CHAPTER 6

SIMPLIFIED PRESCRIPTIVE REQUIREMENTS FOR DETACHED ONE- AND TWO-FAMILY DWELLINGS AND GROUP R-2, R-4 OR TOWNHOUSE RESIDENTIAL BUILDINGS

SECTION 601 GENERAL

601.1 Scope. This chapter sets forth energy-efficiency-related requirements for the design and construction of detached one- and two-family dwellings and Group R-2, R-4 or townhouse residential buildings.

Exception: Portions of the building envelope that do not enclose conditioned space.

601.2 Compliance. Compliance shall be demonstrated in accordance with Section 601.2.1 or 601.2.2. REScheck Version 3.6, Release 2 for the 2003 *International Energy Conservation Code* shall be permitted to demonstrate compliance, except that SHGC of 0.4 is required for all locations and that envelope requirements may not be traded off against the use of high-efficiency heating and cooling equipment. No trade-off calculations are required for termite inspection and treatment gaps required for slabs and basement walls.

601.2.1 Residential buildings, detached one- and two-family dwellings. Compliance for detached one- and two-family dwellings shall be demonstrated by either:

1. Meeting the requirements of this chapter; or
2. Meeting the requirements of Chapter 4, or Chapter 5 for detached one- and two-family dwellings.

601.2.2 Residential buildings, Groups R-2, R-4 or townhouses. Compliance for Group R-2, R-4 or townhouse residential buildings shall be demonstrated by either:

1. Meeting the requirements of this chapter; or
2. Meeting the requirements of Chapter 4, or Chapter 5 for Group R-2, R-4 or townhouse residential buildings.

601.3 Materials and equipment. Materials and equipment shall be identified in a manner that will allow a determination of their compliance with the applicable provisions of this chapter. Materials and equipment used to conform to the applicable provisions of this chapter shall be installed in accordance with the manufacturer's installation instructions.

601.3.1 Insulation. The thermal resistance (*R*-value) shall be indicated on all insulation and the insulation installed such that the *R*-value can be verified during inspection, or a certification of the installed *R*-value shall be provided at the job site by the insulation installer. Where blown-in or sprayed insulation is applied in walls, the installer shall provide a certification of the installed density and *R*-value. Where blown-in or sprayed insulation is applied in the roof/ceiling assembly, the installer shall provide a certification of the initial installed thickness, settled thickness, coverage area, and number of bags of insulating material installed. Markers shall be provided for every 300 square feet (28 m^2) of area, attached to the trusses, rafters or joists, and indicate in 1-inch-high (25 mm) numbers the installed thickness of the insulation.

601.3.2 Fenestration. The *U*-factor of fenestration shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. The solar heat gain coefficient (SHGC) of fenestration shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer.

601.3.2.1 Default fenestration performance. Where a manufacturer has not determined a fenestration product's *U*-factor in accordance with NFRC 100, compliance shall be determined by assigning such products a default *U*-factor from Tables 102.5.2(1) and 102.5.2(2). When a manufacturer has not determined a fenestration product's SHGC in accordance with NFRC 200, compliance shall be determined by assigning such products a default SHGC from Table 102.5.2(3).

601.3.2.2 Air leakage. The air leakage of prefabricated fenestration shall be determined in accordance with AAMA/WDMA 101/I.S.2 or NFRC 400 by an accredited, independent laboratory, and labeled and certified by the manufacturer and shall not exceed the values in Table 502.1.4.1. Alternatively, the manufacturer shall certify that the fenestration is installed in accordance with Section 502.1.4.

601.3.3 Maintenance. Where mechanical or plumbing system components require preventive maintenance for efficient operation, regular maintenance requirements shall be clearly stated and affixed to the component, or the source for such information shall be shown on a label attached to the component.

SECTION 602 BUILDING ENVELOPE

602.1 Thermal performance criteria. The minimum required insulation *R*-value or the area-weighted average maximum required fenestration *U*-factor (other than opaque doors which are governed by Section 602.1.3) for each element in the building thermal envelope (fenestration, roof/ceiling, opaque wall, floor, slab edge, crawl space wall and basement wall) shall be in accordance with the criteria in Table 602.1.

The building envelope requirements of Chapter 4 or 5 shall be used to determine compliance with detached one- and two-family dwellings with greater than 15-percent glazing area; Group R-2, R-4 or townhouse residential buildings with

TABLE 602.1
SIMPLIFIED PRESCRIPTIVE BUILDING ENVELOPE THERMAL COMPONENT CRITERIA
MINIMUM REQUIRED THERMAL PERFORMANCE (*U*-FACTOR AND *R*-VALUE)

CLIMATE ZONE	HEATING DEGREE DAYS	MAXIMUM	MINIMUM					
		Glazing *U*-factor	Ceiling *R*-value	Wall *R*-value	Floor *R*-value	Basement wall *R*-value	Slab perimeter *R*-value and depth	Crawl space wall *R*-value
1	0 - 499	Any	R-13	R-11	R-11	R-0	R-0	R-0
2	500 - 999	0.90	R-19	R-11	R-11	R-0	R-0	R-4
3	1,000 - 1,499	0.75	R-19	R-11	R-11	R-0	R-0	R-5
4	1,500 - 1,999	0.75	R-26	R-13	R-11	R-5	R-0	R-5
5	2,000 - 2,499	0.65	R-30	R-13	R-11	R-5	R-0	R-6
6	2,500 - 2,999	0.40	R-30	R-13	R-19	R-6	R-0	R-7
7	3,000 - 3,499	0.40	R-30	R-13	R-19	R-7	R-0	R-8
8	3,500 - 3,999	0.40	R-30	R-13	R-19	R-8	R-5, 2 ft.	R-10
9	4,000 - 4,499	0.40	R-38	R-13	R-19	R-8	R-5, 2 ft.	R-11
10	4,500 - 4,999	0.45	R-38	R-16	R-19	R-9	R-6, 2 ft.	R-17
11	5,000 - 5,499	0.40	R-38	R-18	R-19	R-9	R-6, 2 ft.	R-17
12	5,500 - 5,999	0.40	R-38	R-18	R-21	R-10	R-9, 4 ft.	R-19
13	6,000 - 6,499	0.35	R-38	R-18	R-21	R-10	R-9, 4 ft.	R-20
14	6,500 - 6,999	0.35	R-49	R-21	R-21	R-11	R-11, 4 ft.	R-20
15	7,000 - 8,499	0.35	R-49	R-21	R-21	R-11	R-13, 4 ft.	R-20
16	8,500 - 8,999	0.35	R-49	R-21	R-21	R-18	R-14, 4 ft.	R-20
17	9,000 - 12,999	0.35	R-49	R-21	R-21	R-19	R-18, 4 ft.	R-20

For SI: 1 foot = 304.8 mm.

greater than 25-percent glazing area; and any residential building in climates with heating degree days (HDD) equal to or greater than 13,000.

602.1.1 Exterior walls. The sum of the *R*-values of the insulation materials installed in framing cavities and insulating sheathing (where used) shall meet or exceed the minimum required "Wall *R*-value" in Table 602.1. Framing, drywall, structural sheathing or exterior siding materials shall not be considered as contributing, in any way, to the thermal performance of exterior walls. Insulation separated from the conditioned space by a vented space shall not be counted towards the required *R*-value.

602.1.1.1 Mass walls. Mass walls shall be permitted to meet the criteria in Table 602.1.1.1(1) based on the insulation position and the climate zone where the building is located. Other mass walls shall meet the frame wall criteria for the building type and the climate zone where the building is located, based on the sum of interior and exterior insulation. Walls with "exterior insulation" position have the entire effective mass layer interior to an insulation layer. Walls with "integral insulation" position have either insulation and mass materials well mixed as in wood (logs); or substantially equal amounts of mass material on the interior and exterior of insulation as in concrete masonry units with insulated cores or masonry cavity walls. Walls with interior insulation position have the mass material located exterior to the insulating material(s). Walls not meeting the above descriptions for exterior or integral positions shall meet the requirements for "other mass walls" in Table 602.1.1.1(1). The *R*-value of the mass assembly for typical masonry construction shall be taken from Table 602.1.1.1(2). The mass assembly *R*-value for a solid concrete wall with a thickness of 4 inches (102 mm) or greater is R-1.1. *R*-values for other assemblies are permitted to be based on the hot box tests referenced in ASTM C 236 or ASTM C 976, two-dimensional calculations or isothermal plane calculations.

602.1.1.2 Steel-frame walls. The minimum required *R*-values for steel-frame walls shall be in accordance with Table 602.1.1.2.

TABLE 602.1.1.2
STEEL-FRAME WALL MINIMUM
PERFORMANCE REQUIREMENTS (*R-VALUE)*

HDD	EQUIVALENT STEEL-FRAME WALL CAVITY AND SHEATHING R-VALUE[a]
0 - 1,999	R-11 + R-5, R-15 + R-4, R-21 + R-3
2,000 - 3,999	R-11 + R-5, R-15 + R-4, R-21 + R-3
4,000 - 5,999	R-11 + R-9, R-15 + R-8, R-21 + R-7
6,000 - 8,499	R-13 + R-10, R-19 + R-9, R-25 + R-8
8,500 - 12,999	R-13 + R-10, R-19 + R-9, R-25 + R-8

a. The cavity insulation *R*-value requirement is listed first, followed by the sheathing *R*-value requirement.

TABLE 602.1.1.1(1)
MASS WALL PRESCRIPTIVE BUILDING ENVELOPE REQUIREMENTS

MASS WALL ASSEMBLY *R*-VALUE[a]			
Building Location		Exterior or Integral Insulation	Other Mass Walls
Zone	Heating Degree Days	Residential Buildings	Residential Buildings
1	0 - 499	R-3.8	R-9.7
2	500 - 999	R-4.8	R-9.7
3	1,000 - 1,499	R-4.8	R-9.7
4	1,500 - 1,999	R-8.1	R-10.8
5	2,000 - 2,499	R-8.9	R-10.8
6	2,500 - 2,999	R-8.9	R-10.8
7	3,000 - 3,499	R-8.9	R-10.8
8	3,500 - 3,999	R-8.9	R-10.8
9	4,000 - 4,499	R-8.9	R-10.9
10	4,500 - 4,999	R-10.4	R-12.3
11	5,000 - 5,499	R-11.9	R-15.2
12	5,500 - 5,999	R-11.9	R-15.2
13	6,000 - 6,499	R-11.9	R-15.2
14	6,500 - 6,999	R-15.5	R-18.4
15	7,000 - 8,499	R-15.5	R-18.4
16	8,500 - 8,999	R-18.4	R-18.4
17	9,000 - 12,999	R-18.4	R-18.4

a. The sum of the value in Table 602.1.1.1(2) and additional insulation layers.

TABLE 602.1.1.1(2)
MASS ASSEMBLY *R*-VALUES

ASSEMBLY TYPE	UNGROUTED CELLS, NOT INSULATED	UNGROUTED CELLS INSULATED		
		No grout	Vertical cells grouted at 10′ o.c. or greater	Vertical cells grouted at less than 10′ o.c.
6″ Lightweight concrete block	2.3	5.0	4.5	3.8
6″ Medium-weight concrete block	2.1	4.2	3.8	3.2
6″ Normal-weight concrete block	1.9	3.3	3.1	2.7
8″ Lightweight concrete block	2.6	6.7	5.9	4.8
8″ Medium-weight concrete block	2.3	5.3	4.8	4.0
8″ Normal-weight concrete block	2.1	4.2	3.8	3.3
12″ Lightweight concrete block	2.9	9.1	7.9	6.3
12″ Medium-weight concrete block	2.6	7.1	6.4	5.2
12″ Normal-weight concrete block	2.3	5.6	5.1	4.3
Brick cavity wall	3.7	6.7	6.2	5.4
Hollow clay brick	2.0	2.7	2.6	2.4

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

602.1.2 Ceilings. The required "Ceiling *R*-value" in Table 602.1 assumes standard truss or rafter construction, and shall apply to all roof/ceiling portions of the building thermal envelope, including cathedral ceilings. Where the construction technique allows the required *R*-value of ceiling insulation to be obtained over the exterior wall top plate, R-30 shall be permitted to be used where R-38 is required in the table, and R-38 shall be permitted to be used where R-49 is required.

602.1.2.1 Steel-framed ceiling. The maximum required U_R-factor for cold-formed steel truss roof/ceiling assemblies shall be in accordance with Table 602.1.2.1(1) and compliance shall be determined by using the U_R-factors in Table 602.1.2.1(2). This table applies to cold-formed steel truss roof framing spaced at 24 inches (609 mm) on center and where the penetrations of the truss members through the cavity insulation do not exceed three penetrations for each 4-foot (1220 mm) length of the truss. The maximum required U_R-factor for C-shaped cold-formed steel roof/ceiling assemblies shall be in accordance with Table 602.1.2.1(3) and compliance shall be determined by using the U_R-factors in Table 602.1.2.1(4).

TABLE 602.1.2.1(1)
MAXIMUM COLD-FORMED STEEL ROOF/CEILING TRUSS U_R-FACTORS

HEATING DEGREE DAYS	U_R-FACTOR
0 - 499	0.0742
500 - 1,499	0.0504
1,500 - 1,999	0.0372
2,000 - 3,999	0.0323
4,000 - 6,499	0.0257
6,500 - 12,999	0.0200

TABLE 602.1.2.1(2)
COLD-FORMED STEEL ROOF/CEILING TRUSS U_R-FACTORS

CAVITY INSULATION *R*-VALUE	CONTINUOUS INSULATION BETWEEN DRYWALL AND BOTTOM CHORD		
	R-0	R-3	R-5
R-13	0.0865	0.0616	0.0546
R-19	0.0597	0.0467	0.0426
R-26	0.0439	0.0364	0.0338
R-30	0.0382	0.0324	0.0303
R-38	0.0302	0.0265	0.0251
R-49	0.0235	0.0212	0.0203

TABLE 602.1.2.1(3)
MAXIMUM C-SHAPED, COLD-FORMED STEEL ROOF/CEILING U_R-FACTORS

HEATING DEGREE DAYS	U_R-FACTOR	
	16 inches o.c.	24 inches o.c.
0 - 499	0.0773	0.0742
500 - 1,499	0.0537	0.0519
1,500 - 1,999	0.0405	0.0390
2,000 - 3,999	0.0355	0.0342
4,000 - 6,499	0.0285	0.0274
6,500 - 12,999	0.0223	0.0215

For SI: 1 inch = 25.4 mm.

TABLE 602.1.2.1(4)
C-SHAPED, COLD-FORMED STEEL ROOF/CEILING U_R-FACTORS[a]

FRAMING[b]	SPACING	R-13	R-19	R-26	R-30	R-38	R-49
2 × 4	16 inches o.c.	0.1328	0.0530	0.0387	0.0336	0.0265	0.0206
2 × 6		0.1328	0.0667	0.0456	0.0386	0.0295	0.0223
2 × 8		0.1328	0.1208	0.0585	0.0475	0.0345	0.0251
2 × 10		0.1328	0.1208	0.1094	0.1037	0.0398	0.0277
2 × 12		0.1328	0.1208	0.1094	0.1037	0.0471	0.0311
2 × 4	24 inches o.c.	0.1129	0.0510	0.0376	0.0327	0.0260	0.0202
2 × 6		0.1129	0.0610	0.0428	0.0366	0.0284	0.0216
2 × 8		0.1129	0.0994	0.0517	0.0429	0.0320	0.0237
2 × 10		0.1129	0.0994	0.0873	0.0816	0.0357	0.0257
2 × 12		0.1129	0.0994	0.0873	0.0816	0.0403	0.0280

For SI: 1 inch = 25.4 mm.

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

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

602.1.3 Opaque doors. Opaque doors in the building envelope shall have a maximum *U*-factor of 0.35. One opaque door shall be exempt from this *U*-factor requirement.

602.1.4 Floor. The required *R*-value in Table 602.1 shall apply to all floors.

Exception: Any individual floor assembly with more than 25 percent of its conditioned floor area exposed directly to outside air shall meet the *R*-value requirement in Table 602.1 for "Ceiling *R*-value."

602.1.4.1 Steel-framed floors. The maximum required U_f-factor for C-shaped, cold-formed, steel-framed floors shall be in accordance with Table 602.1.4.1(1) and compliance shall be determined by using the U_f-factors in Table 602.1.4.1(2).

TABLE 602.1.4.1(1)
MAXIMUM C-SHAPED, COLD-FORMED STEEL FLOOR U_f-FACTORS

HEATING DEGREE DAYS	U_f-FACTOR	
	16 inches o.c.	24 inches o.c.
0 - 2,499	0.0725	0.0708
2,500 - 5,499	0.0477	0.0464
5,500 - 12,999	0.0452	0.0436

For SI: 1 inch = 25.4 mm.

602.1.5 Basement walls. Where the basement is considered a conditioned space, the basement walls shall be insulated in accordance with Table 602.1. Where the basement is not considered a conditioned space, either the basement wall or the ceiling(s) separating the basement from conditioned space shall be insulated in accordance with Table 602.1. Where basement walls are required to be insulated, the required *R*-value shall be applied from the top of the basement wall to a depth of 10 feet (3048 mm) below grade or to the top of the basement floor, whichever is less.

602.1.6 Slab-on-grade floors. For slabs with a top edge 12 inches (305 mm) or less below finished grade, the required "Slab perimeter *R*-value and depth" in Table 602.1 shall be applied to the outside of the foundation or the inside of the foundation wall. The insulation shall extend downward from the top of the slab or downward from the top of the slab to the bottom of the slab and then horizontally to the interior or exterior, until the distance listed in Table 602.1 is reached.

Where installed between the exterior wall and the edge of the interior slab, the top edge of the insulation shall be permitted to be cut at a 45-degree (0.79 rad) angle away from the exterior wall. Insulation extending horizontally outside of the foundation shall be protected by pavement or by a minimum of 10 inches (254 mm) of soil.

In locations of 500 HDD or greater, R-2 shall be added to the "Slab perimeter *R*-value" in Table 602.1 where uninsulated hot water pipes, air distribution ducts or electric heating cables are installed within or under the slab.

Exception: Slab perimeter insulation is not required for unheated slabs in areas of very heavy termite infestation probability as shown in Figure 502.2(7). Where this exception is used, building envelope compliance shall be demonstrated by using Section 502.2.2 or Chapter 4 with the actual "Slab perimeter *R*-value and depth" in Table 602.1, or by using Section 502.2.4.

602.1.7 Closed crawl space walls. Where the floor above a closed crawl space is not insulated, the exterior crawl space walls shall be insulated. The exterior walls shall have a thermal transmittance value not exceeding the value given in Table 602.1.

Wall insulation can be located on any combination of the outside and inside wall surfaces and within the structural cavities or materials of the wall system. Wall insulation requires that the exterior wall band joist area of the floor frame be insulated. Wall insulation shall begin 3 inches (76 mm) below the top of the masonry foundation wall and shall extend down to 3 inches (76 mm) above the top of the footing or concrete floor, 3 inches above the interior ground surface or 24 inches (610 mm) below the outside finished ground level, whichever is less [see Appendix Details 502.2.1.5(1), 502.2.1.5(2) and 502.2.1.5(3)].

TABLE 602.1.4.1(2)
C-SHAPED, COLD-FORMED STEEL FLOOR U_f-FACTORS[a]

FRAMING [b]	SPACING	R-11	R-13	R-15	R-19	R-21	R-25	R-30
2 × 6	16 inches o.c.	0.1058	0.1031	0.1005	0.0583	0.0523	NA	NA
2 × 8		0.1058	0.1031	0.1005	0.0957	0.0935	0.0548	NA
2 × 10		0.1058	0.1031	0.1005	0.0957	0.0935	0.0894	0.0838
2 × 12		0.1058	0.1031	0.1005	0.0957	0.0935	0.0894	0.0838
2 × 6	24 inches o.c.	0.0941	0.0907	0.0875	0.0538	0.0486	NA	NA
2 × 8		0.0941	0.0907	0.0875	0.0818	0.0792	0.0488	NA
2 × 10		0.0941	0.0907	0.0875	0.0818	0.0792	0.0745	0.0697
2 × 12		0.0941	0.0907	0.0875	0.0818	0.0792	0.0745	0.0697

For SI: 1 inch = 25.4 mm.
NA = Not applicable
a. Linear interpolation is permitted for determining *U*-factors which are between those given in the table.
b. Applies to steel framing up to a maximum thickness of 0.064 inches (16 gage).

Termite inspection, clearance and/or wicking gaps are allowed in wall insulation systems [see Appendix Details 502.2.1.5(4) and 502.2.1.5(5)]. Insulation may be deleted in the gap area without energy penalty. The allowable insulation gap widths are listed in Table 502.2(2). If gap widths exceed the allowances, one of the following energy compliance options shall be met:

1. Wall insulation is not allowed and the required insulation value shall be provided in the floor system.
2. Compliance shall be demonstrated with energy trade-off methods provided by MecCheck version 3.0 or higher, or the North Carolina Energy Conservation Code Chapter 4 or 5.

602.1.8 Masonry veneer. For exterior foundation insulation, the horizontal portion of the foundation which supports a masonry veneer is not required to be insulated.

602.1.9 Protection. Exposed insulating materials applied to the exterior of foundation walls shall have a rigid, opaque and weather-resistant protective covering. The protective covering shall extend 6 inches (152 mm) below finished grade level.

602.1.10 Caulking, sealants and gasketing. All penetrations; site-built windows, doors, and skylights; openings between window and door assemblies and their respective jambs and framing; and other sources of air leakage (infiltration and exfiltration) through the building thermal envelope shall be caulked, gasketed, weatherstripped, wrapped or otherwise sealed to limit uncontrolled air movement.

This includes sealing around tubs and showers, at the attic and crawl space panels, at recessed lights and around all plumbing and electrical penetrations. These are openings located in the building envelope between conditioned space and unconditioned space or between the conditioned space and the outside.

602.1.11 Moisture control. Provisions for moisture control shall be in accordance with Section 502.1.1.

602.1.12 Recessed lighting fixtures. Where provided, recessed lighting fixtures shall be installed in accordance with Section 502.1.3.

602.2 Maximum solar heat gain coefficient for fenestration products. The area-weighted-average solar heat gain coefficient (SHGC) for glazed fenestration installed in the building envelope shall not exceed 0.40. Fifteen square feet (1.4 m^2) of the total glazed fenestration shall be exempt from the SHGC requirement. In addition, all glazing in doors shall be exempt from the SHGC requirement.

602.3 Fenestration exemption. Fifteen square feet (1.4 m^2) of the total glazing area shall be exempt from the "Glazing *U*-factor" requirement in Table 602.1. In addition, impact glazing in wind-borne debris regions meeting the requirements of the Large Missile Test of ASTM E 1996 and of ASTM E 1886 shall be exempt from the *U*-Factor requirement.

602.4 Replacement fenestration. Where an entire fenestration product, including frame, sash and glazed portion, is being replaced, the replacement fenestration product shall have a *U*-factor that does not exceed the "Fenestration *U*-factor" requirement in Table 502.2.5 applicable to the climate zone (HDD) where the building is located. The replacement fenestration product(s) must also satisfy the air leakage requirements and SHGC of Sections 601.3.2.2 and 602.2, respectively.

Exception: Replacement skylights shall have a maximum *U*-factor of 0.50 when installed in any location above 1,999 HDD.

SECTION 603
MECHANICAL SYSTEMS

603.1 Heating and air-conditioning equipment and appliances. Heating and air-conditioning equipment and appliances shall comply with the applicable requirements of Section 503.

SECTION 604
SERVICE WATER HEATING

604.1 Water-heating equipment and appliances. Water-heating equipment and appliances shall comply with the applicable requirements of Section 504.

SECTION 605
ELECTRICAL POWER AND LIGHTING

605.1 Electrical energy consumption. In residential buildings having individual dwelling units, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units.