390	0.0342	0.0274	0.0215
2x4	24 inches O.C.	0.1129	0.0510	0.0376	0.0327	0.0260	0.0202
2x6		0.1129	0.0610	0.0428	0.0366	0.0284	0.0216
2x8		0.1129	0.0994	0.0517	0.0429	0.0320	0.0237
2x10		0.1129	0.0994	0.0873	0.0816	0.0357	0.0257
2x12		0.1129	0.0994	0.0873	0.0816	0.0403	0.0280

a. Applies to steel framing up to a maximum thickness of 0.064 inches (16 gage).

b. Linear interpolation is permitted for determining U-factors which are between those given in the table.

Steel-Framed Floor Equivalent Insulation Values

Steel Framing[a]	C-Shaped Cold-Formed Steel U_f-Factors[b]						
Spacing	R-11	R-13	R-15	R-19	R-21	R-25	R-30
Wood Equivalent	0.0725	0.0652	0.0595	0.0477	0.0452	0.0382	0.0327
2x6	16 inches O.C.	0.1058	0.1031	0.1005	0.0583	0.0523	Not Applicable	Not Applicable
2x8		0.1058	0.1031	0.1005	0.0957	0.0935	0.0548	Not Applicable
2x10		0.1058	0.1031	0.1005	0.0957	0.0935	0.0894	0.0838
2x12		0.1058	0.1031	0.1005	0.0957	0.0935	0.0894	0.0838
Wood Equivalent		0.0708	0.0633	0.0574	0.0464	0.0436	0.0370	0.0317
2x6	24 inches O.C.	0.0941	0.0907	0.0875	0.0538	0.0486	Not Applicable	Not Applicable
2x8		0.0941	0.0907	0.0875	0.0818	0.0792	0.0488	Not Applicable
2x10		0.0941	0.0907	0.0875	0.0818	0.0792	0.0745	0.0697
2x12		0.0941	0.0907	0.0875	0.0818	0.0792	0.0745	0.0697

a. Applies to steel framing up to a maximum thickness of 0.064 inches (16 gage).

b. Linear interpolation is permitted for determining U-factors which are between those given in the table.