



RULE-MAKING ORDER
(RCW 34.05.360)

CR-103 (10/1/89)

Agency: State Building Code Council

- Permanent Rule
 Emergency Rule

(1) Date of adoption: November 19, 1993

(2) Purpose: To adopt revised requirements for complying with window, door, and skylight thermal efficiency standards in the Washington State Energy Code.

(3) Citation of existing rules affected by this order:

Repealed: ~~Chapter 51-11-1011 WAC~~
Amended: Chapter 51-11-0201, 0502, 0602, 0625-0630, and 1006 WAC
Suspended:

(4) Authority for adoption:

Statute: RCW 19.27, 19.27A, and 34.05
Other Authority:

(5.1) **PERMANENT RULE ONLY** 93-16-113 08/04/93
Pursuant to notice filed as WSR 93-20-129 on 10/06/93 (date).

Describe any changes other than editing from proposed to adopted version:

See Attached

(5.2) **EMERGENCY RULE ONLY**

Pursuant to RCW 34.05.350 the agency for good cause finds:

- (a) That immediate adoption, amendment, or repeal of a rule is necessary for the preservation of the public health, safety, or general welfare, and that observing the time requirements of notice and opportunity to comment upon adoption of a permanent rule would be contrary to the public interest.
- (b) That state or federal law or federal rule or a federal deadline for state receipt of federal funds requires immediate adoption of a rule.

Reasons for this finding:

(5.3) Any other findings required by other provisions of law as precondition to adoption or effectiveness of rule?

Yes No If yes, explain:

(6) Effective date of rule:
Permanent Rules **Emergency Rules**
 31 days after filing Immediately
 Other (specify) April 1, 1994 Later (specify) _____
*(If less than 31 days after filing, specific finding in 5.3 under RCW 34.05.380(3) is required)

NAME (TYPE OR PRINT) Gene Colin
 SIGNATURE
 TITLE Chair DATE 02/04/94

CODE REVISER USE ONLY

CODE REVISER'S OFFICE
STATE OF WASHINGTON
FILE #

FEB 10 1994

TIME 4:29
WSR 94-05-05A

(5.1) PERMANENT RULE ONLY

Describe any changes other than editing from proposed to adopted version:

Pursuant to RCW 34.05.340 (3), the following itemized code language changes were made in response to the public comment:

1. SEPARATE CODE REQUIREMENTS FOR DOORS FROM WINDOWS

In the existing code, window and door requirements are integrated. In some cases the current code ultimately defined doors as windows in order to fit code requirements. In testimony that the Council received during the public hearings, the case was made that a door is much different than a window. Doors and windows differ in their function, percent of the overall building envelope, materials used and manufacturing processes. For separation and clarification, the following code requirements were adopted:

- **WAC 51-11-0201: General Definitions** A separate definition for "Door" was drafted and inserted in the code. The definition of "Glazing" was amended to more specifically include only the daylight opening area for swinging doors with glazing and the rough opening area for sliding glass doors. The definition of "Glazing area" was amended to be consistent with the new door and glazing definitions and define how the areas of such shall be accounted for in the compliance calculations.
- **WAC 51-11-0502.1.5.1: Standard Procedure for Determination of Glazing U-Values and WAC 51-11-0502.1.5.2: Standard Procedure for Determination of Door U-Values** Section 0502.1.5.1 is now dedicated exclusively to glazing and Section 0502.1.5.2 is now dedicated exclusively to doors.
- **WAC 51-11-0602.6: Exterior Doors** New subsections (0602.6.1 Exterior Door Area and 0602.6.2 Exterior Door U-Value) were created to mirror the format of 0602.7 Glazing. These new door subsections are more explicit and deal with regulations for doors exclusively.

2. RELIEF FOR DOORS

Public testimony also revealed that the National Fenestration Rating Council (NFRC) Standard 100-91 does not yet contain a complete procedure for certifying thermal tests for doors. It was demonstrated that it would be premature for the Council to adopt NFRC Standards for doors at this time. Default tables were suggested as a viable option to testing. In addition, the case was made that doors are a very small percentage of the overall envelope. They have a small impact as an energy conservation measure, especially if they are opened and closed multiple times daily. The following door allowances were adopted:

- **WAC 51-11-0502.1.5.2: Standard Procedure for Determination of Door U-Values**
This section allows the use of the default tables (WAC 51-11-1006, Tables 10-6C and 10-6D). Exception 1 allows NFRC tests. Exception 3 allows one unlabeled or untested exterior swinging door for ornamental, security or architectural purposes.
- **WAC 51-11-0602.6, Exception 2: Exterior Doors** also allows one unlabeled or untested exterior swinging door for ornamental, security or architectural purposes.

3. RELIEF FOR SKYLIGHTS

Similar to doors, the NFRC has several fundamental issues to resolve related to mounting procedures before the Standard 100-91 is complete for testing and certifying skylights. A default table was again suggested as a solution during public testimony. The following skylight allowances were adopted:

- **WAC 51-11-0502.1.5.1, Exception 2: Standard Procedure for Determination of Glazing U-Values** This exception to the NFRC test standard allows the use of a default table (WAC 51-11-1006, Table 10-6B).

4. RELIEF FOR SMALL BUSINESSES

The cost for National Fenestration Rating Council (NFRC) membership, testing and certification can be expensive and thus prohibitive, especially for small businesses. NFRC has future plans to provide a fair and equitable method for small businesses to participate in their program. Until that time, the Washington State Energy Code, pursuant to the Regulatory Fairness Act (RCW 19.85) will provide alternative methods of compliance for small businesses as follows:

- **WAC 51-11-0201: General Definitions:** The Council decided that small businesses should be allowed to use alternative methods of compliance as it relates to the fenestration thermal transmittance testing requirements. Based on testimony during the public hearing, the Council decided that the definition of a small business in RCW 43.31.025 was not a true indication of a small business in the fenestration industry. The Council expanded the definition to allow the 50 or fewer employees stipulation to refer directly to window products. The new definition also allows a business to be categorized as a small business if it has one million dollars or less per year in gross sales of window products. If a business meets the definition of a small business, it may use a default table rather than going to the time and expense of testing and certifying its products.
- **WAC 51-11-0502.1.5.1 Exception 2:** This new exception allows small businesses to use industry standard default values (WAC 51-11-1006, Table 10-6B) rather than going to the expense of testing and certification.

5. LOG HOMES

- **Proposed log home changes are not adopted:** All proposed log home changes are withdrawn. The code language will be reinstated to the current code in the following sections: WAC 51-11-0402.5 (f) exception 2, 0525 Equation 1, 0527 Equation 3, 0601.1, 0602.1, 0602.2, 0602.3, 0602.4, 0602.5, 0602.6, 0602.7.1 0602.7.2 exception and 603.1
- **WAC 51-11-0502.1.5, exception 3, WAC 51-11-0629, Table 6-5 footnotes 8 and 9, and WAC 51-11-0630, Table 6-6 footnotes 9 and 10** These deemed to satisfy provisions which allow a transition period for builders to continue using an industry standard window value are also applied to log homes.

6. CHANGES TO LANGUAGE FOR CLARIFICATION:

- **WAC 51-11-0502.1.5.1:** Changed "listed" to "listed in the NFRC Certified Products Directory" for clarification.
- **WAC 51-11-0502.1.5.1 and 0502.1.5.2, exception 1:** Changed reference from "NFRC Standard 100-91" to "National Fenestration Rating Council (NFRC) Product Certification Program (PCP), as authorized by an independent certification and inspection agency licensed by the NFRC" for clarification.

7. NEW AND MOVED DEFAULT TABLES:

- **WAC 51-11-1006, Table 10-6A:** Replaces the existing punitive default table. This new version is based on tested and simulated numbers plus an additional 15 percent penalty and is much more complete than the existing table.
- **WAC 51-11-1006, Table 10-6B:** This new table is based on tested and simulated industry standard average numbers and is available for use for skylights and by small businesses.
- **WAC 51-11-1006, Table 10-6C:** This table is the existing Table 10-6B for doors with the added 0.40 value for a 1-3/4-inch panel door with 3/4-inch panels. This door is an industry standard.
- **WAC 51-11-1006, Table 10-6D:** This is a new table to allow default values for glazed doors. This was necessary since the requirements for windows and doors are now separated.

WAC 51-11-0201 General definitions.

201.1 Application of Terms: For the purposes of this Code, certain abbreviations, terms, phrases, words and their derivatives, shall be as set forth in this chapter. Where terms are not defined, they shall have their ordinary accepted meanings within the context with which they are used. In the event there is a question about the definition of a term, the definitions for terms in the codes enumerated in RCW 19.27.031 and the edition of Webster's dictionary referenced therein shall be considered as the sources for providing ordinarily accepted meanings.

AAMA: American Architectural Manufacturers Association

Addition: See the Washington State Building Code.

Advanced framed ceiling: Advanced framing assumes full and even depth of insulation extending to the outside edge of exterior walls. (See Standard Framing.)

Advanced framed walls: Studs framed on twenty-four inch centers with double top plate and single bottom plate. Corners use two studs or other means of fully insulating corners, and one stud is used to support each header. Headers consist of double 2X material with R-10 insulation between the header and exterior sheathing. Interior partition wall/exterior wall intersections are fully insulated in the exterior wall.

AFUE. Annual fuel utilization efficiency: Unlike steady state conditions, this rating is based on average usage including on and off cycling as set out in the standardized Department of Energy Test Procedures.

Air conditioning, comfort: The process of treating air to control simultaneously its temperature, humidity, cleanliness and distribution to meet requirements of the conditioned space.

ASHRAE: American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc.

ASTM: American Society for Testing and Materials

Automatic: Self-acting, operating by its own mechanism when actuated by some impersonal influence, as for example, a change in current strength, pressure, temperature or mechanical configuration. (See **Manual**.)

Below grade walls: Walls or the portion of walls which are entirely below the finish grade or which extend two feet or less above the finish grade.

Building, existing: See the Washington State Building Code.

Boiler capacity: The rate of heat output in Btu/h measured at the boiler outlet, at the design inlet and outlet conditions and rated fuel/energy input.

Building envelope: The elements of a building which enclose conditioned spaces through which thermal energy may be transferred to or from the exterior or to or from spaces exempted by the provisions of Section 101.3.1.

Building official: The official authorized to act in behalf of a jurisdiction code enforcement agency or its authorized representative.

Building project: A building or group of buildings, including on-site energy conversion or electric-generating facilities, which utilize a single submittal for a construction permit or are within the boundary of a contiguous area under one ownership.

Comfort Envelope: The area on a psychrometric chart enclosing all those conditions described in Standard RS-4, Figure No. 1, as being comfortable.

Conditioned space: All spaces which are provided with heated and/or cooled air or which are capable of being maintained at temperatures over fifty degrees F during the heating season, including adjacent connected spaces separated by an uninsulated component (e.g., basements, utility rooms, garages, corridors).

Cooled space: Space within a building which is provided with a positive cooling supply.

COP - Coefficient of performance: The ratio of the rate of net heat output (heating mode) or heat removal (cooling mode) to the rate of total on-site energy input to the heat pump, expressed in consistent units and under designated rating conditions. (See Net Heat Output, Net Heat Removal, Total On-Site Energy Input.)

Deadband: The temperature range in which no heating or cooling is used.

Degree day, heating: A unit, based upon temperature difference and time, used in estimating fuel consumption and specifying nominal heating load of a building in winter. For any one day when the mean temperature is less than sixty-five degrees F there exist as many degree days as there are Fahrenheit degrees difference in temperature between the mean temperature for the day and sixty-five degrees F.

Door: An operable opening area in the shell of a conditioned space, excluding sliding glass doors, which is designed and used as a means of ingress and egress. A door may also include a double door one of which is fixed and one of which is operable.

Door area: Total area of door measured using the rough opening and including the door and frame.

Dwelling unit: See the Washington State Building Code.

EER. Energy efficiency ratio: The ratio of net equipment cooling capacity in Btu/h to total rate of electric input in watts under designated operating conditions.

Efficiency, HVAC system: The ratio of useful energy (at the point of use) to the energy input for a designated time period, expressed in percent.

Emissivity: The ability to absorb infrared radiation. A low emissivity implies a higher reflectance of infrared radiation.

Energy: The capacity for doing work; taking a number of forms which may be transformed from one into another, such as thermal (heat), mechanical (work), electrical and chemical; in customary units, measured in kilowatt-hours (kWh) or British thermal units (Btu). (See **New energy**.)

Energy, recovered: (See **Recovered energy**.)

Exterior envelope: (See **Building envelope**.)

Floor over unconditioned space: A floor which separates a conditioned space from an unconditioned space which is buffered from exterior ambient conditions including vented crawl spaces and unconditioned basements or other similar spaces, or exposed to

exterior ambient conditions including open parking garages and enclosed garages which are mechanically ventilated.

F-Value: The perimeter heat loss factor expressed in Btu/hr \cdot ft \cdot °F.

Glazing: All areas, including the frames, in the shell of a conditioned space that let in natural light including windows, clerestories, skylights, sliding (~~or swinging~~) glass doors and glass block walls. The daylight opening area in all other doors shall be considered glazing for the purpose of calculating glazing area. The daylight opening area in all other doors is included in the door U-value and shall not be considered in calculations of glazing U-values.

Glazing area: Total area of the glazing measured using the rough opening, and including the glazing, sash, and frame. (~~For doors where the daylight opening area is less than fifty percent of the door area, the glazing area is the daylight opening area. For all other doors, the glazing area is the door area.~~) For sliding glass doors the glazing area is the rough opening area. For all other doors the glazing area is the daylight opening area.

Gross conditioned floor area: The horizontal projection of that portion of interior space which is contained within exterior walls and which is conditioned directly or indirectly by an energy-using system, and which has an average height of five feet or greater, measured from the exterior faces.

Gross exterior wall area: The normal projection of the building envelope wall area bounding interior space which is conditioned by an energy-using system; includes opaque wall, window and door areas. The gross area of walls consists of all opaque wall areas, including foundation walls, between floor spandrels, peripheral edges of floors, window areas including sash, and door areas, where such surfaces are exposed to exterior ambient conditions and enclose a conditioned space including interstitial areas between two such spaces.

Gross floor area: The sum of the areas of the several floors of the building, including basements, cellars, mezzanine and intermediate floored tiers and penthouses of headroom height, measured from the exterior faces of exterior walls or from the center line 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.

Gross roof/ceiling area: The sum of the areas of the roof/ceiling assembly, consisting of the total interior surface area of all elements, including skylights, which enclose a conditioned space.

Guest room: See the Washington State Building Code.

Heat: The form of energy that is transferred by virtue of a temperature difference.

Heat storage capacity: The physical property of materials (mass) located inside the building envelope to absorb, store, and release heat.

Heated space: Space within a building which is provided with a positive heating supply. Finished living space within a basement or registers or heating devices designed to supply heat to a basement space shall automatically define that space as heated space. (See Positive Heating Supply.)

HSPF. Heating season performance factor. The total heating output (in Btu) of a heat pump during its normal annual usage period for heating divided by the total (watt hour) electric power input during the same period, as determined by test procedures consistent with the U.S. Department of Energy "Test Procedure for Central Air Conditioners, Including Heat Pumps" published in the December 27, 1979, Federal Register, Vol 44, No. 24, IOCFR. 430. When specified in Btu per watt hour an HSPF of 6.826 is equivalent to a COP of 2.0.

Humidistat: A regulatory device, actuated by changes in humidity, used for automatic control of relative humidity.

HVAC: Heating, ventilating and air conditioning.

HVAC system components: HVAC system components provide, in one or more factory-assembled packages, means for chilling and/or heating water with controlled temperature for delivery to terminal units serving the conditioned spaces of the buildings. Types of HVAC system components include, but are not limited to, water chiller packages, reciprocating condensing units and water source (hydronic) heat pumps. (See **HVAC system equipment.**)

HVAC system efficiency: (See **Efficiency, HVAC system.**)

HVAC system equipment: HVAC system equipment provides, in one (single package) or more (split system) factory-assembled packages, means for air circulation, air cleaning, air cooling with controlled temperature and dehumidification; and optionally, either alone or in combination with a heating plant, the functions of heating and humidifying. The cooling function may be either electrically or heat operated and the refrigerant condenser may be air, water or evaporatively cooled. Where the equipment is provided in more than one package, the separate packages shall be designed by the manufacturer to be used together. The equipment may provide the heating function as a heat pump or by the use of electric elements. (The word "equipment" used without modifying adjective may, in accordance with common industry usage, apply either to HVAC system equipment or HVAC system components.)

Illumination: The density of the luminous flux incident on a surface; it is the quotient of the luminous flux by the area of the surface when the latter is uniformly illuminated.

Infiltration: The uncontrolled inward air leakage through cracks and interstices in any building element and around windows and doors of a building caused by the pressure effects of wind and/or the effect of differences in the indoor and outdoor air density.

Insulation baffle: A rigid material, resistant to wind driven moisture, the purpose of which is to allow air to flow freely into the attic or crawl space and to prevent insulation from blocking the ventilation of these spaces, or the loss of insulation. Example materials for this purpose are sheet metal, or wax impregnated cardboard.

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

Manual: Capable of being operated by personal intervention. (See **Automatic.**)

Net heat output: The change in the total heat content of the air entering and leaving the equipment (not including supplementary heat and heat from boilers).

Net heat removal: The total heat content of the air entering and leaving the equipment (without heat) or the difference in total heat content of the water or refrigerant entering and leaving the component.

New energy: Energy, other than recovered energy, utilized for the purpose of heating or cooling. (See **energy**.)

Nominal R-value: The thermal resistance of insulation as specified by the manufacturer according to recognized trade and engineering standards.

Nonrenewable energy sources: All energy sources that are not renewable energy sources including natural gas, oil, coal, wood, liquified petroleum gas, steam, and any utility-supplied electricity.

Occupancy: See the Washington State Building Code.

Opaque envelope areas: All exposed areas of a building envelope which enclose conditioned space, except openings for windows, skylights, doors, glazing and building service systems.

Open blown: Loose fill insulation pneumatically installed in an unconfined attic space.

Outdoor air: Air taken from the outdoors and, therefore, not previously circulated through the system.

Packaged terminal air conditioner: A factory-selected combination of heating and cooling components, assemblies or sections intended to serve a room or zone. (For the complete technical definition, see Standard RS-10.)

Packaged terminal heat pump: A factory-selected combination of heating and cooling components, assemblies or sections intended for application in an individual room or zone. (For the complete technical definition, see Standard RS-21.)

Permeance (perm): The ability of a material of specified thickness to transmit moisture in terms of amount of moisture transmitted per unit time for a specified area and differential pressure (grains per hour•ft²•inches of HG). Permeance may be measured using ASTM E-96-72 or other approved dry cup method as specified in RS-1.

Pool cover: A vapor-retardant cover which lies on or at the surface of the pool.

Positive cooling supply: Mechanical cooling deliberately supplied to a space, such as through a supply register. Also, mechanical cooling indirectly supplied to a space through uninsulated surfaces of space cooling components, such as evaporator coil cases and cooling distribution systems which are capable of maintaining air temperatures within the space of eighty-five degrees F, or lower, at the exterior design conditions specified in Section 302.1. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of this Code.

Positive heating supply: Heat deliberately supplied to a space by design, such as a supply register, radiator or heating element. Also, heat indirectly supplied to a space through uninsulated surfaces of service water heaters and space heating components, such as furnaces, boilers and heating and cooling distributions systems which are capable of maintaining air temperature within the space of fifty degrees F, or higher, at the exterior design conditions specified in Section 302.1. To be considered exempt from inclusion in this definition, such surfaces shall comply with the insulation requirements of this Code.

Power: In connection with machines, the time rate of doing work. In connection with the transmission of energy of all types, the rate at which energy is transmitted; in customary units, it is measured in watts (W) or British Thermal Units per hour (Btu/h).

Public facility rest room: A rest room used by the transient public on a regular (rather than casual) basis. Examples include rest rooms in service stations, airports, train terminals and convention halls. Rest rooms incorporated with private guest rooms in hotels, motels or dormitories and rest room facilities intended for the use of employees and not usually used by the general public are not considered public facility rest rooms.

Radiant slab: A slab on grade containing heated pipes, ducts, or electric heating cables that constitute a radiant slab or portion thereof for a complete or partial heating of the structure.

Readily accessible: See the Washington State Mechanical Code.

Recooling: The removal of heat by sensible cooling of the supply air (directly or indirectly) that has been previously heated above the temperature to which the air is to be supplied to the conditioned space for proper control of the temperature of that space.

Recovered energy: Energy utilized which would otherwise be wasted (i.e. not contribute to a desired end use) from an energy utilization system.

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 cooling.

Renewable energy sources: Renewable energy sources of energy (excluding minerals) are derived from: (1) incoming solar radiation, including but not limited to, natural daylighting and photosynthetic processes; (2) energy sources resulting from wind, waves and tides, lake or pond thermal differences; and (3) energy derived from the internal heat of the earth, including nocturnal thermal exchanges.

Reset: Adjustment of the set point of a control instrument to a higher or lower value automatically or manually to conserve energy.

Roof/ceiling assembly: A roof/ceiling assembly shall be considered as all components of the roof/ceiling envelope through which heat flows, thus creating a building transmission heat loss or gain, where such assembly is exposed exterior ambient conditions to and encloses a conditioned space. The gross area of a roof/ceiling assembly consists of the total interior surface of such assembly, including skylights.

Sequence: A consecutive series of operations.

Service systems: All energy-using systems in a building that are operated to provide services for the occupants or processes housed therein, including HVAC, service water heating, illumination, transportation, cooking or food preparation, laundering or similar functions.

Service water heating: Supply of hot water for domestic or commercial purposes other than comfort heating.

Shaded: Glazed area which is externally protected from direct solar radiation by use of devices permanently affixed to the structure or by an adjacent building, topographical feature, or vegetation.

Shall: Denotes a mandatory code requirement.

Single family. One and two family residential dwelling units with no more than two units in a single building.

Skylight: A glazing surface that has a slope of less than sixty degrees from the horizontal plane.

Slab-on-grade, exterior: Any portion of a slab floor in contact with the ground which is less than or equal to twenty-four inches below the final elevation of the nearest exterior grade.

Slab-below-grade: Any portion of a slab floor in contact with the ground which is more than twenty-four inches below the final elevation of the nearest exterior grade.

Small business: Any business entity (including a sole proprietorship, corporation, partnership, or other legal entity) which is owned and operated independently from all other businesses, which has the purpose of making a profit, and which has fifty or fewer employees, or which has a million dollars or less per year in gross sales, of window products.

Solar energy source: Source of natural daylighting and of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.

Standard framing: All framing practices not defined as "intermediate" or "advanced" shall be considered standard. (See Advanced framed ceiling, Advanced framed walls, Intermediate framed wall.)

Substantial contact: A condition where adjacent building materials are placed in a manner that proximal surfaces are contiguous, being installed and supported as to eliminate voids between materials, without compressing or degrading the thermal performance of either product.

System: A combination of central or terminal equipment or components and/or controls, accessories, interconnecting means, and terminal devices by which energy is transformed so as to perform a specific function, such as HVAC, service water heating or illumination.

Tapering: Installation of a reduced level of ceiling insulation at the eaves, due to reduced clearance.

Thermal by-pass: An area where the envelope surrounding the conditioned space is breached, or where an ineffective application compromises the performance of a thermal or infiltration barrier, increasing the structure's energy consumption by exposing finished surfaces to ambient conditions and additional heat transfer.

Thermal conductance (C): Time rate of heat flow through a body (frequently per unit area) from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady conditions (Btu/hr·ft²·°F).

Thermal resistance (R): The reciprocal of thermal conductance (hr·ft²·°F/Btu).

Thermal transmittance (U): The coefficient of heat transmission (air to air). It is the time rate of heat flow per unit area and unit temperature difference between the warm side and cold side air films (Btu/hr·ft²·°F). The U-value applies to the fractional combinations of different materials used in series along the heat flow path.

Thermal transmittance, overall (U^o): The overall (average) heat transmission of a gross area of the exterior building envelope (Btu/hr·ft²·°F). The U^o-value applies to the combined effect of the time rate of heat flows through the various parallel paths, such as windows, doors and opaque construction areas, comprising the gross

area of one or more exterior building components, such as walls, floors or roof/ceiling.

Thermostat: An automatic control device actuated by temperature and designed to be responsive to temperature.

Total on-site energy input: The combination of all the energy inputs to all elements and accessories as included in the equipment components, including but not limited to, compressor(s), compressor sump heater(s), circulating pump(s), purge devices, fan(s), and the HVAC system component control circuit.

Transmission coefficient: The ratio of the solar heat gain through a glazing system to that of an unshaded single pane of double strength window glass under the same set of conditions.

U-Value: See thermal transmittance.

Uniform Building Code: The Washington State Uniform Building Code as modified by the Washington State Building Code Council.

Uniform Mechanical Code: The Washington State Uniform Mechanical Code as modified by the Washington State Building Code Council.

Unitary cooling and heating equipment: One or more factory-made assemblies which include an evaporator or cooling coil, a compressor and condenser combination, and may include a heating function as well. Where such equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Unitary heat pump: One or more factory-made assemblies which include an indoor conditioning coil, compressor(s) and outdoor coil or refrigerant-to-water heat exchanger, including means to provide both heating and cooling functions. When such equipment is provided in more than one assembly, the separate assemblies shall be designed to be used together.

Vapor retarder: A layer of low moisture transmissivity material (not more than 1.0 perm dry cup) placed over the warm side (in winter) of insulation, over the exterior of below grade walls, and under floors as ground cover to limit the transport of water and water vapor through exterior walls, ceilings, and floors. Vapor retarding paint, listed for this application, also complies with this Code.

Vaulted ceilings: All ceilings where enclosed joist or rafter space is formed by ceilings applied directly to the underside of roof joists or rafters.

Ventilation: The process of supplying or removing air by natural or mechanical means to or from any space. Such air may or may not have been conditioned.

Ventilation air: That portion of supply air which comes from outside (outdoors) plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

Walls (exterior): Any member or group of members which defines the exterior boundaries or courts of a building and which have a slope of sixty degrees or greater with the horizontal plane, and separates conditioned from unconditioned space. Band joists between floors are to be considered a part of exterior walls.

Zone: A space or group of spaces within a building with heating and/or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device. Each dwelling unit in residential buildings shall be considered a single zone.

WAC 51-11-0402 Systems analysis.

402.1 Special Requirements for All Group R Occupancy:

402.1.1 Energy Budgets: Proposed buildings designed in accordance with this section shall be designed to use no more energy from non-renewable sources for space heating, and domestic hot water heating than a standard building whose enclosure elements and energy consuming systems are designed in accordance with section 502.2 of this Code for the appropriate climate zone, and heating system type. Energy derived from renewable sources may be excluded from the total annual energy consumption attributed to the alternative building.

402.1.2 Calculation of Energy Consumption: The application for a building permit shall include documentation which demonstrates, using a calculation procedure as listed in Chapter 8, or an approved alternate, that the proposed building's annual space heating energy use does not exceed the annual space heating and water heating energy use of a standard building conforming to Chapter 5 of this Code for the appropriate climate zone. The total calculated annual energy consumption shall be shown in units of kWh/ft²/year or Btu/ft²/year of conditioned area.

402.1.3 Input Values: The following standardized input values shall be used in calculating annual space heating budgets:

PARAMETER	VALUE
Thermostat set point, heating	65° F
Thermostat set point, cooling	78° F
Thermostat night set back	65° F
Thermostat night set back period	0 hours
Internal gain	
R-3 units	3000 Btu/hr
R-1 units	1500 Btu/hr
Domestic Hot Water Heater Setpoint	120° F
Domestic Hot Water Consumption	20 gallons/person/day.
Minimum heat storage	Calculated using standard engineering practice for the actual building or as approved.
Site weather data	Typical meteorological year (TMY) or ersatz TMY data for the closest appropriate TMY site or other site as approved.
Heating equipment efficiency	
Electric resistance heat	1.00
Heat Pumps	6.80 HSPF.
Other Fuels	0.78 AFUE.

The standard building shall be modeled with glazing area distributed equally among the four cardinal directions. Parameter

values that may be varied by the building designer to model energy saving options include, but are not limited to, the following:

1. Overall thermal transmittance, $(\sum U)$ U_o , of building envelope or individual building components;
2. Heat storage capacity of building;
3. Glazing orientation; area; and shading coefficients;
4. Heating system efficiency.

402.1.4 Solar Shading and Access: Building designs using passive solar features with eight percent or more south facing equivalent glazing to qualify shall provide to the building official a sun chart or other approved documentation depicting actual site shading for use in calculating compliance under this section. The building shall contain at least forty-five Btu/°F for each square foot of south facing glass.

402.1.5 Infiltration: Infiltration levels used shall be set at 0.35 air changes per hour for thermal calculation purposes only.

402.1.6 Heat Pumps: The heating season performance factor (HSPF) for heat pumps shall be calculated using procedures consistent with section 5.2 of the U.S. Department of Energy Test Procedure for Central Air Conditioners, including heat pumps published in the December 27, 1979 Federal Register Vol. 44, No. 24.10 CFR 430. Climate data as specified above, the proposed buildings overall thermal performance value (Btu/°F) and the standardized input assumptions specified above shall be used to model the heat pumps HSPF.

402.2 Energy Analysis: Compliance with this chapter will require an analysis of the annual energy usage, hereinafter called an annual energy analysis.

EXCEPTION: Chapters 5, and 6 of this Code establish criteria for different energy-consuming and enclosure elements of the building which, will eliminate the requirement for an annual systems energy analysis while meeting the intent of this Code.

A building designed in accordance with this chapter will be deemed as complying with this Code if the calculated annual energy consumption is not greater than a similar building (defined as a "standard design") whose enclosure elements and energy-consuming systems are designed in accordance with Chapter 5.

For an alternate building design to be considered similar to a "standard design," it shall utilize the same energy source(s) for the same functions and have equal floor area and the same ratio of envelope area to floor area, environmental requirements, occupancy, climate data and usage operational schedule.

402.3 Design: The standard design, conforming to the criteria of Chapter 5 and the proposed alternative design shall be designed on a common basis as specified herein:

The comparison shall be expressed as kBtu or kWh input per square foot of conditioned floor area per year at the building site.

402.4 Analysis Procedure: The analysis of the annual energy usage of the standard and the proposed alternative building and system design shall meet the following criteria:

a. The building heating/cooling load calculation procedure used for annual energy consumption analysis shall be detailed to permit the evaluation of effect of factors specified in section 402.5.

b. The calculation procedure used to simulate the operation of the building and its service systems through a full-year operating period shall be detailed to permit the evaluation of the effect of system design, climatic factors, operational characteristics, and mechanical equipment on annual energy usage. Manufacturer's data or comparable field test data shall be used when available in the simulation of systems and equipment. The calculation procedure shall be based upon eight thousand seven hundred sixty hours of operation of the building and its service systems.

402.5 Calculation Procedure: The calculation procedure shall cover the following items:

a. Design requirements--Environmental requirements as required in Chapter 3.

b. Climatic data--Coincident hourly data for temperatures, solar radiation, wind and humidity of typical days in the year representing seasonal variation.

c. Building data--Orientation, size, shape, mass, air, moisture and heat transfer characteristics.

d. Operational characteristics--Temperature, humidity, ventilation, illumination, control mode for occupied and unoccupied hours.

e. Mechanical equipment--Design capacity, part load profile.

f. Building loads--Internal heat generation, lighting, equipment, number of people during occupied and unoccupied periods.

EXCEPTION: Group R Occupancy shall comply with calculation procedures in Chapter 8, or an approved alternate.

402.6 Documentation: Proposed alternative designs, submitted as requests for exception to the standard design criteria, shall be accompanied by an energy analysis comparison report. The report shall provide technical detail on the two building and system designs and on the data used in and resulting from the comparative analysis to verify that both the analysis and the designs meet the criteria of Chapter 4 of this Code.

WAC 51-11-0502 Building envelope requirements.

502.1 General:

502.1.1: The stated U- or F-value of any component assembly, listed in Table 5-1 or 5-2, such as roof/ceiling, opaque wall or opaque floor may be increased and the U-value for other components decreased, provided that the total heat gain or loss for the entire building envelope does not exceed the total resulting from compliance to the U-values specified in this Section.

The U-values for typical construction assemblies are included in Chapter 10. These values shall be used for all calculations. Where proposed construction assemblies are not represented in Chapter 10, values shall be calculated in accordance with Chapters 19-27 in RS-1 listed in Chapter 7, using the framing factors listed in Chapter 10 where applicable.

For envelope assemblies containing metal framing, the U- value shall be determined by one of the following methods:

1. Results of laboratory or field measurements.
2. Standard RS-25, listed in Chapter 7, where the metal framing is bonded on one or both sides to a metal skin or covering.
3. The zone method as provided in Chapter 22 of RS-1, listed in Chapter 7.
4. Effective framing/cavity R-values as provided from the following table for metal stud walls:

WALL FRAMING	CAVITY	INSULATION
	R-11	R-19
2 x 4 @ 16" o.c.	5.50	-
2 x 4 @ 24" o.c.	6.60	-
2 x 6 @ 16" o.c.	-	7.60
2 x 6 @ 24" o.c.	-	8.55

502.1.2: For consideration of thermal mass effects, see section 402.4.

502.1.3: When return air ceiling plenums are employed, the roof/ceiling assembly shall:

- a. For thermal transmittance purposes, not include the ceiling proper nor the plenum space as part of the assembly; and
- b. For gross area purposes, be based upon the interior face of the upper plenum surface.

502.1.4 Insulation:

502.1.4.1 General: All insulating materials shall comply with sections 1712 and/or 1713 of the Uniform Building Code. Substantial contact of the insulation with the surface being insulated is required. All insulation materials shall be installed according to the manufacturer's instructions to achieve proper densities, and maintain uniform R-values. To the maximum extent possible, insulation shall extend over the full component area to the intended R-value.

502.1.4.2 Insulation Materials: All insulation materials including facings such as vapor barriers or breather papers installed within floor/ceiling assemblies, roof/ceiling assemblies, walls, crawl spaces, or attics shall have a flame spread rating of less than twenty-five and a smoke density not to exceed four hundred fifty when tested in accordance with UBC Standard 42-1.

EXCEPTIONS:

1. Foam plastic insulation shall comply with section 1712 of the Uniform Building Code.

2. When such materials are installed in concealed spaces of Types III, IV, and V construction, the flame spread and smoke developed limitations do not apply to facing, provided that the facing is installed in substantial contact with the unexposed surface of the ceiling, floor, or wall finish.

3. Cellulose insulation shall comply with section 1713 of the Uniform Building Code.

502.1.4.3 Clearances: Where required, insulation shall be installed with clearances according to manufacturers specifications. Insulation shall be installed so that required ventilation is unobstructed. For blown or poured loose fill insulation clearances shall be maintained through installation of a permanent retainer.

502.1.4.4 Access Hatches and Doors: Access doors from conditioned spaces to unconditioned spaces (e.g., attics and crawl spaces) shall be weatherstripped and insulated to a level equivalent to the insulation on the surrounding surfaces. Access shall be provided to all equipment which prevents damaging or compressing the insulation. A wood framed or equivalent baffle or retainer must be provided when loose fill insulation is installed, the purpose of which is to prevent the loose fill insulation from spilling into the living space when the attic access is opened, and to provide a permanent means of maintaining the installed R-value of the loose fill insulation.

502.1.4.5 Roof/Ceiling Insulation: Open-blown or poured loose-fill insulation may be used in attic spaces where the slope of the ceiling is not more than three feet in twelve and there is at least thirty inches of clear distance from the top of the bottom chord of the truss or ceiling joist to the underside of the sheathing at the roof ridge. When eave vents are installed, baffling of the vent openings shall be provided so as to deflect the incoming air above the surface of the insulation. Baffles shall be, rigid material, resistant to wind driven moisture. Requirements for baffles for ceiling insulation shall meet the Uniform Building Code section 3205(c) for minimum ventilation requirements. When feasible, the baffles shall be installed from the top of the outside of the exterior wall, extending inward, to a point six inches vertically above the height of noncompressed insulation, and twelve inches vertically above loose fill insulation.

502.1.4.6 Wall Insulation: Insulation installed in exterior walls shall comply with the provisions of this section. All wall insulation shall fill the entire cavity. Exterior wall cavities isolated during framing shall be fully insulated to the levels of

the surrounding walls. All faced insulation shall be face stapled to avoid compression.

502.1.4.7 Floor Insulation: Floor insulation shall be installed in a permanent manner in substantial contact with the surface being insulated. Insulation supports shall be installed so spacing is no more than twenty-four inches on center. Foundation vents shall be placed so that the top of the vent is below the lower surface of the floor insulation.

EXCEPTION: Insulation may be omitted from floor areas over heated basements, heated garages, or underfloor areas used as HVAC supply plenums. See Uniform Mechanical Code section 1008 for underfloor supply plenum requirements. When foundation walls are insulated, the insulation shall be attached in a permanent manner. The insulation shall not block the airflow through foundation vents when installed. When foundation vents are not placed so that the top of the vent is below the lower surface of the floor insulation, a permanently attached baffle shall be installed at an angle of thirty degrees from horizontal, to divert air flow below the lower surface of the floor insulation.

502.1.4.8 Slab-On-Grade: Slab-on-grade insulation, installed inside the foundation wall, shall extend downward from the top of the slab for a minimum distance of twenty-four inches or downward and then horizontally beneath the slab for a minimum combined distance of twenty-four inches. Insulation installed outside the foundation shall extend downward to a minimum of twenty-four inches or to the frostline. Above grade insulation shall be protected.

EXCEPTION: For monolithic slabs, the insulation shall extend downward from the top of the slab to the bottom of the footing.

502.1.4.9 Radiant Slabs: The entire area of a radiant slab shall be thermally isolated from the soil, with a minimum of R-10 insulation. The insulation shall be an approved product for its intended use. If a soil-gas control system is present below the radiant slab, which results in increased convective flow below the radiant slab, the radiant slab shall be thermally isolated from the sub-slab gravel layer.

502.1.4.10 Below-Grade Walls:

a. Below grade exterior wall insulation used on the exterior (cold) side of the wall shall extend from the top of the below-grade wall to the top of the footing and shall be approved for below-grade use. Above grade insulation shall be protected.

b. Insulation used on the interior (warm) side of the wall shall extend from the top of the below-grade wall to the below-grade floor level.

502.1.5 Glazing and Door U-Values: ~~((For Group R Occupancy,))~~ Glazing and door U-values shall be determined in accordance with section 502.1.5.1 (For other occupancies, glazing and door U-values shall be determined in accordance with either section 502.1.5.1 or 502.1.5.2.) and 502.1.5.2. All products shall be labeled with the NFRC certified or default U-value. The labeled U-

value shall be used in all calculations to determine compliance with this Code. Sealed insulating glass shall conform to, or be in test for, ASTM E-774-81 class A.

EXCEPTIONS:

1. Until December 31, 1994, the following products may be assigned a U-value of 0.40 for the purposes of determining compliance with the electric resistance component performance path as determined by Equation 3 in WAC 51-11-0527:

A vinyl or wood double pane window, excluding sliding glass doors, constructed with a minimum 1/2 inch air space between glazings and either a low-e glazing or an argon fill of no less than 90%.

The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy the electric resistance path in the Washington State Energy Code."

2. Until December 31, 1994, the following products may be assigned a U-value of 0.65 for the purposes of determining compliance with the other fuels component performance path as determined by Equation 3 in WAC 51-11-0527:

An aluminum, double pane window, excluding sliding glass doors, constructed with a minimum 7/16 inch air space between glazings.

The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy the other fuels path in the Washington State Energy Code."

3. Log homes, in addition to the exceptions above, may utilize the following: Until December 31, 1994, the following products may be assigned a U-value of 0.31 for the purposes of determining compliance with the electric resistance or other fuels component performance path as determined by Equation 3 in WAC 51-11-0527:

A vinyl or wood double pane window, excluding sliding glass doors, constructed with a minimum 1/2 inch air space between glazings and both a low-e glazing and an argon fill of no less than 90%.

The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy either the electric resistance path or the other fuels path for log homes in the Washington State Energy Code."

502.1.5.1 Standard Procedure for Determination of Glazing ((and Door)) U-Values: U-values for glazing ((and doors, including all fire doors,)) shall be ((the tested U-values for thermal transmittance due to conduction resulting from either the AAMA 1503.1-88 test procedure or the ASTM C236-87 or C976-82 test procedures, provided that testing shall be conducted under established winter horizontal heat flow test conditions using fifteen mile per hour wind speed directed perpendicular to the exterior surface of the glazing as specified under AAMA 1503.1-88.

~~AAMA 1503.1-88 testing, shall be conducted by a laboratory accredited by AAMA to perform that test. ASTM C236-87 or C976-82 testing shall be conducted by an independent laboratory accredited by a nationally recognized accreditation program, independent of that laboratory. All tested U-values reported for listing by the state building code council after January 1, 1991, shall include certification by the manufacturer of gas content in the sealed insulated glass unit used for testing and in the production unit.~~

~~Product samples tested shall be production line units or representative of units as purchased by the consumer or contractor. Product sample sizes tested shall be in accordance with AAMA 1503.1-88, except that skylights shall be tested with a nominal two foot by four foot size, or a nominal four foot by four foot size. The installation of the test sample shall be in accordance with AAMA 1503.1-88, section 8.4. All testing performed after January 1, 1991, shall not include screens. All glazing and doors shall be identified with a label that states an overall product U-value that is no less than the actual tested U-value. The labeled U-value shall be used in all calculations to determine compliance with this Code. Sealed insulating glass shall conform to, or be in test for, ASTM E-774-81 level A.~~

EXCEPTIONS:

~~1. The exterior frame dimensions of the product sample size tested shall not deviate by more than three inches from the height and width specified, except that skylights are allowed to be tested in the closest production line size to that specified above.~~

~~2. Passive air inlets are not required to be part of the tested assembly.~~

~~3. Products tested prior to December 31, 1990, to AAMA 1503.1-80, ASTM C236-80 or C976-82 which are not in compliance with the test size requirement above, and which are in compliance with the product sample sizes in AAMA 1503.1-80, shall be acceptable until December 31, 1994.~~

~~4. Untested glazing and doors shall be assigned the default U-values listed in Chapter 10. The default values for the opaque portions of doors shall be those listed in Chapter 10, provided that the U-value listed for a door with a thermal break shall only be allowed if both the door and the frame have a thermal break.~~

~~5. The U-value of an insulated glazing product which has a 'grille pattern' installed between the glazing layers shall be deemed equal to the U-value of an insulated glazing product which is tested without a 'grille pattern' in between glazing layers, provided a minimum one-eighth inch air space exists between the 'grille pattern' and both glass lites.~~

~~6. For a glazing product which is manufactured with an alternative 'low-e coating' than the 'low-e coating' of the tested glazing product, the U-value shall be deemed equal provided that the alternative 'low-e coating' material has an equal or lower rated emissivity.~~

~~7. U-factors, either tested or simulated, labeled and certified in accordance with the National Fenestration Rating Council's (NFRC) procedure 100-91 are acceptable if based on model size AA.) determined, certified and labeled in accordance with the~~

National Fenestration Rating Council (NFRC) Product Certification Program (PCP), as authorized by an independent certification and inspection agency licensed by the NFRC. Compliance shall be based on Model Size AA. Product samples used for U-value determinations shall be production line units or representative of units as purchased by the consumer or contractor. Products that are listed in the NFRC Certified Products Directory or certified to the NFRC standard shall not use default values.

EXCEPTIONS:

1. Untested glazing products may be assigned default U-values from Table 10-6A.
2. Overhead glazing and units produced by a small business may be assigned default U-values from Table 10-6B.
3. Passive air inlets are not required to be part of the tested assembly.
4. Compliance for tested overhead glazing shall be based on NFRC Model Size BB.

~~502.1.5.2 ((Alternate Glazing and Door U-Values for Other Than Group R Occupancy: Glazing U-values for other than Group R Occupancy are also allowed to be taken from Table 13 of Chapter 27 of RS-1 listed in Chapter 7 or calculated in accordance with the procedures of Chapter 27 of RS-1 listed in Chapter 7 and door U-values are also allowed to be taken from Table 6 in Chapter 22 of RS-1 listed in Chapter 7.))~~ Standard Procedure for Determination of Door U-Values: Half-lite and full-lite doors, including fire doors, shall be assigned default U-values from Table 10-6D. All other doors, including fire doors, shall be assigned default U-values from Tables 10-6C.

EXCEPTIONS:

1. U-values determined, certified and labeled in accordance with the National Fenestration Rating Council (NFRC) Product Certification Program (PCP), as authorized by an independent certification and inspection agency licensed by the NFRC.
2. The default values for the opaque portions of doors shall be those listed in Table 10-6C, provided that the U-value listed for a door with a thermal break shall only be allowed if both the door and the frame have a thermal break.
3. One unlabeled or untested exterior swinging door with the maximum area of 24 square feet may be installed for ornamental, security or architectural purposes. Products using this exception shall not be included in either the U-value or glazing area calculation requirements.

502.1.6 Moisture Control:

502.1.6.1: Vapor retarders shall be installed on the warm side (in winter) of insulation as specified in the following cases.

EXCEPTION: Vapor retarder installed with not more than one-third of the nominal R-value between it and the conditioned space.

502.1.6.2 Floors: Floors separating conditioned space from unconditioned space shall have a vapor retarder installed. The

vapor retarder shall have a one perm dry cup rating or less (i.e., four mil. polyethylene or kraft faced material).

502.1.6.3: Roof/ceiling assemblies where the ventilation space above the insulation is less than an average of twelve inches shall be provided with a vapor retarder. Faced batt insulation where used as a vapor retarder shall be face stapled. Single rafter joist vaulted ceiling (~~(cavities [cavities])~~) cavities shall be of sufficient depth to allow a minimum one inch vented air space above the insulation.

502.1.6.4: Vapor retarders shall not be required in roof/ceiling assemblies where the ventilation space above the insulation averages twelve inches or greater.

502.1.6.5: Vapor retarders shall not be required where all of the insulation is installed between the roof membrane and the structural roof deck.

502.1.6.6 Wall Insulation: Walls separating conditioned space from unconditioned space shall have a vapor retarder installed. Faced batt insulation shall be face stapled.

502.1.6.7 Ground Cover: A ground cover of six mil (0.006 inch thick) black polyethylene or approved equal shall be laid over the ground within crawl spaces. The ground cover shall be overlapped twelve inches minimum at the joints and shall extend to the foundation wall.

EXCEPTION: The ground cover may be omitted in crawl spaces if the crawl space has a concrete slab floor with a minimum thickness of three and one-half inches.

502.2 Thermal Criteria for Group R Occupancy:

502.2.1: The proposed UA as calculated using Equations 2 and 3 shall not exceed the Target UA as calculated using Equation 1. For the purpose of determining equivalent thermal performance, the glazing area for the target UA shall be calculated using figures in Table 5-1, and all the glazing shall be located in the wall area. The opaque door area shall be the same in the target UA and the proposed UA.

502.2.2 Space Heat Type: The following two categories comprise all space heating types:

1. Electric Resistance: Space heating systems which include baseboard units, radiant units, and forced air units as either the primary or secondary heating system.

EXCEPTION: Electric resistance systems for which the total electric heat capacity in each individual dwelling unit does not exceed the greater of: 1) One thousand watts per dwelling unit, or; 2) One watt per square foot of the gross floor area.

2. Other: All gas, wood, oil, and propane space heating systems, unless electric resistance is used as a secondary heating system, and all heat pump space heating systems. (See EXCEPTIONS, Electric Resistance, section 502.2.2 above.)

502.3 (~~Thermal Performance Criteria For Other Than Group R Occupancies.~~)

502.3.1: ~~The overall thermal transmittance value (U^o) of the gross area of elements of the exterior building envelope of all buildings other than low rise residential buildings shall not exceed the values given in Tables 5-2. Equations 2, 4 and 5 shall be used to determine acceptable combinations of building components and thermal properties to meet this requirement for heating. U^o and U^w are specified in units of:~~

$$\frac{\text{Btu}}{\text{hr.} \cdot \text{ft}^2 \cdot ^\circ\text{F}}$$

502.3.2 Slab on Grade Floors: ~~For slab on grade floors the thermal resistance of the insulation around the perimeter of the floor shall not be less than the value given in Table 5-2.~~

502.3.3 Alternative Wall Allowance for Other Than Group R Occupancies: ~~For other than Group R Occupancies, three stories or less, the maximum allowed value for average thermal transmittance (U_a) of the exterior walls may be increased to the values given in Table 5-2 BUILDINGS OVER THREE CONDITIONED STORIES provided that at least one of the following criteria is also met:~~

1. ~~Mechanical supply of outside air and mechanical exhaust of building air shall be automatically shut off and the duct closed for at least eight hours per day during hours of nonoccupancy, or~~

2. ~~The primary source of heating for the building shall be one or more heat pumps meeting the provisions of section 503.4.2 or gas or oil combustion heating equipment with a minimum combustion efficiency of eighty five percent for central heating plants and eighty percent for room and space heaters. This efficiency shall be determined in accordance with the provisions of section 503.4.3.~~

~~Provided further: That if both criteria are met, the maximum allowed value for thermal transmittance (U^o) of the exterior walls used in Table 5-2 may be increased by 0.05 in determining compliance with the provisions of the Code.~~

~~For walls with a wall weight of at least thirty lbs. per ft^2 (provided that walls constructed of hollow masonry units have cores filled with either grout, concrete, or with an insulating material with resistance per inch (R) of at least $2.25 \text{ ft}^2/\text{hr. } ^\circ\text{F}/\text{Btu}$) the calculated thermal resistance of the wall sections measured face to face on wall units which are exposed to inside air temperatures, not including the thermal resistance of air films or additional exterior wall elements may be increased by twenty five percent in determining compliance with the provisions of the code provided that:~~

~~Heating and cooling set point temperatures in the conditioned spaces or zones of the building shall be separated by at least five degrees F. The temperature control shall be designed to prevent new energy from being used to heat the space above the heating set point temperature or cool the space below the cooling set point temperature.)~~ Reserved.

502.4 Air Leakage ((for All Occupancies)):

502.4.1: The requirements of this section shall apply to all buildings and structures, or portions thereof, and only to those

locations separating outdoor ambient conditions from interior spaces that are heated or mechanically cooled.

502.4.2: Exterior doors and windows shall be designed to limit air leakage into or from the building envelope. Site-constructed doors and windows shall be sealed in accordance with Section 502.4.3.

502.4.3:

a. Exterior joints around windows and door frames, openings between walls and foundation, between walls and roof and wall panels; openings at penetrations of utility services through walls, floors, and roofs; and all other openings in the building envelope for all occupancies and all other openings in between units in R-1 occupancy shall be sealed, caulked, gasketed, or weatherstripped to limit air leakage.

b. All exterior doors or doors serving as access to an enclosed unheated area shall be weatherstripped to limit leakage around their perimeter when in a closed position.

c. Site built windows are exempt from testing but shall be made tight fitting. Fixed lights shall have glass retained by stops with sealant or caulking all around. Operating sash shall have weatherstripping working against overlapping trim, and a closer/latch which will hold the sash closed. The window frame to framing crack shall be made tight with caulking, overlapping membrane, or other approved technique.

d. Openings that are required to be fire resistive are exempt from this section.

502.4.4 Recessed Lighting Fixtures: When installed in the building envelope, recessed lighting fixtures 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 rated, installed inside a sealed box constructed from a minimum one-half inch thick gypsum wall board, or constructed from a preformed polymeric vapor barrier, or other air tight assembly manufactured for this purpose.

3. Type IC rated, certified under ASTM E283 to have no more than 2.0 cfm air movement from the conditioned space to the ceiling cavity. The lighting fixture shall be tested at seventy-five Pascals or 1.57 lbs/ft² pressure difference and have a label attached, showing compliance.

AMENDATORY SECTION (Amending WSR 92-01-140, filed 12/19/91, effective 7/1/92)

WAC 51-11-0525 Equation 1--Group R Occupancy.

EQUATION 1 — GROUP R OCCUPANCY

TARGET UA

$$U_{AT} = U_W A_W + U_{BGW} A_{BGW} + U_G A_G + U_F A_F + U_{RC} A_{RC} + U_{CC} A_{CC} + U_D A_D + F_S P_S$$

Where:

U_{AT} = the target combined thermal transmittance of the gross exterior wall, floor, and roof/ceiling assembly area.

U_W = the thermal transmittance value of the opaque above-grade wall area found in Table 5-1.

A_W = opaque above-grade wall area.

U_{BGW} = the thermal transmittance value of the below-grade opaque wall area found in Table 5-1.

A_{BGW} = opaque below-grade wall area.

U_G = the thermal transmittance value of the glazing area found in Table 5-1.

A_G = .15 (total floor area of the conditioned space).

U_F = the thermal transmittance value of the floor area found in Table 5-1.

A_F = floor area over unconditioned space.

U_{RC} = the thermal transmittance value of the roof/ceiling area found in Table 5-1.

A_{RC} = roof/ceiling area.

U_{CC} = the thermal transmittance value of the cathedral ceiling area found in Table 5-1.

A_{CC} = cathedral ceiling area.

U_D = the thermal transmittance value of the opaque door area found in table 5-1.

A_D = opaque door area.

F_S = concrete slab component F-value found in Table 5-1.

P_S = linear ft. of concrete slab perimeter.

**EQUATION 1 -- GROUP R OCCUPANCY
TARGET UA**

$$UA_T = U_W A_W + U_{BGW} A_{BGW} + U_G A_G + U_F A_F + U_{RC} A_{RC} + U_{CC} A_{CC} + U_D A_D + F_S P_S$$

Where:

UA_T = the target combined thermal transmittance of the gross exterior wall, floor, and roof/ceiling assembly area.

U_W = the thermal transmittance value of the opaque above grade wall area found in Table 5-1.

A_W = opaque above grade wall area.

U_{BGW} = the thermal transmittance value of the below grade opaque wall area found in Table 5-1.

A_{BGW} = opaque below grade wall area.

U_G = the thermal transmittance value of the glazing area found in Table 5-1.

A_G = .15 (total floor area of the conditioned space).

U_F = the thermal transmittance value of the floor area found in Table 5-1.

A_F = floor area over unconditioned space.

U_{RC} = the thermal transmittance value of the roof/ ceiling area found in Table 5-1.

A_{RC} = roof/ceiling area.

U_{CC} = the thermal transmittance value of the cathedral ceiling area found in Table 5-1.

A_{CC} = cathedral ceiling area.

U_D = the thermal transmittance value of the opaque door area found in table 5-1.

A_D = opaque door area.

F_S = concrete slab component F-value found in Table 5-1.

P_S = Lineal ft. of concrete slab perimeter.

AMENDATORY SECTION (Amending WSR 92-01-100, filed 12/19/91,
effective 7/1/92)

WAC 51-11-0527 Equation 3--Group R Occupancy.

EQUATION 3 — GROUP R OCCUPANCY —

PROPOSED UA

$$UA = U_W A_W + U_{BGW} A_{BGW} + U_G A_G + U_F A_F + U_{RC} A_{RC} + U_{CC} A_{CC} + U_D A_D + F_S P_S$$

Where:

UA = the combined thermal transmittance of the gross exterior wall, floor, and roof/ceiling assembly area.

U_W = the thermal transmittance of the opaque wall area.

U_{BGW} = the thermal transmittance value of the below grade opaque wall area.

A_{BGW} = opaque below grade wall area.

A_W = opaque wall area.

U_G = the thermal transmittance of the glazing (window or skylight) area.

A_G = glazing area, including windows in exterior doors.

U_F = the thermal transmittance of the floor area.

A_F = floor area over unconditioned space.

U_{RC} = the thermal transmittance of the roof/ceiling area.

A_{RC} = roof/ceiling area.

U_{CC} = the thermal transmittance of the cathedral ceiling area.

A_{CC} = cathedral ceiling area.

U_D = the thermal transmittance value of the opaque door area.

A_D = opaque door area.

F_S = concrete slab component f factor.

P_S = lineal ft. of concrete slab perimeter.

NOTE: Where more than one type of wall, window, roof/ceiling, door, and skylight is used, the U and A terms for those items shall be expanded into sub elements as:

$$U_{W1} A_{W1} + U_{W2} A_{W2} + U_{W3} A_{W3} + \dots \text{etc.}$$

**EQUATION 3 -- GROUP R OCCUPANCY
PROPOSED UA**

$$UA = U_W A_W + U_{BGW} A_{BGW} + U_G A_G + U_F A_F + U_{RC} A_{RC} + U_{CC} A_{CC} + U_D A_D + F_S P_S$$

Where:

UA = the combined thermal transmittance of the gross exterior wall, floor, and roof/ceiling assembly area.

U_W = the thermal transmittance of the opaque wall area.

U_{BGW} = the thermal transmittance value of the below grade opaque wall area.

A_{BGW} = opaque below grade wall area.

A_W = opaque wall area.

U_G = the thermal transmittance of the glazing (window or skylight) area.

A_G = glazing area, including windows in exterior doors.

U_F = the thermal transmittance of the floor area.

A_F = floor area over unconditioned space.

U_{RC} = the thermal transmittance of the roof/ceiling area.

A_{RC} = roof/ceiling area.

U_{CC} = the thermal transmittance of the cathedral ceiling area.

A_{CC} = cathedral ceiling area.

U_D = the thermal transmittance value of the opaque door area.

A_D = opaque door area.

F_S = concrete slab component f-factor.

P_S = lineal ft. of concrete slab perimeter.

NOTE: Where more than one type of wall, window, roof/ceiling, door, and skylight is used, the U and A terms for those items shall be expanded into sub-elements as:

$$U_{W1} A_{W1} + U_{W2} A_{W2} + U_{W3} A_{W3} + \dots \text{etc.}$$

AMENDATORY SECTION (Amending WSR 91-01-111, filed 12/19/90, effective 7/1/91)

WAC 51-11-0601 Scope.

601.1 General: This chapter establishes design criteria in terms of prescribed requirements for building construction.

The provisions of this chapter are applicable to all Group R Occupancies. Occupancies shall comply with all the requirements of Chapter 5 except for the modifications herein specified.

The building envelope requirements of this chapter may be met by installing one of the prescriptive packages in Tables 6-1 to 6-6 (~~for Group R Occupancy, or Table 6-7 for Other Occupancies~~). Installed components shall meet the requirements of section 602 and 605. Compliance with nominal R-Values shall be demonstrated for the thermal resistance of the added insulation in framing cavities and/or insulated sheathing only and shall not include the thermal transmittance of other building materials or air films, but shall permit interruption by occasional framing members.

AMENDATORY SECTION (Amending WSR 91-01-112, filed 12/19/90, effective 7/1/91)

WAC 51-11-0602 Building envelope requirements for Group R Occupancy.

602.1 Roof/Ceiling: Ceilings below vented attics and single-rafter, joist-vaulted ceilings shall be insulated to not less than the nominal R-value specified for ceilings in Tables 6-1 to 6-6 as applicable.

602.2 Exterior Walls Both Above and Below Grade: Above grade exterior walls shall be insulated to not less than the nominal R-value specified in Tables 6-1 to 6-6 as applicable. The following walls should be considered to meet R-19 without additional documentation:

1. 2 x 6 framed and insulated with R-19 fiberglass batts.
2. 2 x 4 framed and insulated with R-13 fiberglass batts plus R-3.2 foam sheathing.
3. 2 x 4 framed and insulated with R-11 fiberglass batts plus R-5.0 foam sheathing.

602.3 Exterior Walls (Below Grade): Below grade exterior walls surrounding conditioned space shall be insulated to not less than the nominal R-value specified for below grade walls in Tables 6-1 to 6-6 as applicable.

602.4 Slab-on-grade Floors: Slab-on-grade floors shall be insulated along their perimeter to not less than the nominal R-values specified for slab-on-grade floors in Tables 6-1 to 6-6 as applicable. Slab insulation shall be installed in compliance with section 502.1.4.8. See Chapter 5, section 502.1.4.9, for additional requirements for radiant slab heating.

602.5 Floors Over Unconditioned Space: Floors over unconditioned spaces, such as vented crawl spaces, unconditioned basements, and parking garages shall be insulated to not less than the nominal R-value shown for floors over unconditioned spaces, in Tables 6-1 to 6-6.

602.6 Exterior Doors: (~~For all doors which are less than fifty percent glazing, including fire doors, the opaque door area shall have a maximum area weighted average U-value not exceeding that shown in Tables 6-1 to 6-6 and the glazing shall comply with section 602.7. U-values for the opaque door area shall be determined in accordance with section 502.1.5.1. For all doors which are fifty percent or more glazing, the entire door area shall comply with the glazing requirements in section 602.7.~~) Doors shall comply with Sections 602.6.1 and 602.6.2.

EXCEPTIONS:

1. Doors whose area and U-value are included in the calculations for compliance with the requirements for glazing in section 602.7 shall be exempt from the door U-value requirements (~~stated above~~) prescribed in Tables 6-1 to 6-6.

2. One unlabeled or untested exterior swinging door with the maximum area of 24 square feet may be installed for ornamental, security or architectural purposes. Products using this exception shall not be included in either the U-value or glazing area calculation requirements.

602.6.1 Exterior Door Area: For half-lite and full-lite doors, the glazing area shall be included in calculating the allowed total glazing area in Section 602.7.1. Single glazing used for ornamental, security or architectural purposes shall be calculated using the exception to Section 602.7.2.

602.6.2 Exterior Door U-Value: Doors, including fire doors, shall have a maximum area weighted average U-value not exceeding that prescribed in Tables 6-1 to 6-6.

602.7 Glazing:

602.7.1 Glazing Area: The total glazing area as defined in Chapter 2 shall not exceed the percentage of gross conditioned floor area specified in Tables 6-1 to 6-6. This area shall also include any glazing in doors (~~using the exception of section 602.6~~).

602.7.2 Glazing U-Value: The total glazing area as defined in Chapter 2 shall have an area weighted average U-value not to exceed that specified in Tables 6-1 to 6-6. U-values for glazing shall be determined in accordance with section 502.1.5.1. These areas and U-values shall also include any doors using the exception of section 602.6.

If the U-values for all glazing products are below the U-value specified, then no calculations are required. If compliance is to be achieved through an area weighted calculation, then the areas and U-values shall be included in the plans submitted with a building permit application.

EXCEPTION: Single glazing for ornamental, security, or architectural purposes shall have its area doubled and shall be included in the percentage of the

total glazing area as allowed for in Tables 6-1 to 6-6. The maximum area (before doubling) allowed for the total of all single glazing is one percent of the floor area.

602.8 Air Leakage For Group R Occupancy: The minimum air leakage control measures shall be as specified in section 502.4 as applicable.

AMENDATORY SECTION (Amending WSR 91-01-112, filed 12/19/90, effective 7/1/91)

WAC 51-11-0603 Building mechanical systems for Group R Occupancy.

603.1: Group R Occupancies that are space heated by air-to-air, ground-to-air, or water-to-air heat pumps shall comply with Table 6-2 or 6-4 or 6-6 for other fuels. System sizing shall be determined by an analysis consistent with section 503.2 of this Code, or, when approved by the building official, Chapter 9. All mechanical equipment efficiencies and service water heating system efficiencies shall comply with standards as stated in sections 503 and 504 of this Code.

AMENDATORY SECTION (Amending WSR 92-01-140, filed 12/19/91, effective 7/1/92)

WAC 51-11-0625 Table 6-1.

TABLE 61-0 PRESCRIPTIVE REQUIREMENTS FOR GROUP R OCCUPANCY
CLIMATE ZONE I - HEATING BY ELECTRIC RESISTANCE

OPTION	GLAZING % FLOOR AREA	GLAZING U-VALUE	DOORS U-VALUE	CEILING ¹	VAULTED CEILING ¹	WALLS ABOVE GRADE	WALLS ² BELOW GRADE	FLOOR ³	SLAB ⁴ ON GRADE
I.	10%	0.46	0.40	R-30	R-30	R-21	R-10	R-30	R-10
II.	12%	0.43	0.30	R-38	R-30	R-19	R-10	R-30	R-10
III.	12%	0.40	0.40	R-38	R-30	R-21	R-10	R-30	R-10
IV.	14%	0.40	0.30	R-38	R-30	R-19	R-10	R-30	R-10
V.	18%	0.39	0.30	R-38	R-30	R-21	R-10	R-30	R-10
VI.	21%	0.36	0.30	R-38	R-30	R-21	R-10	R-30	R-10
VII.	25%	0.32 ¹	0.20	R-38	R-30	R-19+R-21	R-10	R-30	R-10
VIII.	30%	0.29 ¹	0.20	R-38	R-30	R-19+R-21	R-10	R-30	R-10

* Reference Case

1. Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor area of 18%, it shall comply with all of the requirements of the 21% glazing option (for height). Proposed designs which exceed the specific requirements of a listed option above, may achieve compliance by Chapter 61-0.3 of the Code.

2. Requirement applies to all ceilings except single or false vaulted ceilings. Metal decks are allowed for wood ceilings.

3. Requirement applicable only to single or false vaulted ceilings.

4. Below grade walls shall be limited either to a minimum level of R-19 or to the barrier to the same level as walls above grade. Exterior finishes located at below grade walls shall be:

- 1. Thermally treated spacer or exposed to ambient air conditions.
- 2. Required slab perimeter finishes shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See section 603.4.
- 3. The following options shall be applicable to buildings below the three stories above the first floor for glazing areas of 31% or less, 0.33 maximum for glazing areas of 30% or less.
- 4. This wall finishes requirement does not apply to walls with vertical finishes plus R-5 foam sheathing.

water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See section 603.2.

**TABLE 6-1 • PRESCRIPTIVE REQUIREMENTS¹ FOR GROUP R OCCUPANCY
CLIMATE ZONE 1 • HEATING BY ELECTRIC RESISTANCE**

Option	Glazing % Floor Area	Glazing U-Value	Doors ¹⁰ U-Value	Ceiling ²	Vaulted Ceiling ³	Wall Above Grade	Wall•int ⁴ Below Grade	Wall•ext ⁴ Below Grade	Floor ⁵	Slab ⁴ on Grade
I.	10%	0.46	0.40	R-38	R-30	R-21	R-21	R-10	R-30	R-10
II.	12%	0.43	0.20	R-38	R-30	R-19	R-19	R-10	R-30	R-10
III.	12%	0.40 ⁹	0.40	R-38	R-30	R-21	R-21	R-10	R-30	R-10
IV.*	15%	0.40 ⁹	0.20	R-38	R-30	R-19	R-19	R-10	R-30	R-10
V.	18%	0.39	0.20	R-38	R-30	R-21	R-21	R-10	R-30	R-10
VI.	21%	0.36	0.20	R-38	R-30	R-21	R-21	R-10	R-30	R-10
VII.⁷	25%	0.32 ⁷	0.20	R-38	R-30	R-19+R5 ⁸	R-21	R-10	R-30	R-10
VIII.⁷	30%	0.29 ⁷	0.20	R-38	R-30	R-19+R5 ⁸	R-21	R-10	R-30	R-10

* Reference Case

- ¹ Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor area of 19%, it shall comply with all of the requirements of the 21% glazing option (or higher). Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.
- ² Requirement applies to all ceilings except single rafter or joist vaulted ceilings. 'Adv' denotes Advanced Framed Ceiling.
- ³ Requirement applicable only to single rafter or joist vaulted ceilings.
- ⁴ Below grade walls shall be insulated either on the exterior to a minimum level of R-10, or on the interior to the same level as walls above grade. Exterior insulation installed on below grade walls shall be a water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See section 602.2.
- ⁵ Floors over crawl spaces or exposed to ambient air conditions.
- ⁶ Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See section 602.4.
- ⁷ The following options shall be applicable to buildings less than three stories: 0.35 maximum for glazing areas of 25% or less; 0.32 maximum for glazing areas of 30% or less.
- ⁸ This wall insulation requirement denotes R-19 wall cavity insulation plus R-5 foam sheathing.
- ⁹ Until December 31, 1994, a vinyl or wood double-pane window, excluding sliding glass doors, constructed with a minimum ½ inch air space between glazings, and either a low-e glazing or an argon fill of no less than 90%, shall be deemed to satisfy the glazing U-value. The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy the electric resistance path in the Washington State Energy Code."
- ¹⁰ Doors, including all fire doors, shall be assigned default U-values from Table 10-6C or 10-6D.

WAC 51-11-0626 Table 6-2.

TABLE 6-2 - PRESCRIPTIVE REQUIREMENTS FOR GROUP R OCCUPANCY CLIMATE ZONE 1 - HEATING BY OTHER FUELS

OTTON	IFVAC EQUIP. EFFIC.	GLAZING FLOOR AREA	GLAZING U-VALUE	DOORS U-VALUE	CEILING	VAULTED CEILING	WALLS ABOVE GRADE	WALLS BELOW GRADE	WALLS ABOVE GRADE	WALLS BELOW GRADE	FLOOR	SLAB ON GRADE
I	Med.	10%	0.70	0.40	R-30	R-30	R-15	R-15	R-10	R-10	R-19	R-10
II	Med.	12%	0.65	0.40	R-30	R-30	R-15	R-15	R-10	R-10	R-19	R-10
III	High	21%	0.75	0.40	R-30	R-30	R-19	R-19	R-10	R-10	R-19	R-10
IV	Med.	21%	0.65	0.40	R-30	R-30	R-19	R-19	R-10	R-10	R-19	R-10
V	Low	21%	0.60	0.40	R-30	R-30	R-19	R-19	R-10	R-10	R-19	R-10
VI	Med.	25%	0.45	0.40	R-35	R-35	R-19	R-19	R-10	R-10	R-25	R-10
VII	Med.	30%	0.40	0.40	R-30	R-30	R-19	R-19	R-10	R-10	R-25	R-10

- 1. Reference: See
- 2. Minimum requirements for each climate zone. For example, if a proposed design has a glazing ratio to the conditioned floor area of 18%, it shall comply with all of the requirements of the 21% glazing application (high). Proposed design which cannot meet the specific requirements of a listed climate zone may calculate compliance by Chapter 405.3 of the Code.
- 3. Requirement applies to all ceilings except single rather or joint vented ceilings. Also, does not address framed ceilings.
- 4. Requirement applicable only to single rather or joint vented ceilings.
- 5. Below grade walls shall be insulated either to the exterior to a minimum level of R-10, or to the interior to the same level as walls above grade. Exterior insulation installed on below grade walls shall be treated as permanent exterior insulation for the intended use, and installed according to the manufacturer's specifications. See section 602.3.
- 6. Floor over crawl space or exposed to unheated air conditions
- 7. Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See section 602.4.
- 8. The following options shall be applicable to buildings as shown three stories or less: maximum for glazing area of 35% or less; 0.45 minimum for glazing area of 30% or less.
- 9. This wall insulation requirement does not apply to wall cavity insulation plus R-5 foam sheathing.
- 10. Minimum HVAC Equipment Efficiency requirements: Low - does not apply; Medium - AFUE of 0.74; High - does not apply; AFUE of 0.78; Very High - does not apply; AFUE of 0.81.
- 11. Minimum HVAC Equipment Efficiency requirements for hot water pumps: Low - does not apply; Medium - does not apply; High - does not apply; Very High - does not apply. Water and ground source heat pumps shall be considered as medium efficiency and have a minimum COP as required in Table 6-7.

**TABLE 6-2 • PRESCRIPTIVE REQUIREMENTS¹ FOR GROUP R OCCUPANCY
CLIMATE ZONE 1 • HEATING BY OTHER FUELS**

Option	HVAC ⁹ Equip. Effic.	Glazing % Floor Area	Glazing U-Value	Doors ¹¹ U-Value	Ceiling ²	Vaulted Ceiling ³	Wall Above Grade	Wall•int ⁴ Below Grade	Wall•ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
I.	Med.	10%	0.70	0.40	R-30	R-30	R-15	R-15	R-10	R-19	R-10
II.	Med.	12%	0.65 ¹⁰	0.40	R-30	R-30	R-15	R-15	R-10	R-19	R-10
III.	High	21%	0.75	0.40	R-30	R-30	R-19	R-19	R-10	R-19	R-10
IV.*	Med.	21%	0.65 ¹⁰	0.40	R-30	R-30	R-19	R-19	R-10	R-19	R-10
V.	Low	21%	0.60	0.40	R-30	R-30	R-19	R-19	R-10	R-19	R-10
VI.⁷	Med.	25%	0.45 ⁷	0.40	R-38	R-30	R-19	R-19	R-10	R-25	R-10
VII.⁷	Med.	30%	0.40 ⁷	0.40	R-30	R-30	R-19	R-19	R-10	R-25	R-10

* Reference Case

¹ Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor area of 19%, it shall comply with all of the requirements of the 21% glazing option (or higher). Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.

² Requirement applies to all ceilings except single rafter or joist vaulted ceilings. 'Adv' denotes Advanced Framed Ceiling.

³ Requirement applicable only to single rafter or joist vaulted ceilings.

⁴ Below grade walls shall be insulated either on the exterior to a minimum level of R-10, or on the interior to the same level as walls above grade. Exterior insulation installed on below grade walls shall be a water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See section 602.2.

⁵ Floors over crawl spaces or exposed to ambient air conditions.

⁶ Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See section 602.4.

⁷ The following options shall be applicable to buildings less than three stories: 0.50 maximum for glazing areas of 25% or less; 0.45 maximum for glazing areas of 30% or less.

⁸ This wall insulation requirement denotes R-19 wall cavity insulation plus R-5 foam sheathing.

⁹ Minimum HVAC Equipment efficiency requirement. 'Low' denotes an AFUE of 0.74. 'Med.' denotes an AFUE of 0.78. 'High' denotes an AFUE of 0.88.

Minimum HVAC Equipment efficiency requirement for heat pumps. 'Low' denotes an HSFP of 6.35. 'Med' denotes an HSFP of 6.8. 'High' denotes an HSFP of 7.7. Water and ground source heat pumps shall be considered as medium efficiency and have a minimum COP as required in Table 5-7.

¹⁰ Until December 31, 1994, an aluminum, double-pane window, excluding sliding glass doors, constructed with a minimum 7/16 inch air space between glazings shall be deemed to satisfy the glazing U-value. The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy the other fuels path in the Washington State Energy Code."

¹¹ Doors, including all fire doors, shall be assigned default U-values from Table 10-6C or 10-6D.

AMENDATORY SECTION (Amending WSR 92-01-100, filed 12/19/91,
effective 7/1/92)

WAC 51-11-0627 Table 6-3.

TABLE 6-3 - PRESCRIPTIVE REQUIREMENTS FOR GROUP R OCCUPANCY - CLIMATE ZONE 3 - HEATING BY ELECTRIC RESISTANCE

OPTION	GLAZING R FLOOR AREA	GLAZING U-VALUE	DOORS U-VALUE	CEILING ¹	VAULTED CEILING ¹	WALLS ABOVE GRADE	WALLS ² IN ¹ BELOW GRADE	FLOOR ¹	SLAB ¹ ON GRADE
I	10%	0.38	0.20	R-38	R-30	R-21	R-12	R-30	R-10
II	12%	0.40	0.20	R-38	R-30	R-19+R-5'	R-12	R-25	R-10
III	15%	0.40	0.20	R-38	R-30	R-19+R-5'	R-12	R-30	R-10
IV	18%	0.38	0.20	R-38	R-30	R-19+R-5'	R-12	R-30	R-10
V	21%	0.35	0.20	R-38A6v	R-38	R-19+R-5'	R-12	R-30	R-10
VI	25%	0.30 ¹	0.20	R-49A6v	R-38	R-19+R-5'	R-12	R-30	R-10
VII	30%	0.28 ¹	0.20	R-60A6v	R-38	R-21+R-7.5'	R-12	R-30	R-10

¹ Reference Code

- Minimum requirements for each option listed. For example, if a project design has a glazing ratio in the conditional floor area of 18%, it shall comply with all of the requirements of the 18% glazing option (see 3(b)). Proposed design which does not meet the specific requirements of a listed option may calculate compliance by Chapter 4 or 5 of this Code.
- Requirements apply to all ceilings except single rafters or joist raftered ceilings, 1-ply drywall, Advanced Framed Ceiling.
- Requirements applicable only to single rafters or joist raftered ceilings.
- Below grade walls shall be insulated either on the exterior or a minimum level of R-10, or on the interior in the same level as walls above grade. Exterior insulation limited on below grade walls shall be a water resistant material, mass furnished for its intended use and installed according to the manufacturer's specifications. See section 403.2.
- Floors over crawl spaces or exposed to ambient air conditions.
- Required slab perimeter insulation shall be a water resistant material, mass furnished for its intended use, and installed according to manufacturer's specifications. See section 403.4.
- The following options shall be applicable to buildings four stories or more: 0.33 maximum for glazing areas of 25% or less; 0.31 maximum for glazing areas of 30% or less.
- This wall limitation requires most exterior R-19 wall cavity insulation plus R-5 foam sheathing.
- This wall limitation requires exterior R-21 wall cavity insulation plus R-7.5 foam sheathing.

**TABLE 6-3 • PRESCRIPTIVE REQUIREMENTS¹ FOR GROUP R OCCUPANCY
CLIMATE ZONE 2 • HEATING BY ELECTRIC RESISTANCE**

Option	Glazing % Floor Area	Glazing U-Value	Doors ¹¹ U-value	Ceiling ²	Vaulted Ceiling ³	Wall Above Grade	Wall•int ⁴ Below Grade	Wall•ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
I.	10%	0.38	0.20	R-38	R-30	R-21	R-21	R-12	R-30	R-10
II.	12%	0.40 ¹⁰	0.20	R-38	R-30	R-19+R-5 ⁸	R-21	R-12	R-25	R-10
III.*	15%	0.40 ¹⁰	0.20	R-38	R-30	R-19+R-5 ⁸	R-21	R-12	R-30	R-10
IV.	18%	0.38	0.20	R-38	R-30	R-19+R-5 ⁸	R-21	R-12	R-30	R-10
V.⁷	21%	0.35	0.20	R-38 ^{Adv}	R-38	R-19+R-5 ⁸	R-21	R-12	R-30	R-10
VI.⁷	25%	0.30 ⁷	0.20	R-49 ^{Adv}	R-38	R-19+R-5 ⁸	R-21	R-12	R-30	R-10
VII.⁷	30%	0.28 ⁷	0.20	R-60 ^{Adv}	R-38	R-21+R7.5 ⁹	R-21	R-12	R-30	R-10

* Reference Case

- ¹ Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor area of 19%, it shall comply with all of the requirements of the 21% glazing option (or higher). Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.
- ² Requirement applies to all ceilings except single rafter or joist vaulted ceilings. 'Adv' denotes Advanced Framed Ceiling.
- ³ Requirement applicable only to single rafter or joist vaulted ceilings.
- ⁴ Below grade walls shall be insulated either on the exterior to a minimum level of R-10, or on the interior to the same level as walls above grade. Exterior insulation installed on below grade walls shall be a water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See section 602.2.
- ⁵ Floors over crawl spaces or exposed to ambient air conditions.
- ⁶ Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See section 602.4.
- ⁷ The following options shall be applicable to buildings less than three stories: 0.33 maximum for glazing areas of 25% or less; 0.31 maximum for glazing areas of 30% or less.
- ⁸ This wall insulation requirement denotes R-19 wall cavity insulation plus R-5 foam sheathing.
- ⁹ This wall insulation requirement denotes R-21 wall cavity insulation plus R-7.5 foam sheathing.
- ¹⁰ Until December 31, 1994, a vinyl or wood double-pane window, excluding sliding glass doors, constructed with a minimum ½ inch air space between glazings, and either a low-e glazing or an argon fill of no less than 90%, shall be deemed to satisfy the glazing U-value. The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy the electric resistance path in the Washington State Energy Code."
- ¹¹ Doors, including all fire doors, shall be assigned default U-values from Table 10-6C or 10-6D.

AMENDATORY SECT. 4 (Amending WSR 92-01-1 , filed 12/19/91,
effective 7/1/92)

WAC 51-11-0628 Table 6-4.

TABLE 6-4-4 PREScriptive REQuIREMENTS FOR GROUP R OCCUPANCY CLIMATE ZONE 3 HEATING BY OTHER FUELS

OPTION	HVAC EQUIPMENT SPEC.	GLAZING FLOOR AREA	GLAZING U-VALUE	DOORS U-VALUE	CEILING	VAULTED CEILING	WALL ABOVE GRADE	WALL BELOW GRADE	FLOOR	SLAB ON GRADE
I.	Med.	10%	0.70	0.40	R-38	R-30	R-19	R-12	R-25	R-10
II.	Med.	13%	0.65	0.40	R-38	R-30	R-19	R-12	R-25	R-10
III.	High	17%	0.65	0.40	R-38	R-30	R-19	R-12	R-25	R-10
IV.	Med.	17%	0.60	0.40	R-38	R-30	R-19	R-12	R-30	R-10
V.	Low	17%	0.50	0.40	R-38	R-30	R-19	R-12	R-30	R-10
VI.	Med.	21%	0.50	0.40	R-38	R-30	R-19	R-12	R-30	R-10
VII.	Med.	25%	0.40	0.40	R-38	R-30	R-19	R-12	R-30	R-10
VIII.	Med.	30%	0.40	0.40	R-38	R-30	R-19	R-12	R-30	R-10

- 1. Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio in the conditions floor area of 19%, it shall comply with all of the requirements of the 21% glazing option or higher. Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapter 6 of this Code.
- 2. Requirements apply to all ceiling except single tier or false wood ceiling. Add 2 inches of covered framed ceiling.
- 3. Requirements applicable only to single tier or false wood ceiling.
- 4. Below grade walls shall be insulated either on the exterior or interior to a minimum R-10 or on the interior to the same level as wall above grade. Exterior insulation installed on below grade walls shall be a minimum R-5 and shall be manufactured for the intended use, and installed according to the manufacturer's specifications. See section 603.2.
- 5. Floors over crawl spaces are exposed to ambient air conditions.
- 6. Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See section 603.4.
- 7. The following options shall be applicable to buildings less than three stories—0.45 minimum for glazing area—0.25 minimum for ceiling area—0.40 minimum for glazing area of 20% or less.
- 8. The wall insulation requirement is more R-19 wall cavity insulation plus R-5 from sheathing.
- 9. Minimum HVAC Equipment efficiency requirements—Low density as AFUE of 0.74—Med. density as AFUE of 0.78—High density as AFUE of 0.82.

**TABLE 6-4 • PRESCRIPTIVE REQUIREMENTS¹ FOR GROUP R OCCUPANCY
CLIMATE ZONE 2 • HEATING BY OTHER FUELS**

Option	HVAC ⁹ Equip. Effic.	Glazing % Floor Area	Glazing U-Value	Doors ¹¹ U-Value	Ceiling ²	Vaulted Ceiling ³	Wall Above Grade	Wall•int ⁴ Below Grade	Wall•ext ⁴ Below Grade	Floor ⁵	Slab ⁶ on Grade
I.	Med.	10%	0.70	0.40	R-38	R-30	R-19	R-19	R-12	R-25	R-10
II.	Med.	12%	0.65 ¹⁰	0.40	R-38	R-30	R-19	R-19	R-12	R-25	R-10
III.	High	17%	0.65 ¹⁰	0.40	R-38	R-30	R-19	R-19	R-12	R-25	R-10
IV.*	Med.	17%	0.60	0.40	R-38	R-30	R-19	R-19	R-12	R-30	R-10
V.	Low	17%	0.50	0.40	R-38	R-30	R-19	R-19	R-12	R-30	R-10
VI.	Med.	21%	0.50	0.40	R-38	R-30	R-19	R-19	R-12	R-30	R-10
VII.	Med.	25%	0.40 ⁷	0.40	R-38	R-30	R-19	R-19	R-12	R-30	R-10
VIII.	Med.	30%	0.40 ⁷	0.40	R-38	R-30	R-19	R-19	R-12	R-30	R-10

* Reference Case

¹ Minimum requirements for each option listed. For example, if a proposed design has a glazing ratio to the conditioned floor area of 19%, it shall comply with all of the requirements of the 21% glazing option (or higher). Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.

² Requirement applies to all ceilings except single rafter or joist vaulted ceilings. 'Adv' denotes Advanced Framed Ceiling.

³ Requirement applicable only to single rafter or joist vaulted ceilings.

⁴ Below grade walls shall be insulated either on the exterior to a minimum level of R-10, or on the interior to the same level as walls above grade. Exterior insulation installed on below grade walls shall be a water resistant material, manufactured for its intended use, and installed according to the manufacturer's specifications. See section 602.2.

⁵ Floors over crawl spaces or exposed to ambient air conditions.

⁶ Required slab perimeter insulation shall be a water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications. See section 602.4.

⁷ The following options shall be applicable to buildings less than three stories: 0.45 maximum for glazing areas of 25% or less; 0.40 maximum for glazing areas of 30% or less.

⁸ This wall insulation requirement denotes R-19 wall cavity insulation plus R-5 foam sheathing.

⁹ Minimum HVAC Equipment efficiency requirement. 'Low' denotes an AFUE of 0.74. 'Med.' denotes an AFUE of 0.78. 'High' denotes an AFUE of 0.88.

¹⁰ Until December 31, 1994, an aluminum, double-pane window, excluding sliding glass doors, constructed with a minimum 7/16 inch air space between glazings shall be deemed to satisfy the glazing U-value. The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy the other fuels path in the Washington State Energy Code."

¹¹ Doors, including all fire doors, shall be assigned default U-values from Table 10-6C or 10-6D.

WAC 51-11-0629 Table 6-5.

~~TABLE 6-5
LOG HOMES PRESCRIPTIVE REQUIREMENTS¹
HEATING BY ELECTRIC RESISTANCE~~

OPTION	AVERAGE LOG THICKNESS	GLAZING % FLOOR AREA	GLAZING U VALUE	DOORS U VALUE	CEILING¹	VAULTED CEILING	FLOOR²	SLAB ON GRADE
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~~CLIMATE ZONE 1~~

I.⁷	5.5°	15%	0.31	0.14	R 60 Adv	R 38	R 38	R 10
II.⁷	7.5°	15%	0.40	0.20	R 60 Adv	R 38	R 30	R 10
III.⁷	9.6°	15%	0.40	0.20	R 38	R 30	R 30	R 10

~~CLIMATE ZONE 2~~

IV.⁷	6.7°	15%	0.31	0.14	R 60 Adv	R 38	R 38	R 10
V.⁷	8.7°	15%	0.40	0.14	R 60 Adv	R 38	R 38	R 10
VI.⁷	9.8°	15%	0.40	0.20	R 60 Adv	R 38	R 30	R 10
VII.⁷	10.5°	15%	0.40	0.20	R 49 Adv	R 38	R 30	R 10
VIII.⁷	13.5°	15%	0.40	0.20	R 38	R 30	R 30	R 10

~~Reference Case~~

~~1 For Group R Occupancy use Table 6-5 for only the portion of floor area using log/solid timber walls. Use Tables 6-1 to 6-4 for all other portions of the floor area. Minimum requirements are for each option listed. Interpolations between options is not permitted. Proposed designs which cannot meet the specific requirements of a listed option above, may calculate compliance by Chapters 4 or 5 of this Code.~~

~~2 Required minimum average log thickness.~~

~~3 "Adv" denotes Advanced Framing. Requirement applies to all ceilings except single rafter joist vaulted ceilings.~~

~~4 Requirement applicable only to single rafter joist vaulted ceilings.~~

~~5 Floors over crawl spaces or exposed to ambient air conditions.~~

~~6 Required slab perimeter insulation shall be water-resistant material, manufactured for its intended use, and installed according to manufacturer's specifications.~~

~~7 These options shall be applicable to buildings less than three stories.~~

TABLE 6-5
LOG HOMES PRESCRIPTIVE REQUIREMENTS¹
HEATING BY ELECTRIC RESISTANCE

Option	Average ² Log Thickness	Glazing % Floor Area	Glazing U-Value	Doors ¹⁰ U-Value	Ceiling ³	Vaulted ⁴ Ceiling	Floor ⁵	Slab ⁶ on Grade
Climate Zone 1								
I.⁷	5.5"	15%	0.31 ⁹	0.14	R-60 Adv	R-38	R-38	R-10
II.⁷	7.5"	15%	0.40 ⁸	0.20	R-60 Adv	R-38	R-30	R-10
III.*	9.6"	15%	0.40 ⁸	0.20	R-38	R-30	R-30	R-10
Climate Zone 2								
IV.⁷	6.7"	15%	0.31 ⁹	0.14	R-60 Adv	R-38	R-38	R-10
V.⁷	8.7"	15%	0.40 ⁸	0.14	R-60 Adv	R-38	R-38	R-10
VI.⁷	9.8"	15%	0.40 ⁸	0.20	R-60 Adv	R-38	R-30	R-10
VII.⁷	10.5"	15%	0.40 ⁸	0.20	R-49 Adv	R-38	R-30	R-10
VIII.*	13.5"	15%	0.40 ⁸	0.20	R-38	R-30	R-30	R-10

* Reference Case

- ¹ For Group R Occupancy use Table 6-5 for only the portion of floor area using log/solid timber walls. Use Tables 6-1 to 6-4 for all other portions of the floor area. Minimum requirements are for each option listed. Interpolations between options is not permitted. Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.
- ² Required minimum average log thickness.
- ³ 'Adv' denotes Advanced Framing. Requirement applies to all ceilings except single rafter joist vaulted ceilings.
- ⁴ Requirement applicable only to single rafter joist vaulted ceilings.
- ⁵ Floors over crawl spaces or exposed to ambient air conditions.
- ⁶ Required slab perimeter insulation shall be water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications.
- ⁷ These options shall be applicable to buildings less than three stories.
- ⁸ Until December 31, 1994, a vinyl or wood double-pane window, excluding sliding glass doors, constructed with a minimum 1/2 inch air space between glazings, and either a low-e glazing or an argon fill of no less than 90%, shall be deemed to satisfy the glazing U-value. The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy the electric resistance path in the Washington State Energy Code."
- ⁹ Until December 31, 1994, a vinyl or wood double-pane window, excluding sliding glass doors, constructed with a minimum 1/2 inch air space between glazings and both a low-e glazing and an argon fill of no less than 90%, shall be deemed to satisfy the glazing U-value. The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy either the electric resistance path or the other fuels path for log homes in the Washington State Energy Code."
- ¹⁰ Doors, including all fire doors, shall be assigned default U-values from Table 10-6C or 10-6D.

WAC 51-11-0630 Table 6-6.

TABLE 6-6
LOG HOMES PRESCRIPTIVE REQUIREMENTS
HEATING BY OTHER FUELS

OPTION	AVERAGE LOG THICKNESS	CLAZING % FLOOR AREA	CLAZING U-VALUE	DOORS U-VALUE	CEILING ¹	VAULTED ¹ CEILING	FLOOR ¹	SLAB ¹ ON GRADE
<u>CLIMATE ZONE 1</u>								
I. ⁷	3.5"	21%	0.40	0.39	R-49 Adv	R-38	R-30	R-10
II.	4.4"	21%	0.40	0.40	R-38	R-30	R-19	R-10
III.	5.2"	21%	0.50	0.40	R-38	R-30	R-19	R-10
IV.	6.5"	21%	0.60	0.40	R-38	R-30	R-19	R-10
V.	7.0"	21%	0.60	0.40	R-38	R-30	R-19	R-10
VI. ⁸	8.2"	21%	0.65	0.40	R-38	R-30	R-19	R-10
<u>CLIMATE ZONE 2</u>								
VII. ⁷	3.5"	17%	0.31	0.14	R-60 Adv	R-38	R-38	R-10
VIII. ^{7,1}	3.5"	17%	0.40	0.40	R-60 Adv	R-38	R-30	R-10
IX. ⁷	4.6"	17%	0.40	0.40	R-60 Adv	R-38	R-30	R-10
X.	5.4"	17%	0.40	0.40	R-38	R-30	R-30	R-10
XI.	6.8"	17%	0.50	0.40	R-38	R-30	R-30	R-10
XII. ⁸	9.0"	17%	0.60	0.40	R-38	R-30	R-30	R-10

Reference Code

¹ For Group R Occupancy use Table 6-6 for only the portion of floor area using log/solid timber walls. Use Tables 6-1 to 6-4 for all other portions of the floor area. Minimum requirements are for each option listed. Interpolations between options is not permitted. Proposed designs which cannot meet the specific requirements of a listed option above, may calculate compliance by Chapters 4 or 5 of this Code.

⁷ Required minimum average log thickness.

⁸ Adv denotes Advanced Framing. Requirement applies to all ceilings except single rafter joint vaulted ceilings. Requirement applicable only to single rafter joint vaulted ceilings.

¹ Floors over crawl spaces or exposed to ambient air conditions.

¹ Required slab perimeter insulation shall be water-resistant material, manufactured for its intended use, and installed according to manufacturer's specifications.

⁷ These options shall be applicable to buildings less than three stories.

⁸ For this option, minimum HVAC system efficiency is an AFUE of 0.88.

**TABLE 6-6
LOG HOMES PRESCRIPTIVE REQUIREMENTS¹
HEATING BY OTHER FUELS**

Option	Average ² Log Thickness	Glazing % Floor Area	Glazing U-Value	Doors ¹¹ U-Value	Ceiling ³	Vaulted ⁴ Ceiling	Floor ⁵	Slab ⁶ on Grade
Climate Zone 1								
I.⁷	3.5"	21%	0.40	0.39	R-49 Adv	R-38	R-30	R-10
II.	4.4"	21%	0.40	0.40	R-38	R-30	R-19	R-10
III.	5.2"	21%	0.50	0.40	R-38	R-30	R-19	R-10
IV.	6.5"	21%	0.60	0.40	R-38	R-30	R-19	R-10
V.	7.0"	21%	0.60	0.40	R-38	R-30	R-19	R-10
VI.*	8.2"	21%	0.65 ⁹	0.40	R-38	R-30	R-19	R-10
Climate Zone 2								
VII.⁷	3.5"	17%	0.31 ¹⁰	0.14	R-60 Adv	R-38	R-38	R-10
VIII.^{7,8}	3.5"	17%	0.40	0.40	R-60 Adv	R-38	R-30	R-10
IX.⁷	4.6"	17%	0.40	0.40	R-60 Adv	R-38	R-30	R-10
X.	5.4"	17%	0.40	0.40	R-38	R-30	R-30	R-10
XI.	6.8"	17%	0.50	0.40	R-38	R-30	R-30	R-10
XII.*	9.0"	17%	0.60	0.40	R-38	R-30	R-30	R-10

* Reference Case

- ¹ For Group R Occupancy use Table 6-6 for only the portion of floor area using log/solid timber walls. Use Tables 6-1 to 6-4 for all other portions of the floor area. Minimum requirements are for each option listed. Interpolations between options is not permitted. Proposed designs which cannot meet the specific requirements of a listed option above may calculate compliance by Chapters 4 or 5 of this Code.
- ² Required minimum average log thickness.
- ³ 'Adv' denotes Advanced Framing. Requirement applies to all ceilings except single rafter joist vaulted ceilings.
- ⁴ Requirement applicable only to single rafter joist vaulted ceilings.
- ⁵ Floors over crawl spaces or exposed to ambient air conditions.
- ⁶ Required slab perimeter insulation shall be water resistant material, manufactured for its intended use, and installed according to manufacturer's specifications.
- ⁷ These options shall be applicable to buildings less than three stories.
- ⁸ For this option, minimum HVAC system efficiency is an AFUE of 0.88.
- ⁹ Until December 31, 1994, an aluminum, double-pane window, excluding sliding glass doors, constructed with a minimum 7/16 inch air space between glazings shall be deemed to satisfy the glazing U-value. The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy the other fuels path in the Washington State Energy Code."
- ¹⁰ Until December 31, 1994, a vinyl or wood double-pane window, excluding sliding glass doors, constructed with a minimum 1/2 inch air space between glazings and both a low-e glazing and an argon fill of no less than 90%, shall be deemed to satisfy the glazing U-value. The only labeling requirement for products using this exception shall be a description of the product, and a label stating: "This product is deemed to satisfy either the electric resistance path or the other fuels path for log homes in the Washington State Energy Code."
- ¹¹ Doors, including all fire doors, shall be assigned default U-values from Table 10-6C or 10-6D.

WAC 51-11-1006 Section 1006 Default U-values for glazing and doors.

1006.1 Untested Glazing and Doors: Untested glazing and doors shall be assigned the ((following)) U-values((=

a. ~~Manufactured glazing products:~~

single glazing (all): _____ U = 1.20; _____
double glazing:
aluminum or steel framed: _____ U = 0.90; _____
wood or vinyl framed: _____ U = 0.75; _____

b. ~~Nonmanufactured site built fixed lite glazing products with a minimum of one half inch airspace in a wood frame only. All products supplied by manufacturers, such as kits for solariums, shall use the default U values for manufactured glazing products cited above.~~

air filled: _____ U = 0.60; _____
argon filled: _____ U = 0.55; _____
low e, air filled: _____ U = 0.50; _____
low e, argon filled: _____ U = 0.40; _____

~~Products which do not comply with all of these criteria shall use the default U values listed under manufactured glazing products.~~

c. ~~For Doors, see Table 10-6 on the next page))~~ from Tables 10-6A, 10-6B, 10-6C or 10-6D as appropriate.

~~E 10-6 TRANSMISSION COEFFICIENTS (U) FOR WOOD AND STEEL DOORS~~
~~Rtu/hr-ft²-°F~~

Nominal Door Thickness, Inches	Descriptions	No Storm Door	Wood Storm Door^c	Metal Storm Door^d
Wood Doors^b				
1-3/8	Panel door with 7/16 inch panels^e	0.57	0.33	0.37
1-3/8	Hollow core flush door	0.47	0.30	0.32
1-3/8	Solid core flush door	0.39	0.26	0.28
1-3/4	Panel door with 7/16 inch panels^e	0.57	0.33	0.36
1-3/4	Hollow core flush door	0.46	0.29	0.32
1-3/4	Panel door with 1-1/8 inch panels^e	0.39	0.26	0.28
1-3/4	Solid core flush door	0.33	0.28	0.25
2-1/4	Solid core flush door	0.27	0.20	0.21
Steel Doors^b				
1-3/4	Fiberglass or mineral wool core w/ steel stiffeners, no thermal break^f	0.60	----	----
1-3/4	Paper honeycomb core without thermal break^f	0.56	----	----
1-3/4	Solid urethane foam core without thermal break^a	0.40	----	----
1-3/4	Solid fire rated mineral fiberboard core without thermal break^f	0.38	----	----
1-3/4	Polystyrene core without thermal break (18 gage commercial steel)^f	0.35	----	----
1-3/4	Polyurethane core without thermal break (18 gage commercial steel)^f	0.29	----	----
1-3/4	Polyurethane core without thermal break (24 gage commercial steel)^f	0.29	----	----
1-3/4	Polyurethane core w/ thermal break & wood perimeter (24 gage commercial steel)^f	0.20	----	----
1-3/4	Solid urethane foam core with thermal break	0.19	0.16	0.17

~~Note: All U-factors for exterior doors in this table are for doors with no glazing, except for the storm doors which are in addition to the main exterior door. Any glazing area in exterior doors should be included with the appropriate glass type and analyzed. Interpolation and moderate extrapolation are permitted for door thicknesses other than those specified.~~

~~Value are based on a nominal 32 by 80 in. door size with no glazing.~~

~~Outside air conditions: 15 mph wind speed, 0°F air temperature; inside air conditions: natural convection, 70°F air temperature.~~

~~Values for wood storm door are for approximately 50 percent glass area.~~

~~Values for metal storm door are for any percent glass area.~~

~~55 percent panel area.~~

~~ASTM C-236 hotbox data on a nominal 3 by 7 ft door size with no glazing.~~

~~The U-factors in Table 6 are for exterior wood and steel doors. The values given for wood doors were calculated, and those for steel doors were taken from hot box tests (Sabine et al 1975; Yellor 1965) or from manufacturer's test reports. An outside surface conductance of 6.0 Btu/hr-ft²-°F was used, and the indoor surface conductance was taken as 1.4 Btu/hr-ft²-°F for vertical surfaces with horizontal heat flow. All values given are for exterior doors without glazing. If an exterior door contains glazing, the glazing should be analyzed as a window.~~

TABLE 10-6A
Window Default Table

Description ^{1,2,3,4}		Frame Type ^{5,6}		
		Aluminum	Aluminum Thermal Break ⁷	Wood/Vinyl
Single		1.20	1.20	1.20
Double, < 1/2"	Clear	0.92	0.75	0.63
	Clear + Argon	0.87	0.71	0.60
	Low-e	0.85	0.69	0.58
	Low-e + Argon	0.79	0.62	0.53
Double, ≥ 1/2"	Clear	0.86	0.69	0.58
	Clear + Argon	0.83	0.67	0.55
	Low-e	0.78	0.61	0.51
	Low-e + Argon	0.75	0.58	0.48
Triple,	Clear	0.70	0.53	0.43
	Clear + Argon	0.69	0.52	0.41
	Low-e	0.67	0.49	0.40
	Low-e + Argon	0.63	0.47	0.37

- 1 < 1/2" = a minimum dead air space of less than 0.5 inches between the panes of glass.
≥ 1/2" = a minimum dead air space of 0.5 inches or greater between the panes of glass.
- 2 Any low-e (emissivity) coating (0.1, 0.2 or 0.4).
- 3 U-values listed for argon shall consist of sealed, gas-filled insulated units for argon, CO2, SF6, argon/SF6 mixtures and Krypton.
- 4 "Glass block" assemblies may use a U-value of 0.51.
- 5 Insulated fiberglass framed products shall use wood/vinyl U-values.
- 6 Aluminum clad wood windows shall use the U-values listed for wood/vinyl windows.
- 7 Aluminum Thermal Break = An aluminum thermal break framed window shall incorporate the following minimum design characteristics:
 - a) The thermal conductivity of the thermal break material shall be not more than 3.6 Btu-in/hr/ft²/degree F;
 - b) The thermal break material must produce a gap in the frame material of not less than 0.210 inches; and,
 - c) All metal framing members of the products exposed to interior and exterior air shall incorporate a thermal break meeting the criteria in a) and b) above.

TABLE 10-6B
APPROXIMATE WINDOW AND SKYLIGHT DEFLECTION TABLE¹

DESCRIPTION ^{2,3,4,5,6}	FRAME TYPE ^{7,8}			
	ALUMINUM	ALUM. THERMAL BREAK ⁹	WOOD/VINYL	ALUM. CLAD WOOD/REINFORCED VINYL ¹⁰
Double, Clear 1/4"	0.82	0.66	0.56	0.59
Double, Clear 1/4" + argon	0.77	0.63	0.53	0.56
Double, Low-e4 1/4"	0.76	0.61	0.52	0.54
Double, Low-e2 1/4"	0.73	0.58	0.49	0.51
Double, Low-e1 1/4"	0.70	0.55	0.47	0.49
Double, Low-e4 1/4" + argon	0.70	0.55	0.47	0.49
Double, Low-e2 1/4" + argon	0.66	0.52	0.43	0.46
Double, Low-e1 1/4" + argon	0.64	0.50	0.41	0.43
Double, Clear 3/8"	0.78	0.63	0.54	0.57
Double, Clear 3/8" + argon	0.75	0.60	0.51	0.54
Double, Low-e4 3/8"	0.72	0.57	0.48	0.51
Double, Low-e2 3/8"	0.69	0.54	0.45	0.48
Double, Low-e1 3/8"	0.66	0.51	0.43	0.46
Double, Low-e4 3/8" + argon	0.68	0.53	0.44	0.47
Double, Low-e2 3/8" + argon	0.63	0.49	0.41	0.44
Double, Low-e1 3/8" + argon	0.61	0.47	0.39	0.41
Double, Clear 1/2"	0.75	0.60	0.50	0.54
Double, Clear 1/2" + argon	0.72	0.58	0.48	0.51
Double, Low-e4 1/2"	0.68	0.53	0.44	0.47
Double, Low-e2 1/2"	0.64	0.50	0.41	0.44
Double, Low-e1 1/2"	0.61	0.47	0.39	0.42
Double, Low-e4 1/2" + argon	0.65	0.50	0.42	0.44
Double, Low-e2 1/2" + argon	0.60	0.46	0.37	0.40
Double, Low-e1 1/2" + argon	0.58	0.43	0.35	0.38
Triple, Clear 1/4"	0.66	0.52	0.42	0.44
Triple, Clear 1/4" + argon	0.63	0.49	0.39	0.42
Triple, Low-e4 1/4"	0.64	0.50	0.40	0.40
Triple, Low-e2 1/4"	0.62	0.48	0.39	0.41
Triple, Low-e1 1/4"	0.61	0.47	0.38	0.40
Triple, Low-e4 1/4" + argon	0.60	0.46	0.37	0.39
Triple, Low-e2 1/4" + argon	0.58	0.43	0.34	0.37
Triple, Low-e1 1/4" + argon	0.57	0.42	0.34	0.36
Triple, Clear 1/2"	0.61	0.46	0.37	0.40
Triple, Clear 1/2" + argon	0.59	0.45	0.36	0.38
Triple, Low-e4 1/2"	0.58	0.43	0.35	0.37
Triple, Low-e2 1/2"	0.55	0.41	0.32	0.35
Triple, Low-e1 1/2"	0.54	0.39	0.31	0.33
Triple, Low-e4 1/2" + argon	0.55	0.41	0.32	0.35
Triple, Low-e2 1/2" + argon	0.52	0.38	0.30	0.32
Triple, Low-e1 1/2" + argon	0.51	0.37	0.29	0.31

Footnotes to Table 10-6B

- 1 Subtract 0.02 from the listed default U-value for non-aluminum spacer. Acceptable spacer materials may include but is not limited to fiberglass, wood and butyl or other material with an equivalent thermal performance.
- 2 1/4" = a minimum dead air space of 0.25 inches between the panes of glass.
3/8" = a minimum dead air space of 0.375 inches between the panes of glass.
1/2" = a minimum dead air space of 0.5 inches between the panes of glass.
Product with air spaces different than those listed above shall use the value for the next smaller air space; i.e. 3/4-inch = 1/2-inch U-values, 7/16-inch = 3/8-inch U-values, 5/16-inch = 1/4-inch U-values.
- 3 Low-e4 (emissivity) shall be 0.4 or less.
Low-e2 (emissivity) shall be 0.2 or less.
Low-e1 (emissivity) shall be 0.1 or less.
- 4 U-values listed for argon shall consist of sealed, gas-filled insulated units for argon, CO₂, SF₆, and argon/SF₆ mixtures. The following conversion factor shall apply to Krypton gas-filled units: 1/4" or greater with krypton is equivalent to 1/2" argon.
- 5 Dividers placed between glazing: The U-value listed shall be used where the divider has a minimum gap of 1/8-inch between the divider and lite of each inside glass surface. Add 0.03 to the listed U-value for True Divided Lite windows.
- 6 "Glass block" assemblies may use a U-value of 0.51.
- 7 Insulated fiberglass framed products shall use wood/vinyl U-values.
- 8 Subtract 0.02 from the listed default values for solariums.
- 9 Aluminum Thermal Break = An aluminum thermal break framed window shall incorporate the following minimum design characteristics:
 - a) The thermal conductivity of the thermal break material shall be not more than 3.6 Btu-in/hr/ft²/F°;
 - b) The thermal break material must produce a gap in the frame material of not less than 0.210 inches; and,
 - c) All metal framing members of the products exposed to interior and exterior air shall incorporate a thermal break meeting the criteria in a) and b) above.
- 10 Aluminum clad wood windows shall use the U-values listed for Aluminum Clad Wood/Reinforced Vinyl windows. Vinyl clad wood window shall use the U-values listed for Wood/Vinyl windows. Any vinyl frame window with metal reinforcement in more than one rail shall use the U-values listed for Aluminum Clad Wood/Reinforced Vinyl window.

TABLE 10-6C
TRANSMISSION COEFFICIENTS (U) FOR WOOD AND STEEL DOORS
Btu/h · ft² · F

Nominal Door Thickness, Inches	Description	No Storm Door	Wood Storm Door ^c	Metal Storm Door ^d
Wood Doors^b				
1-3/8	Panel door with 7/16 inch panels ^e	0.57	0.33	0.37
1-3/8	Hollow core flush door	0.47	0.30	0.32
1-3/8	Solid core flush door	0.39	0.26	0.28
1-3/4	Panel door with 7/16 inch panels ^e	0.57	0.33	0.36
1-3/4	Hollow core flush door	0.46	0.29	0.32
1-3/4	Panel door with 3/4 inch panels ^e	0.40	0.27	0.29
1-3/4	Panel door with 1-1/8 inch panels ^e	0.39	0.26	0.28
1-3/4	Solid core flush door	0.33	0.28	0.25
2-1/4	Solid core flush door	0.27	0.20	0.21
Steel Doors^b				
1-3/4	Fiberglass or mineral wool core w/ steel stiffeners, no thermal break ^f	0.60	---	---
1-3/4	Paper honeycomb core without thermal break ^f	0.56	---	---
1-3/4	Solid urethane foam core without thermal break ^a	0.40	---	---
1-3/4	Solid fire rated mineral fiberboard core without thermal break ^f	0.38	---	---
1-3/4	Polystyrene core without thermal break (18 gage commercial steel) ^f	0.35	---	---
1-3/4	Polyurethane core without thermal break (18 gage commercial steel) ^f	0.29	---	---
1-3/4	Polyurethane core without thermal break (24 gage commercial steel) ^f	0.29	---	---
1-3/4	Polyurethane core w/ thermal break & wood perimeter (24 gage commercial steel) ^f	0.20	---	---
1-3/4	Solid urethane foam core with thermal break	0.19	0.16	0.17

Note: All U-values for exterior doors in this table are for doors with no glazing, except for the storm doors which are in addition to the main exterior door. Any glazing area in exterior doors should be included with the appropriate glass type and analyzed. Interpolation and moderate extrapolation are permitted for door thicknesses other than those specified.

- a Values are based on a nominal 32 by 80 in. door size with no glazing.
- b Outside air conditions: 15 mph wind speed, 0°F air temperature; inside air conditions: natural convection, 70°F air temperature.
- c Values for wood storm door are for approximately 50 percent glass area.
- d Values for metal storm door are for any percent glass area.
- e 55 percent panel area.
- f ASTM C 236 hotbox data on a nominal 3 by 7 ft door size with no glazing.

The U-values in Table 6C are for exterior wood and steel doors. The values given for wood doors were calculated, and those for steel doors were taken from hotbox tests (Sabine et al. 1975; Yellot 1965) or from manufacturer's test reports. An outdoor surface conductance of 6.0 Btu/h · ft² · °F was used, and the indoor surface conductance was taken as 1.4 Btu/h · ft² · °F for vertical surfaces with horizontal heat flow. All values given are for exterior doors without glazing. If an exterior door contains glazing, refer to Table 10-6D.

TABLE 10-6D
APPROVED GLAZED DOOR DEFAULT U-VALUES²

Description ^{2,3,4,5}	Door Material			
	Insulated ⁶		Wood ⁷	
	Full-Lite ^{4,9}	Half-Lite ^{10,11}	Full-Lite ³	Half-Lite ¹⁰
Double, Clear 1/4"	0.39	0.31	0.47	0.42
Double, Clear 1/4" + argon	0.37	0.30	0.45	0.41
Double, Low-e4 1/4"	0.36	0.30	0.44	0.41
Double, Low-e2 1/4"	0.35	0.29	0.43	0.40
Double, Low-e1 1/4"	0.24	0.28	0.41	0.39
Double, Low-e4 1/4" + argon	0.33	0.28	0.41	0.39
Double, Low-e2 1/4" + argon	0.31	0.26	0.39	0.38
Double, Low-e1 1/4" + argon	0.31	0.26	0.38	0.37
Double, Clear 3/8"	0.37	0.30	0.45	0.41
Double, Clear 3/8" + argon	0.36	0.29	0.44	0.41
Double, Low-e4 3/8"	0.34	0.28	0.42	0.40
Double, Low-e2 3/8"	0.33	0.28	0.41	0.39
Double, Low-e1 3/8"	0.21	0.26	0.38	0.37
Double, Low-e4 3/8" + argon	0.32	0.27	0.40	0.38
Double, Low-e2 3/8" + argon	0.29	0.25	0.37	0.37
Double, Low-e1 3/8" + argon	0.29	0.25	0.36	0.36
Double, Clear 1/2"	0.36	0.29	0.44	0.41
Double, Clear 1/2" + argon	0.34	0.28	0.42	0.40
Double, Low-e4 1/2"	0.32	0.27	0.40	0.38
Double, Low-e2 1/2"	0.30	0.26	0.38	0.37
Double, Low-e1 1/2"	0.29	0.25	0.36	0.36
Double, Low-e4 1/2" + argon	0.30	0.26	0.38	0.37
Double, Low-e2 1/2" + argon	0.28	0.25	0.36	0.36
Double, Low-e1 1/2" + argon	0.28	0.24	0.34	0.35
Triple, Clear 1/4"	0.31	0.26	0.39	0.38
Triple, Clear 1/4" + argon	0.29	0.25	0.37	0.37
Triple, Low-e4 1/4"	0.30	0.26	0.38	0.37
Triple, Low-e2 1/4"	0.29	0.25	0.37	0.36
Triple, Low-e4 1/4" + argon	0.27	0.24	0.35	0.35
Triple, Low-e2 1/4" + argon	0.26	0.24	0.34	0.35

Footnotes to Table 10-6D

- 1 Subtract 0.02 from the listed default U-value for insulated spacers. Insulated spacer material includes fiberglass, wood and butyl or other material with an equivalent Thermal performance.
- 2 1/4" = a minimum dead air space of 0.25 inches between the panes of glass.
3/8" = a minimum dead air space of 0.375 inches between the panes of glass.
1/2" = a minimum dead air space of 0.5 inches between the panes of glass.
Products with air spaces different than those listed above shall use the value for next smaller air space; i.e. 3/4-inch = 1/2-inch U-values, 7/16-inch = 3/8-inch U-values, 5/16-inch = 1/4-inch U-values.
- 3 Low-e4 (emissivity) shall be 0.4 or less.
Low-e2 (emissivity) shall be 0.2 or less.
Low-e1 (emissivity) shall be 0.1 or less.
- 4 U-values listed for argon shall consist of sealed, gas-filled, insulated units for argon, CO₂, SF₆, and argon/SF₆ mixtures.
The following conversion factor shall apply to Krypton gas-filled units:
1/4-inch or greater airspace of Krypton gas-fill = 1/2-inch air space Argon gas-fill.
- 5 Dividers placed between glazing: The U-values listed shall be used where the divider has a minimum gap of 1/8-inch between the divider and lite of each inside glass surface. Add 0.03 to the listed U-value for True Divided Lite windows.
- 6 Insulated = Any urethane insulated foam core door with a thermal break. Thermal Break = A thermal break door shall incorporate the following design characteristics:
 - a) The thermal conductivity of the thermal break material shall be not more than 3.6 Btu-in/hr•ft²•°F; and
 - b) The thermal break material shall not be less than 0.210 inches.
- 7 Wood = any wood door.
- 8 Full-Lite = A door that consists of more than 50 percent glazing.
- 9 Add 0.05 to the listed U-value for Full-Lite values if the insulated door does not have a thermal break.
- 10 Half-Lite = A door that consists of 50 percent or less glazing.
- 11 Add 0.06 to the listed U-value for Half-Lite values if the insulated door does not have a thermal break.