

FORM OF ORDER AND TRANSMITTAL BY BOARD, COMMISSION, OR COUNCIL

State of Washington

Washington State Building Code Council

(name of governing body)

(agency name, if applicable)

Resolution No. \_\_\_\_\_

Administrative Order No. 88-10

(1) Be it resolved by the Washington State Building Code Council acting at Angle Lake Fire Hall, 2929 South 200th Street, Seattle, WA that it does adopt the annexed rules relating to: The Washington State Energy Code, Chapter 51-12, as proposed by interested parties.

(2) ALTERNATIVE A. Use only for Adoption of Permanent Rules.

This action is taken pursuant to Notice No. WSR 88-24-037 filed with the code reviser on Dec. 6, 1988. These rules shall take effect: [ ] thirty days after they are filed with the code reviser pursuant to RCW 34.04.040(2). [X] at a later date, such date being July 1, 1989.

(2) ALTERNATIVE B. Use only for Adoption of Emergency Rules.

We, \_\_\_\_\_, find that an emergency exists and that this order is necessary for the preservation of the public health, safety, or general welfare and that observance of the requirements of notice and opportunity to present views on the proposed action would be contrary to public interest. A statement of the facts constituting the emergency is:

These rules are therefore adopted as emergency rules to take effect upon filing with the code reviser.

(3) Pursuant to the requirements of RCW 34.04.026 that "every agency shall incorporate the most specific, but in no case omit all, of the following language alternatives when adopting or amending rules" fill in statement (a), (b), or (c) as appropriate:

[ ] (a) This rule is promulgated pursuant to RCW \_\_\_\_\_ and is intended to administratively implement that statute. [X] (b) This rule is promulgated pursuant to RCW 19.27.074 and 19.27A.010&020 which directs that the

Washington State Building Code Council

(agency)

has authority to implement the provisions of RCW 19.27A

(name of act or RCW citation)

[ ] (c) This rule is promulgated under the general rule-making authority of the

(agency)

as authorized in RCW \_\_\_\_\_

(4) The undersigned hereby declares that the agency has complied with the provisions of the Open Public Meetings Act (chapter 42.30 RCW), the Administrative Procedure Act (chapter 34.04 RCW), and the State Register Act (chapter 34.08 RCW) in the adoption of these rules.

(5) This order, after being first recorded in the order register of this governing body, is herewith transmitted to the Code Reviser for filing pursuant to chapter 34.04 RCW and chapter 1-12 WAC.

APPROVED AND ADOPTED January 20, 1989

STATE OF WASHINGTON FILED

JAN 31 1989

By Marc Sullivan Chair, Washington State Building Code Council

CODE REVISER'S OFFICE WSR 89-04-043

AMENDATORY SECTION (Amending Resolution No. 86-17, filed 9/23/86)

## WAC 51-12-102 SECTION 102. SCOPE.

This Code sets forth minimum requirements for the design of new buildings and structures that provide facilities or shelter for public assembly, educational, business, mercantile, institutional, storage and residential occupancies, as well as those portions of factory and industrial occupancies designed primarily for human occupancy by regulating their exterior envelopes and the selection of their HVAC, service water heating, electrical distribution and illuminating systems and equipment for effective use of energy.

Buildings shall be designed to comply with the requirements of either Chapter 4, 5, or 6 of this Code.

(a) Exempt Buildings. Buildings and structures or portions thereof meeting any of the following criteria shall be exempt from the building envelope requirements of Sections 402 to 405 inclusive, and Sections 601 and 605, but shall comply with all other requirements for building mechanical systems, service water heating and lighting systems.

1. Buildings and structures or portions thereof whose peak design rate of energy usage is less than three and four tenths (3.4) Btu/h per square foot or one point zero (1.0) watt per square foot of floor area for all purposes.
2. Buildings and structures or portions thereof which are neither heated according to the definition of heated space in chapter 2, nor cooled, by a depletable energy source, including buildings heated with wood with installed back-up or supplemental heating utilizing a depletable energy source provided that: The depletable energy use for space conditioning complies with the requirements of exemption (1).
3. Greenhouses that are isolated from any conditioned space and not intended for occupancy.

(b) Application to Existing Buildings.

1. Additions to Existing Buildings. Additions to existing buildings or structures may be made to such buildings or structures without making the entire building or structure comply, provided that the new additions shall conform to the provisions of this Code.
2. Historic Buildings. The Building Official may modify the specific requirements of this Code for historic buildings and require in lieu thereof alternate requirements which will result in a reasonable degree of energy efficiency. This modification may be allowed for those buildings which have been specifically designated as historically significant by the state or local governing body, or listed in "The National Register of Historic Places" or which have been determined to be eligible for listing.
3. Alterations and Repairs. All alterations and repairs to buildings or portions thereof originally constructed subject to the requirements of this 1986 Code shall conform to the provisions of this Code without exception. For all other existing buildings, initial tenant alterations shall comply with the new construction requirements of this Code. Other alterations and repairs may be made to existing buildings and moved buildings without making the entire building comply with all of the requirements of this Code for new buildings, provided the following requirements are met:
  - A. Building Envelope. The result of the alterations or repairs (1) improves the energy efficiency of the building and (2) complies with the overall average thermal transmittance values of the gross area of the elements of the exterior building envelope in Table 4-2, 4-3, or 4-4 of Chapter 4 or the

nominal R values in Tables 6-1 or 6-5 and U values in Table 6-2 or glazing requirements in Table 6-5 of Chapter 6.

**EXCEPTIONS:**

1. Untested storm windows may be installed over existing glazing, however, where glass and sash are being replaced in low-rise residential buildings, class 75 glazing shall be installed where there is an electric resistance space heating system and class 90 glazing shall be installed where there is any other space heating system.
2. Where the structural elements of the altered portions of roof/ceiling, wall or floor are not being replaced, these elements shall be deemed to comply with this Code if all existing framing cavities which are exposed during construction are filled to the full depth with batt insulation or insulation having an equivalent nominal R value while, for roof/ceilings, maintaining the required space for ventilation. Existing roof/ceilings, walls and floors without framing cavities need not be insulated.
  - B. Building Mechanical Systems. Those parts of systems which are altered or replaced shall comply with this Code.

**EXCEPTION:** For low-rise residential buildings not initially subject to the requirements of this Code, replacement heat pumps shall meet class 2 efficiencies specified in Table 6-3 and replacement central combustion heating equipment shall be equipped with spark ignition. All other replacement combustion heating equipment including horizontal furnaces shall have a minimum AFUE of .65.

- C. Service Water Heating. Those parts of systems which are altered or replaced shall comply with Section 420.
- D. Lighting. Those parts of systems which are altered or replaced in buildings initially constructed subject to the requirements of this Code shall comply with Sections 425 and 426. Other remodels or replacements of lighting systems which are part of a substantial remodel shall comply with Sections 425 and 426. In addition, other remodels or replacements which affect the lighting system of an entire floor shall comply with Sections 425 and 426. For all other remodels or replacements which affect the lighting system of less than an entire floor those parts of systems which are altered or replaced shall comply with the switching requirements of Section 425 and, unless they comply with the lighting power budgets of Section 426 shall either maintain or reduce the watts per square foot of installed lighting.
- E. Change From Unheated to Heated Space. Changes from unheated to heated space for buildings, structures or portions thereof shall be permitted if the building, structure or portion thereof is brought into compliance with the building envelope requirements as per Section 102(b)3 of this Code, but in no case, less than those building envelope requirements in effect at the time of the initial construction of the building.

The Building Official may approve designs of alterations or repairs which do not fully conform with all of the requirements of this Code when in his/her opinion

full conformance is physically impossible and/or economically impractical and: (1) the alteration or repair improves the energy efficiency of the building; or (2) the alteration or repair is energy efficient and is necessary for the health, safety, and welfare of the general public.

AMENDATORY SECTION (Amending Order 85-14, filed 11/26/85)

WAC 51-12-206 SECTION 206. F. (~~{RESERVED}~~) FIREPLACE. (1) Any permanently installed masonry fireplace or;  
(2) Any factory-built metal solid fuel burning device designed to be used with an open combustion chamber and without features to control the air to fuel ratio.

AMENDATORY SECTION (Amending Order 85-14, filed 11/26/85)

WAC 51-12-219 SECTION 219. S.  
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.  
SERVICE WATER HEATING DEMAND. The maximum design rate of energy withdrawal from a service water heating system in a designated period of time (usually an hour or a day).  
SHADED. External protection of glazing area from direct solar radiation by use of devices permanently affixed to the structure or by an adjacent building, topographical feature or vegetation.  
SHALL. Where shall is used in specific provision, that provision is mandatory.  
SHOULD. Not mandatory but desirable as good practice.  
SKYLIGHT. A clear or translucent panel or slope set in the plane of a roof to admit daylight into the interior of a building.  
SLAB ON GRADE (in a heated space). Any portion of a slab poured in contact with the ground where the top of the finished slab is less than 12 inches below the final elevation of the nearest exterior grade.  
SOLAR ENERGY SOURCE. Source of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.  
SOLID FUEL BURNING APPLIANCE. Any device for burning wood, coal, or any other nongaseous and nonliquid fuel, including woodstove and fireplace.  
SUBSTANTIALLY REMODELED OR REHABILITATED. Any alteration or restoration of a building or structure within any 12 month period, the cost of which exceeds 60 percent of the current replacement value of the particular building or structure.  
SYSTEM. A combination of equipment and/or controls, accessories, interconnecting means, and terminal elements by which energy is transformed so as to perform a specific function, such as HVAC, service water heating or illumination.

AMENDATORY SECTION (Amending Order 85-14, filed 11/26/85)

WAC 51-12-223 SECTION 223. W X Y Z.

WINDOW THERMAL TESTING. U values for Class 75 or Class 60 glazing shall be the tested values for thermal transmittance due to conduction resulting from either the American Architectural Manufacturers Association (AAMA) 1503.1-1980 test procedure or the American Society for Testing Materials (ASTM) C236 or C976 test procedures; testing shall be conducted under established winter horizontal heat flow test conditions using the 15 mph wind speed and product sample sizes specified under AAMA 1503.1-1980. Testing shall be conducted by a certified testing laboratory. Sealed insulating glass, where used, shall conform to ASTM E-774-81 level C or better.

WOODSTOVE. A solid fuel burning device other than a fireplace, including any fireplace insert, wood stove, wood burning heater, wood stick boiler, coal-fired furnace, coal stove, or similar device burning any solid fuel used for aesthetic or space-heating purposes in a private residence or commercial establishment, which has a heat output less than one million British thermal units per hour. The term "woodstove" does not apply to cook stoves.

EXCEPTION: U values for site built fixed lites shall use window thermal test results when available. If tested results are unavailable, the Building Official shall require documentation based on a tested value of a comparable window.

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.

AMENDATORY SECTION (Amending Order 85-14, filed 11/26/85)

WAC 51-12-305 SECTION 305. VENTILATION.

The outdoor air quantities specified in Table 3-1 for each type of occupancy shall be used as a minimum for design. These quantities are for 100 percent outdoor air ventilating systems, but a reduction to 33 percent of the specified values for recirculating HVAC systems is permitted. In no case, shall the outdoor air quantities be less than 5 CFM per person.

The minimum requirements for openable area to provide natural ventilation are specified in the ((1985)) 1988 Uniform Building Code as adopted by the state of Washington. All kitchens and bathrooms without natural ventilation in Group R Occupancy spaces shall be provided with exhaust fans or other ventilation systems approved by the building official having a capacity of not less than that specified in Table No. 3-1. (See UBC Section 1205.) Ventilation requirements for other occupancy spaces may be met using operable openings as provided in the UBC.

Where a mechanical ventilation system is installed, the mechanical ventilation system shall be capable of supplying to each zone ventilation air with the minimum outdoor air quantities specified in Table No. 3-1 based upon the greater of the occupant densities in that table or the design occupant density. The outdoor air shall be ducted directly to every air handling unit in each zone not provided with sufficient openable area for natural ventilation. The maximum outdoor air quantities used as the basis for calculating the heating and cooling design loads shall not exceed three times the quantities specified in Table No. 3-1.

In all parking garages, other than open parking garages as defined in UBC 709(b), used for storing or handling of automobiles operating under their own power and on all loading platforms in bus terminals, ventilation shall be provided at 1.5 cfm per square foot of gross floor area. The building official may approve an alternate ventilation system designed to exhaust a minimum of 14,000 cfm for each operating vehicle. Such system shall be based on the anticipated

Instantaneous movement rate of vehicles but not less than 2.5 percent (or one vehicle) of the garage capacity. Automatic CO sensing systems may be submitted for approval.

In all buildings used for the repair of automobiles, each repair stall shall be equipped with an exhaust extension duct, extending to the outside of the building, which if over ten feet in length, shall mechanically exhaust 300 cfm. Connecting offices and waiting rooms shall be supplied with conditioned air under positive pressure.

Combustion air requirements shall conform to the requirements of Chapter 6 of the UMC.

Mechanical refrigerating equipment and rooms storing refrigerates shall conform to the requirements of Chapter 15 of the UMC.

EXCEPTION: If outdoor air quantities other than those specified in Table No. 3-1 are used or required because of special occupancy or process requirements, source control of air contamination, health, and safety or other standards, the required outdoor air quantities shall be used as the basis for calculating the heating and cooling design loads.

Table No. 3-1 is an excerpt from ASHRAE Standard 62-73, "Natural and Mechanical Ventilation" published in 1973. Standard 62-73 is no longer in print. ASHRAE now recommends the use of standard 62-81 "Ventilation for Acceptable Indoor Air Quality" for improved ventilation design.

TABLE NO. 3-1

AIR QUANTITIES FOR VENTILATION

Estimated persons/1000 sq. ft. floor area. Use only when design occupancy is not known	Required ventilation air, cubic feet per minute per human occupant, (when the number is bracketed, refer to the notes).	Notes
266	266	61
266	266	61
266	266	61
266	266	61
266	266	61
266	266	61
266	266	61
266	266	61
266	266	61
266	266	61
256	256	51
255	255	50
255	255	50
254	254	49
254	254	49
249	249	44
250	250	45
252	252	47
254	254	49
254	254	49
248	248	43
248	248	43
241	241	36
242	242	37
243	243	38
244	244	39
245	245	40
246	246	41
247	247	42
248	248	43
248	248	43

1. RESIDENTIAL  
 (Private dwelling places,  
 single or multiple units)

Single Unit Dwellings	5	5		270	65
General Living Areas, Bedrooms	-	20		271	66
Kitchens	-	20	1	272	67
Baths, Toilet Rooms	-	20	1	273	68
Basements, Utility Rooms	-	5		274	69
Multiple Unit Dwellings	7	5		275	70
General Living Areas, Bedrooms	-	20	1	276	71
Kitchens	-	20	1	277	72
Baths, Toilet Rooms	-	20	1	278	73
Basements, Utility Rooms	-	5		279	74
Garages	-	(1.5)	2	280	75

2. COMMERCIAL

General Requirements--Merchandising (Apply to all forms unless specially noted)				281	76
Sales Floors and Showrooms (Basement and Street Floors)	30	7		282	77
Sales Floor and Showrooms (Upper floors)	20	7		283	78
				284	79
				285	80
				286	81
				287	82

Estimated persons/1000 sq. ft. floor area. Use only when design occupancy is not known

Required ventilation air, cubic feet per minute per human occupant, (when the number is bracketed, refer to the notes).

	Estimated persons/1000 sq. ft. floor area. Use only when design occupancy is not known	Required ventilation air, cubic feet per minute per human occupant, (when the number is bracketed, refer to the notes).	Notes			
Storage Areas (Serving Sales Floors and Storerooms)	5	5		288	83	
Dressing Rooms	-	7		289	84	
Malls and Arcades	40	7		290	85	
Shipping and Receiving Areas	10	15		291	86	
Warehouses	5	7		292	87	
Elevators	-	7		293	88	
		7		294	89	
Food Markets, Supermarkets, etc.	10	5	3	295	90	
Meat Processing Rooms				296	91	
Drug Stores				297	92	
Pharmacists' Work Rooms	10	20		298	93	
Specialty Shops				299	94	
Pet Shops	-	(1.0)	2	300	95	
Florists	10	5	4	301	96	
Greenhouses	1	5	4, 5	302	97	
Banks (See Sales Floors and Offices				303	98	
Vaults	-	5		304	99	
				305	100	
Food Services				306	101	
Dining Rooms	70	10		307	102	
Kitchens	20	30	6	308	103	
Cafeterias, Short-Order, Drive-Ins, Seating Areas, and Queuing Areas				309	104	
Bars (Predominantly Stand-up)	100	30		310	105	
Cocktail Lounges	150	30		311	106	
	100	30		312	107	
		30		313	108	



Hotels, Motels, Resorts					314	109
Bedrooms (Single, Double)	5				315	110
Living Rooms (Suites)	20				316	111
Baths, Toilets (Attached to Bedrooms)	-		7		317	112
Corridors	5				318	113
Lobbies	30				319	114
Conference Rooms (Small)	70				320	115
Assembly Rooms (Large)	140				321	116
Public Rest Rooms	100				322	117
Cottages (Treat as Single- Unit Dwellings)	-				323	118
(See also Food Services, Industrial, Merchandising, Barber and Beauty Shops, Garages for Associated Hotel/Motel Services)					324	119
					325	120
					326	121
					327	122
					328	123
Dry Cleaners and Laundries						
Commercial	10				329	124
Storage/Pickup Areas	30				330	125
Coin-operated	20				331	126
			9		332	127
Barber, Beauty and Health Services						
Beauty Shops (Hair dressers)	50				333	128
Reducing Salons (Exercise Rooms)	20				334	129
Sauna Baths and Steam Rooms	-				335	130
					336	131

	Estimated persons/1000 sq. Ft. floor area. Use only when design occupancy is not known	Required ventilation air, cubic feet per minute per human occupant, (when the number is bracketed, refer to the notes).	Notes
Barber Shops	25	7	
Photo Studios	10	5	10
Camera Rooms, Stages	10	10	
Darkrooms			
Shoe Repair Shops (Combined Workrooms/ Trade Areas)	10	10	
Garages, Auto Repair Shops, Service Stations	-	(1.5)	2
Parking Garages (Enclosed)	-	(1.5)	2
Auto Repair Workrooms (General)	20	7	2, 11
Service Station Offices			
Theaters			
Ticket Booths	-	5	
Lobbies, (Foyers and Lounges)	150	20	
Auditoriums (in Motion Picture Theaters, Legitimate Theaters, Lecture, Concert and Opera Halls-no smoking)	150	5	
Auditoriums (Smoking Permitted)	150	10	
Stages (with Proscenium and Curtains)	70	10	10, 12
Green Rooms and Workrooms	20	10	
Public Rest Rooms	100	15	

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Ballrooms Public	100	15		361	156
Bowling Alleys (Seating Area)	70	15		362	157
Gymnasiums and Arenas Playing Floors--minimal or No Seating	70	20		364	159
Locker Rooms	20	(30)	13	365	160
Spectator Areas	150	20		366	161
Ramps, Foyers, and Lobbies	150	10		367	162
Pool Rooms	25	20		368	163
Amusement Parlors	25	20		369	164
Tennis, Squash, Handball Courts (Indoor)	-	20		370	165
Swimming Pools (Indoor)	25	15	14	371	166
Ice-skating and Curling Rinks	70	10	14	372	167
Roller Rinks	70	10	14	373	168
Transportation Waiting Rooms	50	15		374	169
				375	170
				376	171
				377	172
				378	173
				379	174

	Estimated persons/1000 sq. ft. floor area. Use only when design occupancy is not known	Required ventilation air, cubic feet per minute per human occupant, (when the number is bracketed, refer to the notes).	Notes		
Garages	-	(1.5)	2	380	175
Ticket and Baggage Areas, Corridors and Gate Areas	50	15		381	176
Control Towers	50	25		382	177
Hangers	2	10	15	383	178
Public Rest Rooms	100	15		384	179
Platform	150	10		385	180
Concourses	150	10		386	181
Repair Shops	-	10		387	182
				388	183
Offices					
General Office Space	10	15		389	184
Conference Rooms	60	25		390	185
Drafting Rooms, Art Rooms	20	7		391	186
Doctor's Consultation Rooms	-	10		392	187
Waiting Rooms (Doctors, Employment Agencies, etc.)	30	10	9	393	188
Lithographing Rooms	20	7	9	394	189
Diao Printing Rooms	20	7		395	190
Computer Rooms	20	5		396	191
Keypunching Rooms	30	7		397	192
Public Rest Rooms	100	15		398	193
				399	194
				400	195

Communication  
 TV/Radio Broadcasting Booths,  
 Radio Studios  
 Motion Picture and TV Stages  
 Pressrooms  
 Composing Rooms  
 Engraving Shops  
 Telephone Switchboard Rooms  
 (Manual)  
 Telephone Switchgear Rooms  
 (Automatic)  
 Teletypewriter/Facsimile Rooms

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3. INSTITUTIONAL

Schools  
 Classrooms  
 Multiple Use Rooms  
 Laboratories  
 Craft Shops, Vocational  
 Training Shops  
 Music, Rehearsal Rooms  
 Auditoriums  
 Gymnasiums  
 Libraries  
 Common Rooms, Lounges  
 Offices  
 Lavatories  
 Locker Rooms  
 Lunchrooms, Dining Halls  
 Corridors  
 Utility Rooms  
 Dormitory Bedrooms

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	Estimated persons/1000 sq. ft. floor area. Use only when design occupancy is not known	Required ventilation air, cubic feet per minute per human occupant, (when the number is bracketed, refer to the notes).	Notes
Hospitals, Nursing, and Convalescent Homes			
Foyers	50	20	432 227
Hallways	50	20	433 228
Single, Dual Bedrooms	15	10	434 229
Wards	20	10	435 230
Food Service Centers	20	35	436 231
Operating Rooms, Delivery Rooms	-	20	437 232
Ready Rooms, Recovery Rooms	-	15	438 233
Amphitheaters	100	10	439 234
Physical Therapy Areas	20	15	440 235
Autopsy Rooms	10	30	441 236
Incinerator Service Areas	-	5	442 237
			443 238
			444 239
For Shops, Restaurants, Utility Rooms, Kitchens, Bathrooms and Other Service Items (See Hotels)			445 240
			446 241
			447 242
Research Institutes			448 243
Laboratories (Light-duty, Nonchemical)	50	15	449 244
Laboratories (Chemical)	50	15	450 245
Laboratories (Heavy-duty)	50	15	451 246
Laboratories (Radioisotope, Chemically and Biologically Toxic)	50	15	452 247
			453 248
			454 249
Machine Shops	50	15	455 250
Darkrooms, Spectroscopy Rooms	50	10	456 251
Animal Rooms	20	40	457 252
			458 253

Military and Naval Installations								
Barracks	20	7	459	254				
Toilets/Washrooms	100	15	460	255				
Shower Rooms	100	10	461	256				
Drill Halls	70	15	462	257				
Ready Rooms, MP Stations	40	7	463	258				
Indoor Target Ranges	70	20	464	259	19			
Museums			465	260				
Exhibit Halls	70	7	466	261				
Workrooms	10	10	467	262				
Warehouses	5	5	468	263				
			469	264				
Prisons (See also Gymnasiums, Libraries, Applicable Industrial Areas)			470	265				
Cell Blocks	20	7	471	266				
Eating Halls	70	15	472	267				
Guard Stations	40	7	473	268				
			474	269				
			475	270				
Veterinary Hospitals								
Kennels, Stalls	20	25	476	271	17			
Operating Rooms	20	25	477	272	17			
			478	273				

Estimated persons/1000 sq. ft. floor area. Use only when design occupancy is not known

Required ventilation air, cubic feet per minute per human occupant, (when the number is bracketed, refer to the notes).

Notes

4. ORGANIZATIONAL

	Estimated persons/1000 sq. ft. floor area. Use only when design occupancy is not known	Required ventilation air, cubic feet per minute per human occupant, (when the number is bracketed, refer to the notes).	Notes
Reception Rooms	30	10	
Churches, Temples (See Theaters, Schools and Offices)	-	-	481 276 482 277 483 278
Legislative Halls Legislative Chambers Committee Rooms and Conference Rooms	70	20	484 279 485 280 486 281
Foyers, Corridors Offices	70 50 10	20 20 10	487 282 488 283 489 284
Press Lounges Press/Radio/TV Booths Public Rest Rooms	20 20 20	20 20 15	490 285 491 286 492 287
Private Rest Rooms (For Food Service, Utilities, etc., see Hotels)	-	20	493 288 494 289 495 290
Police and Fire Stations (See Prisons and Military Installations)	-	-	496 291 497 292 498 293
Survival Shelters	-	5	499 294



1 Installed capacity for intermittent use.

2 cfm per sq. ft. of floor area.

3 Spaces maintained at low temperatures (-10 to 50° F) are not covered by these requirements unless the occupancy is continuous. Ventilation from adjoining spaces is permissible. When the occupancy is intermittent, infiltration will normally exceed the ventilation requirement. (See Chapter 23, Refrigeration Load, ASHRAE Handbook of Fundamentals, 1972.)

4 Maximum allowable concentration (MAC) for sulfur dioxide = 30 microgram/cubic meter.

5 Ventilation to optimize plant growth, temperature, humidity, etc. will almost always be greater than shown.

6 Exhaust to outside; source control as required.

7 Installed capacity for intermittent use.

8 Exhaust to outside; source control as required.

9 Installed equipment must incorporate positive exhaust and control (as required) of undesirable contaminants (toxic or otherwise).

10 Thermal effects probably determine requirements.

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- 11 Stands where engines are run must incorporate systems for positive engine exhaust withdrawal.
- 12 Special ventilation will be needed to eliminate stage effect contaminants.
- 13 cfm/locker.
- 14 The same for air-supported structures.
- 15 Special solvent and exhaust problems handled separately.
- 16 Special contaminant control systems may be required.
- 17 Special requirements or codes may determine requirements.
- 18 Special exhaust systems required.
- 19 Floor area behind firing line only.

NOTE: In the case of an occupancy type not specifically mentioned above, the ventilation air requirements shall be determined by the Building Official. Such determination shall be based on the most comparable occupancy type specified.

AMENDATORY SECTION (Amending Resolution No. 86-17, filed 9/23/86)

WAC 51-12-402 SECTION 402. OVERALL THERMAL PERFORMANCE AND BUILDING ENVELOPE REQUIREMENTS.

- (a) The stated  $U_o$  value of any one element of a building, such as roof/ceiling, wall or floor, may be increased and the  $U_o$  value for other components decreased provided that the overall heat gain or loss for the entire building envelope does not exceed the total resulting from the conformance to the stated  $U_o$  values.
- (b) Where return air ceiling plenums are employed, the roof/ceiling assembly area shall:
1. For thermal transmittance purposes, not include the ceiling proper nor the plenum space as part of the assembly; and
  2. For gross area purposes, be based upon the interior face of the upper plenum surface.
- (c)  $U_o$  values listed in Tables 4-2, 4-3, and 4-4 refer to component assembly only. Credit for buffering from adjacent unheated spaces is not allowed when calculating  $U_o$  values.
- (d) Exemption for Passive Solar features.  
Glazing areas which meet all of the following criteria may be exempted from the  $U_o$  calculations. Exempted glazing shall not be included in the gross wall area.
1. For buildings that have Electric Resistance heating systems, the glazing area must have a tested thermal transmittance ( $U$ ) value of less than .61. For Other heating systems, the glazing area need not be tested, but must be double glazed. (See Section 403(e).)
  2. The south glazing shall be oriented within 45 degrees of true south.
  3. The glazing shall be mounted at least 60 degrees up from the horizontal.
  4. The glazing shall have a transmission coefficient greater than or equal to 0.80 for visible light or greater than or equal to 0.73 for total solar radiation.

5. Documentation shall be provided in the form of a sun chart, a photograph, or approved evidence, demonstrating that the glazing area shall not be shaded for at least 4 hours between 8 a.m. and 4 p.m. standard time on January 21 and March 21.
6. The building shall contain a heat capacity equivalent to at least 20 Btu/degree F for each square foot of south glazing when the south glazing area is between 10% and 14% of the buildings gross floor area, and at least 45 Btu/degree F for each square foot of south glazing when the south area glazing exceeds 14 percent of gross floor area. This heat storage capacity shall be located inside the insulated shell of the structure and not covered with insulation materials, such as carpet, which yield an R value of 1.0 or greater. If the storage medium is not within the space containing the south glazing, an approved natural or mechanical means of transferring the heat to the heat storage medium shall be provided. Heat storage capacity shall be calculated using the below equation and/or accepted analytical methods:

$$HS = D \times SH \times V$$

Where:

HS = Heat Storage. The heat storage capacity available inside the insulated space.

V = Volume of heat storage components.

D = Density of material inside the insulated shell of the building to a depth yielding a thermal resistance of R 1, except in the case of slab floors where only the slab itself is credited. Mass located in conditioned or unconditioned basements without solar glazing shall not be counted (lbs/cu ft).

SH = Specific heat of the material (Btu/lb/°F).

(e) Insulation.

1. General: Thermal and acoustical insulation located on or within floor/ceiling and roof/ceiling assemblies, crawl spaces, walls, partitions, and insulation on pipes and tubing shall comply with this section. Duct insulation shall conform to Section 416 and Table 4-16.
 

EXCEPTIONS:

  - A. Roof insulation shall comply with Section 3204 of the Uniform Building Code.
  - B. Roof insulation in vaulted ceilings over 3 in 12 shall conform with Section 3204 of the Uniform Building Code.
  - C. Exposed deck ceiling insulation shall conform with Section 3204 of the Uniform Building Code.
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 not to exceed 25 and a smoke density not to exceed 450 when tested in accordance with UBC Standard No. 42-1.
 

EXCEPTIONS:

  - A. Foam plastic insulation shall comply with Section ((4747)) 1712 of the Uniform Building Code.
  - B. 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.
  - C. Cellulose insulation shall conform to Section 1713 of the Uniform Building Code.

3. Ventilation: Enclosed joist or rafter spaces formed where ceilings are applied directly to the underside of roof joists or rafters must have joists or rafters of sufficient size to provide a minimum of one inch clear vented air space above the insulation (see also Section 3205 (c) of UBC). Ceiling insulation may be tapered or compressed at the perimeter to permit proper venting.

(F) Moisture Control.

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

- A. Walls separating conditioned space from unconditioned space shall have a vapor retarder installed when thermal insulation is installed. The vapor retarder shall have a one perm dry cup rating or less. Inset stapled batts with a perm rating less than one may be installed if staples are placed not more than (8) inches on center and gaps between the facing and the framing do not exceed (1/16) of an inch.

B. Roof/ceilings.

- i. Roof/ceiling assemblies where the ventilation space above the insulation is less than an average of twelve (12) inches shall be provided with a vapor retarder having a dry cup perm rating of 1.0 or less.
- ii. Vapor retarders shall not be required in roof/ceiling assemblies where the ventilation space above the insulation averages twelve (12) inches or greater.
- iii. Vapor retarders shall not be required where all of the insulation is installed between the roof membrane and the structural roof deck.
- iv. Vapor retarders with a 1.0 or less dry cup perm rating polyethylene or an approved equal shall be installed in roof/ceiling assemblies where the insulation is comprised of insulation between the roofing membrane and the structural roof decking and insulation below the structural roof decking.

C. Ground Cover.

A ground cover of 4 mil (0.004 inch thick) polyethylene or approved equal shall be laid over the ground within crawl spaces. The ground cover shall be overlapped twelve (12) inches minimum at joints and shall extend to the foundation wall.

EXCEPTION: The ground cover may be omitted in unheated crawl spaces if the crawl space has a concrete slab floor with a minimum thickness of 3-1/2 inches.

AMENDATORY SECTION (Amending Order 86-04, filed 5/13/86)

WAC 51-12-411 SECTION 411. HVAC EQUIPMENT PERFORMANCE REQUIREMENTS.

- (a) The requirement of this section applies to equipment and component performance for heating, ventilating and air-conditioning systems. Where equipment efficiency levels are specified, approved data furnished by the equipment supplier or certified under a nationally recognized certification program or rating procedure shall be used to satisfy these requirements. Equipment efficiencies shall be based on the

standard rating conditions shown in Tables 4-9, 4-10 and 4-11.

(b) HVAC-System Heating Equipment Heat Pumps--Heating Mode: Heat pumps whose energy input is entirely electric shall have a Coefficient of Performance (COP) heating, as defined herein) not less than the values shown in Table 4-12.

1. These requirements apply to, but are not limited to, unitary heat pumps (air source and water source) in the heating mode and to heat pumps in the packaged terminal air-conditioner and room air-conditioner forms in the heating mode. Field assembled unitary heat pumps, consisting of one or more components, shall comply with this section.

2. Coefficient of Performance (COP) Heating: The ratio of the rate of net heat output to the rate of total energy input, expressed in consistent units and under designated rating conditions.

The rate of net heat output shall be defined as the change in the total heat content of the air entering and leaving the equipment (not including supplementary heat).

Total energy input shall be determined by combining the energy inputs to all elements, except supplementary heaters, of the heat pump, including, but not limited to, compressor(s), pump(s), supply-air fan(s), return-air fan(s), outdoor-air fan(s), cooling-tower fan(s), and the HVAC-system equipment control circuit.

3. Supplementary Heater: The heat pump shall be installed with a control to prevent supplementary heater operation when the heating load can be met by the heat pump alone. Supplementary heater operation is permitted during transient periods, such as start-ups, following room thermostat set-point advance, and during defrost, when the outdoor air temperature is below 55°F.

A two-stage thermostat, which controls the supplementary heat on its second stage, with outdoor air control, shall be accepted as meeting this requirement. The cut-on temperature for the compression heating shall be higher than the cut-on temperature for the supplementary heat, and the cut-off temperature for the compression heating shall be higher than the cut-off temperature for the supplementary heat. Supplementary heat may be derived from any source of electric resistance heating or combustion heating.

(c) HVAC-System-Combustion Heating Equipment: All commercial gas and oil-fired central heating plants shall show a minimum combustion efficiency of not less than those shown in Table 4-5.

All residential gas, oil, and propane central heating systems must have a minimum AFUE of .74. All other residential heating equipment fueled by gas, oil, or propane must be equipped with an intermittent ignition device.

(d) Mechanical Ventilation. Each mechanical ventilation system (supply and/or exhaust) shall be equipped with a readily accessible or automatic means for either shut-off or volume reduction and shut-off when ventilation is not required.

(e) Packaged and unitary HVAC-system equipment, electrically operated cooling mode. HVAC-system equipment as listed below whose energy input in the cooling mode is entirely electric, shall show a Coefficient of Performance (COP) cooling as defined herein not less than values shown in Table 4-13.

1. These requirements apply to, but are not limited to unitary cooling equipment (air-cooled, water-cooled and evaporatively-cooled); the cooling mode of unitary and packaged heat pumps (air source and water source); packaged terminal air-conditioners; and room air-

conditioners.

EXCEPTION: These requirements do not apply to equipment used for refrigerated food or florists' and nurseries' coolers.

2. Coefficient of Performance (COP) Cooling: The ratio of the rate of net heat removal to the rate of total energy input, expressed in consistent units and under designated rating conditions.

The rate of net heat removal shall be defined as the change in the total heat contents of the air entering and leaving the equipment (without reheat).

Total energy input shall be determined by combining the energy inputs to all elements of the equipment, including but not limited to compressor(s), pump(s), supply-air fan(s), return-air fan(s), condenser-air fan(s), cooling-tower fan(s), circulating water pump(s), and the HVAC-system equipment control circuit.

- (f) Applied HVAC-system components, electrically operated cooling-mode. HVAC-system components, as listed in Table 4-14 whose energy input is entirely electric, shall show a Coefficient of Performance (COP) cooling, as defined herein, and not less than the values shown in Table 4-14.

1. Coefficient of Performance (COP) Cooling. The ratio of the rate of net heat removal to the rate of total energy input, expressed in consistent units and under designated rating conditions.

2. The rate of net heat removal is defined as the difference in total heat contents of the water or refrigerant entering and leaving the component.

3. Total energy input shall be determined by combining the energy inputs to all elements and accessories of the component, including but not limited to, compressor(s), internal circulating pump(s), condenser-air fan(s), evaporative-condenser cooling water pump(s), purge, and the HVAC-system component control circuit.

- (g) HVAC-system equipment--heat operated cooling mode. Efficiency limitation equipment: Heat operated cooling equipment shall show a (COP) cooling not less than the values shown in Table 4-15. These requirements apply to, but are not limited to, absorption equipment, engine driven equipment, and turbine driven equipment.

- (h) Fireplaces. Fireplaces shall be provided with:

1. Tightly fitting flue dampers, operated with a readily accessible manual or approved automatic control.

EXCEPTION: Fireplaces with gas logs installed in accordance with UMC 803 shall be equipped with tightly fitting glass or metal doors.

2. An outside source for combustion air. The duct shall be at least six square inches in area, and shall be provided with a readily operable damper.

- (i) Solid fuel burning appliances shall be provided with combustion air ducted directly to the appliance.

Combustion air shall be provided as per manufacturers specifications.

EXCEPTIONS: Combustion air may be supplied to the room in which the solid fuel burning appliance is located in lieu of direct ducting, in an existing building, provided that:

1. The solid fuel burning appliance is not designed for directly connected outside combustion air or;

2. The existing construction prohibits the introduction of outside combustion air directly to the solid fuel burning appliance.

3. The combustion air source shall be located as close to the solid fuel burning appliance as possible, shall be provided with a backdraft damper, and shall be no less than six inches in diameter.

4. The solid fuel burning appliance is part of a central heating system and is installed in a room designed to house it.

AMENDATORY SECTION (Amending Resolution No. 86-17, filed 9/23/86)

WAC 51-12-426 SECTION 426. LIGHTING POWER BUDGET. A lighting power budget is the upper limit of the power to be available to provide the lighting needs in accordance with the criteria and calculation procedure specified herein.

The lighting power budget for a building shall be the sum of the power limits computed for all lighted interior and exterior spaces and shall be determined in accordance with the procedures specified in this section.

EXCEPTION: One- and two-family detached dwellings and the dwelling portion of multifamily buildings are exempt from the requirements of Section 426.

(a) Budget Development.

The installed lighting wattage for the building project shall not exceed the budget level calculated in this section. The budget wattage level shall be the sum of the interior budget calculated and the exterior budget. Lighting wattage includes lamp and ballast wattage.

(b) Building Interiors.

The interior lighting budget shall be calculated by multiplying the gross conditioned floor area, in square feet, by the appropriate unit power budget, in watts per square foot, specified in Table No. 4-18.

For special conditions when approved by the Building Official, calculation based on Illuminating Engineering Society Unit Power Density or similar nationally recognized standards may be used.

The lighting power budget shall be based on the primary occupancy for which the space within the building is intended. If multiple occupancies are intended, the lighting power budget for each type of occupancy shall be separately calculated and summed to obtain the lighting budget for the interior spaces of the building. If a common circulation area serves multiple occupancies or multiple retail spaces, the lighting power budget for the common circulation area shall be the weighted average of the lighting power budgets for all other areas on that floor. In cases where a lighting plan for only a portion of a building is submitted, the interior lighting budget shall be based on the gross floor area covered by the plan.

EXCEPTIONS:

1. Where the following automatic lighting controls are installed, for calculations used to determine code compliance, the installed lighting wattage may be reduced by the following percentages:
  - A. For occupant-sensing devices, energy savings of 30 percent shall be allowed for any single space up to 400 square feet and enclosed by ceiling height partitions; classrooms, conference rooms, computer rooms, storage areas, corridors, or waiting rooms.
  - B. For daylighting controls, energy savings of 30 percent for continuous dimming and 20 percent for stepped controls shall be allowed for any daylight space.
  - C. For lumen maintenance controls, energy savings of 10 percent shall be allowed for any space.
  - D. For daylighting controls with occupant-sensing

devices, energy savings of 44 percent shall be allowed for any single space up to 400 square feet within daylit spaces, and enclosed by ceiling height partitions.

E. For occupant-sensing devices with lumen maintenance controls, energy savings of 37 percent shall be allowed for any single space up to 400 square feet and enclosed by ceiling height partitions.

2. Lighting for the following applications shall be exempted from inclusion in the calculation of lighting power budgets:

A. Stage lighting, entertainment, or audiovisual presentations where the lighting is an essential technical element for the function performed.

B. Lighting for medical and dental tasks.

C. Lighting in areas specifically designed for visually handicapped people.

D. For restaurant occupancies, lighting for kitchens and food preparation areas.

(c) Building Exteriors.

The exterior lighting budget shall be calculated by multiplying the building perimeter in feet by 7.5 watts per foot. Lighting for parking structures shall be calculated at 0.3 watts per gross square foot of parking area. An allowance for outdoor surface parking and circulation lighting may be added at 0.05 watts per square foot of area. Lighting for signs that are not an integral part of the building shall be exempted from inclusion in these calculations.

TABLE 4-1  
Classification of Building Occupancies

	All Group R Occupancy Space	Other than Group R Occupancy Space
Three conditioned stories and less	Table 4-2	Table 4-3
More than three conditioned stories	Table 4-4	Table 4-4

TABLE 4-2  
Low-rise Residential Buildings  
Maximum Allowed Uo Values  
and Minimum Allowed R Values

Heat Type	Climatic Zone	Roofs	Cathedral Ceilings	Walls (Includes Glazing)	Floors	Slab <sup>1</sup> on Grade
		Uo	Uo	Uo	Uo	Installed R Value
Electric Resistance	I	0.026	0.035	0.144	0.055	((8)) 7



Heat Type	Climatic Zone	Roofs Ceilings	Cathedral Ceilings	Walls (Includes Glazing)	Floors	Slab <sup>1</sup> on Grade
Other	I	0.035	0.035	0.203	0.055	((8)) <u>7</u>
Electric Resistance	II	0.026	0.035	0.144	0.043	10
Other	II	0.035	0.035	0.203	0.055	10

<sup>1</sup>Insulation shall be water-resistant material manufactured for this use.

TABLE 4-3

Nonresidential Occupancies  
Buildings 3 Stories or Less  
Maximum Allowed U<sub>o</sub> Values and  
Minimum Allowed R Values

Zone	Ceilings	Walls (Includes Glazing)	Floors	Slab <sup>1</sup> on Grade
	<u>U<sub>o</sub></u>	<u>U<sub>o</sub></u>	<u>U<sub>o</sub></u>	<u>Installed R Value</u>
I	0.035	0.25	0.05	((8)) <u>7</u>
II	0.035	0.20	0.05	10

<sup>1</sup>Insulation shall be water-resistant material manufactured for this use.

TABLE 4-4

All Occupancies  
Buildings over 3 Stories  
Maximum Allowed U<sub>o</sub> Values and  
Minimum Allowed R Values

Zone	Ceilings	Walls (Includes Glazing)	Floors	Slab <sup>1</sup> on Grade
	<u>U<sub>o</sub></u>	<u>U<sub>o</sub></u>	<u>U<sub>o</sub></u>	<u>Installed R Value</u>
I	0.08	0.30	0.08	((8)) <u>7</u>
II	0.06	0.25	0.08	10

<sup>1</sup>Insulation shall be water-resistant material manufactured for this use.

TABLE 4-5

Nonresidential HVAC System Heating Equipment-  
Gas- and Oil-Fired  
Minimum Steady State Combustion Efficiency

Types of Equipment	Furnaces of Capacity of 225,000 Btu/h and Less	All Other Commercial/ Industrial Furnaces and Boilers
	Percent <sup>1</sup>	Percent <sup>2</sup>
Forced-air furnaces and low-pressure steam or hot-water boilers	74	75
Gravity central furnaces	69	-
All other vented heating equipment	69	-

<sup>1</sup>Combustion efficiency for furnaces of capacities of 225,000 Btu/h and less and boilers of capacities of 300,000 Btu/h and less shall be tested in accordance with the applicable U.S. Department of Energy furnace test procedures.

<sup>2</sup>Combustion efficiency of commercial/industrial furnaces and boilers is defined as 100 percent minus stack losses in percent of heat input. Stack losses are:

- Loss due to sensible heat in dry flue gas.
- Loss due to incomplete combustion.
- Loss due to sensible and latent heat in moisture formed by combustion of hydrogen in the fuel.

TABLE 4-6  
(Reserved)

TABLE 4-7  
(Reserved)

TABLE 4-8  
Allowable Air Infiltration Rates

Windows	Residential Doors	Commercial Doors
(cfm per lineal foot of operable sash crack	cfm per sq. ft. of door area	cfm per lin. ft. of crack
	sliding entrance glass	swinging, sliding, revolving
0.5	0.5      1.00	11.0

TABLE 4-9  
 HVAC System Heating Equipment (Heat Pumps)  
 Standard Rating Conditions

Conditions		Type		
		Air Source		Water Source
Air entering equipment	°F	70 db	70 db	70 db
Outdoor unit ambient	°F	47 db/ 43 wb	17 db/ 15 wb	--
Entering water temperature	°F	--	--	60
Water flow rate		--	--	as used in cooling mode

TABLE 4-10  
 HVAC System Equipment  
 Standard Rating Conditions -- Cooling

		Temperatures			
		DB	WB	Inlet	Outlet
Air Entering Equipment	°F	80	67	--	--
Condenser Ambient (Air Cooled)	°F	95	75	--	--
Condenser Water (Water Cooled)	°F	--	--	85	95

Standard ratings are at sea level.

Note: db = dry bulb  
 wb = wet bulb

TABLE 4-11  
 Applied HVAC System Components  
 Standard Rating Conditions -- Cooling

Item		Centrifugal or Self-Contained Reciprocating Water-Chiller	Condenserless Reciprocating Water-Chiller
Leaving chilled Water temperature	°F	44	44
Entering chilled Water temperature	°F	54	54

Item		Centrifugal or Self-Contained Reciprocating Water-Chiller	Condenserless Reciprocating Water-Chiller	
Leaving condenser Water temperature	°F	95	--	
Entering water temp.	°F	85	--	
Fouling factor, water				
Non-ferrous tubes	*	0.0005	0.0005	
Steel tubes	*	0.0010	0.0010	
Fouling factor, Refrigerant	*	0.0000	0.0000	
Condenser ambient				
Air or evap. cooled	°F		95 dB/75 wb	--
Compressor				
Water cooled				
Saturated				
(or evap.				
Discharge		°F	--	105
cooled)				
Temperature				
Air cooled	°F		--	120

Standard ratings are at sea level.  
\* h ft<sup>2</sup> F/Btu.

TABLE 4-12  
HVAC-System Heating Equipment (Heat Pumps)  
Minimum COP & HSPF for Heat Pumps, Heating Mode

Source and Outdoor Temperature (°F)	Minimum COP	Minimum HSPF
Air source -- 47 dB/43 WB	2.7	
Air source -- 17 dB/15 WB	1.8	
Air source		6.35
Water source -- 60 entering	3.0	
Ground source	3.0	

TABLE 4-13  
Minimum EER and COP-Cooling for  
Electrically Driven HVAC System Equipment-Cooling<sup>1</sup>

Standard Rating Capacity	Air Cooled		Evaporative or Water Cooled	
	EER	COP	EER	COP
Under 65,000 Btu/hr (19,050 watts)	7.8	2.28	8.8	2.58
65,000 Btu/hr (19,060 watts) and over	8.2	2.4	9.2	2.69

<sup>1</sup>The U.S. Department of Energy has established required test procedures for single-phase, air-cooled, residential central air conditioners under 19 KW (65,000 Btu/h) capacity, which have been incorporated into ARI Standard 210-79. EER and COP values in Table 4-13 are based on Test A of DOE Test Procedures.

TABLE 4-14

Minimum EER and COP for Electrically  
Driven HVAC-System Components<sup>1</sup>

Water Chilling Packages

Component	Type	Condensing Means					
		Air		Water		Evap.	
		EER	COP	EER	COP	EER	COP
Condenser included	Centrifugal or rotary	8.00	2.34	13.80	4.04		
Condenser included	Reciprocating	8.40	2.46	12.00	3.51		
Condenserless	Reciprocating	9.90	2.90	12.00	3.51		
Compressor & condenser units 65,000 Btu/hr (19,050 watts) and over <sup>2</sup>	Positive displacement	9.50	2.78	12.50	3.66	12.50	3.66

Hydronic Heat Pumps

Component	Type	EER	COP
Water source under 65,000 Btu/h (19,000 watts)	Centrifugal or rotary	9.00	2.64
Water source 65,000 Btu/h (19,000 watts) and over	Centrifugal or rotary	9.40	2.75

<sup>1</sup>When tested at the standard rating conditions specified in Table No. 4-9, 4-10, and 4-11.

<sup>2</sup>Ratings in accordance with Standard for Positive Displacement Refrigerant Compressor and Condensing Units, ARI Standard 520-74 as applicable. COP based on condensing unit standard rating capacity and energy input to the unit, all at sea level.

TABLE 4-15  
HVAC-System Heat-Operated Cooling Equipment

Minimum COP =  $\frac{\text{Net Cooling Output}}{\text{Total Heat Input (Electrical Auxiliary Inputs Excluded)}}$

Heat Source	Minimum COP
Direct fired (gas, oil)	0.48
Indirect fired (steam, hot water)	0.68

TABLE 4-16

## Insulation of Ducts

Duct Location	Insulation Types		
	Mechanically Cooled	Climate Zone	Insulation Types Heating Only
On roof or on exterior of building	C, V <sup>2</sup> and W	I	C and W
	D, V <sup>2</sup> and W	II	D and W
Attics, garages and crawl spaces, in walls <sup>1</sup> , within floor-ceiling spaces <sup>1</sup>	B and V <sup>2</sup>	I	B
	C and V <sup>2</sup>	II	C
Within the conditioned space or in basements	None Required		None Required
Cement slab or within ground	A		B

Note: Where ducts are used for both heating and cooling, the minimum insulation shall be as required for the most restrictive condition.

<sup>1</sup> Insulation may be omitted on that portion of a duct which is located within a wall or floor-ceiling space where both sides of this space are exposed to conditioned air and where this space is not ventilated or otherwise exposed to unconditioned air.

<sup>2</sup> Vapor barriers shall be installed on conditioned air supply ducts in geographic areas where the average of the July, August, and September mean dewpoint temperature exceeds 60°F.

INSULATION TYPES: Minimum densities and out-of-package thicknesses.

- A. 0.5-inch 1.5 to 2 lb/cu. ft. duct liner, mineral or glass fiber blanket or equivalent to provide an installed total thermal resistance of at least R-2
- B. 2-inch 0.60 lb/cu. ft. mineral or glass fiber blanket  
1.5-inch 1.5 to 2 lb/cu. ft. duct liner, mineral or glass fiber blanket  
1.5-inch 3 to 7 lb/cu. ft. mineral or glass fiber board or equivalent to provide an installed total thermal resistance of at least R-5

- C. 3-inch 0.60 lb/cu. ft. mineral or glass fiber blanket  
 2-inch 1.5 to 2 lb/cu. ft. duct liner, mineral or glass fiber blanket  
 2-inch 3 to 7 lb/cu. ft. mineral or glass fiber board or equivalent to provide an installed total thermal resistance of at least R-7
- D. 4-inch 0.60 lb/cu. ft. mineral or glass fiber blanket  
 3-inch 1.5 to 2 lb/cu. ft. duct liner, mineral or glass fiber blanket  
 3-inch 3 to 7 lb/cu. ft. mineral or glass fiber board or equivalent to provide an installed total thermal resistance of at least R-10
- V. Vapor barrier, with perm rating not greater than 0.5 perm, all joints sealed.
- W. Approved weatherproof barrier.

TABLE 4-17

## Minimum Pipe Insulation

Piping System Types	Fluid temperature range, °F	Run-outs up to 2" <sup>1</sup>	Insulation Thickness In Inches for Pipe Sizes <sup>2</sup>				
			1" and less	1.25" to 2"	2.5" to 4"	5" to 6"	8" and larger
HEATING AND HOT WATER SYSTEMS							
Steam and hot water							
High pressure/temperature	306-450	1.5	2.5	2.5	3.0	3.5	3.5
Med. pressure/temperature	251-305	1.5	2.0	2.5	2.5	3.0	3.0
Low pressure/temperature	201-250	1.0	1.5	1.5	2.0	2.0	2.0
Low temperature	100-200	.5	1.0	1.0	1.5	1.5	1.5
Steam condensate (for feed water)	Any	1.0	1.0	1.5	2.0	2.0	2.0
COOLING SYSTEMS							
Chilled water	40-55	.5	.5	.75	1.0	1.0	1.0
Refrigerant, or brine	Below 40	1.0	1.0	1.5	1.5	1.5	1.5

<sup>1</sup>Runouts not exceeding 12 feet in length to individual terminal units.

<sup>2</sup>For piping exposed to outdoor air, increase thickness by .5 inch.

TABLE 4-18

Interior Lighting Power Budget<sup>1</sup>

Group	Occupancy Description	Lighting Power Budget <sup>2</sup> (W/sq ft)
A	Assembly w/stage	1.1
	Stage lighting	Exempt
	Assembly w/o stage: other than B and E	1.1
B	Gasoline service station	1.7
	Storage garages	0.3
	Office buildings	1.7
	Wholesale stores	2.0
	Police and fire stations	1.7
	Retail Stores:	
	less than 6000 s.f.	4.0
	6000 to 20,000 s.f.	3.0
	over 20,000 s.f.	2.0
	Drinking and dining establishments	1.85
	Food preparation task light	Exempt
	Aircraft hangars - storage	0.7
	Process plants <sup>3</sup>	1.0
	Factories and work shops <sup>3</sup>	1.7
	Storage structures	0.7
E	Schools and daycare centers	1.7
	Audio-visual presentation lighting	Exempt
H	Storage structures	0.7
	Handling areas	1.7
	Paint shops	2.5
	Auto repair shops	1.7
	Aircraft repair hangars	1.7
I	Institutions	1.7
	Administrative support areas	1.7
	Diagnostic, treatment, food service task lighting	Exempt
R	Dwelling units	Exempt
	Food preparation task lighting	Exempt

<sup>1</sup>Watts/sq. ft. of room may be increased by two percent per foot of height above 20 feet.

<sup>2</sup>Emergency exit lighting is exempt from interior lighting budget.

<sup>3</sup>Lighting that is part of machines or equipment is exempt from this budget.

AMENDATORY SECTION (Amending Order 85-14, filed 11/26/85)

WAC 51-12-503 SECTION 503. ANALYSIS PROCEDURE.

The analysis of the annual energy usage of the standard design 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 of sufficient detail to permit the evaluation of effect of factors specified in Section 504.

EXEMPTION: Low-rise residential not installing cooling equipment, shall not be required to model cooling loads.

- (b) The calculation procedure used to simulate the operation of the building and its service systems through a full year operating period shall be of sufficient detail 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 all systems and equipment. The calculation procedure shall be based upon operation of the building and its service systems through a typical year. Variations in climatic data shall be represented.
- (c) The calculation procedure for the standard design and the proposed alternative design shall separately identify the energy input to each of the following systems: heating, cooling, ventilation, and lighting. The energy input to any other system using over ten percent of the total energy input shall also be separately identified. The energy use for the standard and alternative designs shall be calculated by summing the energy inputs assigned to each identified system and all other energy inputs not separately identified. The systems identified, and, to the extent possible, the assumptions made in assigning energy inputs to each system, shall be the same for the standard design and the proposed alternative design. When electrically driven heat pumps are employed to provide all or part of the heat for the alternative design, the standard design shall also, for the purposes of the analysis, assume that electrically driven heat pumps in conformance with Section 411 and having capacity at least as great as those used in the alternative design are employed.
- (d) The energy use assigned to each building system in the proposed alternative design shall be as calculated in subsection (c) or eighty percent of the use calculated for the same system in the standard design in subsection (c), whichever is greater.

AMENDATORY SECTION (Amending Resolution No. 86-17, filed 9/23/86)

WAC 51-12-601 SECTION 601. LOW-RISE RESIDENTIAL BUILDING ENVELOPE REQUIREMENTS.

For all components, except for walls, the R values specified in Table 6-1 are for installed insulation material only. R values for construction are defined as any combination of rigid-sheathing, loose fill, or batt insulation that achieves the prescribed R value. Where insulation is installed in a continuous manner and is not interrupted by occasional framing members, its R value may be increased by 20% in determining compliance with the requirements of this table. This allowance does not apply to insulation of slab on grade or walls.

- (a) Walls. The total assembly of opaque exterior wall sections, walls in finished basements, and the interior walls exposed to unheated spaces shall have a thermal resistance R value not less than the values specified in Table 6-1. Total wall assembly R values include values for insulation, sheathing, gypsum-board, air-films, concrete, etc. The following walls shall be considered to meet the R-19 total assembly criteria without additional documentation:
1. 2" x 6" with installed R-19 batt.

2. 2" x 4" with an installed R-13 batt and ((R-5)) R-3.7 insulating sheathing.
3. 2" x 4" with an installed R-11 batt and ((R-5+4)) R-5.0 insulating sheathing.

EXCEPTION: Concrete or masonry foundation walls of unfinished basements that have one foot or less of the wall above grade need not be insulated until finished, provided that:

- A. Any frame walls comply with the requirements of Table 6-1;
- B. The rim-joists are properly insulated;
- C. All walls that are more than an average of one foot above grade are insulated to meet the requirements of Table 6-1.

(b) Roof/ceiling. The roof/ceiling assembly shall have a thermal resistance R value not less than the value specified for the indicated type of construction in Table 6-1.

EXCEPTION: Insulation levels in the case of single rafter or joist vaulted ceilings. These types of ceilings may be insulated to a level of R-30, regardless of space heat type.

(c) Thermal Design Standards for Floors.

1. 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 6-1.

Insulation installed inside the foundation shall extend downward from the top of the slab for a minimum distance of 24 inches; or downward to the bottom of the slab, then horizontally beneath the slab for a minimum total distance of 24 inches. Insulation installed outside the foundation shall extend downward a minimum of 6 inches below grade but not less than to the frostline and need not extend deeper than to the top of the footing.

2. Floor Sections. Floor sections over unheated spaces, such as unheated basements, unheated garages or ventilated crawl spaces, shall be constructed to comply with the required values as specified in Table 6-1.

EXCEPTION: Insulation may be omitted from floor areas over heated basements, heated garages, or under floor areas used as HVAC plenums or where operable foundation vents are used and when foundation walls are insulated. When foundation walls are insulated in accordance with Section 601(a), the insulation shall be attached in a permanent manner.

(d) Thermal Design Standards for Openings.

1. At a minimum, all windows must be double glazed, and are classed according to U values as shown on Table 6-2. Glazing requirements are listed in Table 6-4.

2. At a minimum, all skylights must be double glazed. The area of Class 90 skylights and Class 90 exterior windows sloped more than 30° from the vertical shall be doubled and this area included in the percentage of the total glazing area as allowed for in Table 6-4. Class 75 or Class 60 glazing in skylights or Class 75 or Class 60 windows sloped more than 30° from the vertical need not be doubled.

3. 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 Table 6-4. The maximum area (before doubling) allowed for the total of all single glazing is 1% of the floor area.

(e) Air Leakage.

1. Windows and Doors. All windows within a wall and doors shall conform to the air infiltration requirements specified in Section 405. Site built windows shall be constructed to minimize leakage.

EXCEPTION: Openings required to be protected by fire resistive assemblies are exempt from this section.

2. Exterior joints around windows and door frames, openings between walls and foundations, between walls and roof and between wall panels; openings at penetrations of utility services through walls, floors and roofs; and all other such openings in the building envelope shall be sealed, caulked, gasketed, or weatherstripped to limit air leakage.

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

1. Walls separating conditioned space from unconditioned space shall have a vapor retarder installed when thermal insulation is installed. The vapor retarder shall have a one perm dry cup rating or less. Inset stapled batts with a facing with a perm rating less than one may be installed if staples are placed not more than (8) inches on center and gaps between the facing and the framing do not exceed (1/16) of an inch.

2. Roof/ceilings:

A. Roof/ceiling assemblies where the ventilation space above the insulation is less than an average of twelve (12) inches shall be provided with a vapor retarder having a dry cup perm rating of 1.0 or less.

B. Vapor retarders shall not be required in roof/ceiling assemblies where the ventilation space above the insulation averages twelve (12) inches or greater.

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

D. Vapor retarders with a 1.0 or less dry cup perm rating shall be installed in roof/ceiling assemblies where the insulation is comprised of insulation between the roofing membrane and the structural roof decking and insulation below the structural roof decking.

3. Ground Cover.

A ground cover of 4 mil (0.004 inch thick) polyethylene or approved equal shall be laid over the ground within crawl spaces. The ground cover shall be overlapped twelve (12) inches minimum at joints and shall extend over the top of the footing.

EXCEPTION: The ground cover may be omitted in unheated crawl spaces if the crawl space has a concrete slab floor with a minimum thickness of 3-1/2 inches.

- (g) General Requirements for Loose Fill Insulation. Blown or poured loose fill insulation may be used in attic spaces where the slope of the ceiling is not more than 3 feet in 12 feet and there is at least 30 inches of clear distance from the top of the bottom chord of the truss or ceiling joist to the underside of the roof 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.

- (h) Space Heat Type. The following four 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.

EXCEPTIONS: Electric resistance elements which are integral to either heat pump or passive solar heating systems (as defined below), or when the total electric heat capacity in each individual dwelling unit does not exceed the greater of: 1) 1,000 watts per dwelling, or; 2) 1.0 watt per square foot of the gross floor area.

2. Electric, Passive Solar. Electric resistance space heating systems which utilize solar energy to provide a portion of the building's heating load. A Passive Solar System is required to have at least ten (10) percent of the building's gross floor area in glazing that meets the specifications of Section 601(i).
  3. Other. Includes all gas, wood (not meeting the provisions of Section 102 (a)2), oil, propane, and electric heat pump space heating systems, unless electric resistance is used as a secondary heating system. (See EXCEPTIONS, Electric Resistance, Section 601 (h)1. above.) Nonelectric heat pump heating systems are also included in this category.
  4. Other, Passive Solar. Other types of space heating systems which utilize solar energy to provide a portion of the building's heating load. A Passive Solar System is required to have at least ten (10) percent of the building's gross floor area in glazing that meets the specifications of Section 601(i).
- (i) Passive Solar Glazing. Glazing areas are required to meet the following criteria in order to be considered Passive Solar Glazing.
1. Glazing areas are required to meet the "Electric, Passive Solar" and "Other, Passive Solar" glazing requirements of Table 6-4.
  2. The south glazing shall be oriented within 45 degrees of true south.
  3. The glazing shall be mounted at least 60 degrees up from the horizontal.
  4. The glazing shall have a transmission coefficient greater than or equal to 0.80 for visible light or greater than or equal to 0.73 for total solar radiation.
  5. Documentation shall be provided in the form of a sun chart, a photograph, or approved evidence, demonstrating that the glazing area shall not be shaded for at least 4 hours between 8 a.m. and 4 p.m. standard time on January 21 and March 21.
  6. The building shall contain a heat capacity equal to a four inch concrete slab. The heat capacity shall be equivalent to at least 20 Btu/degree F for each square foot of south glazing when the south glazing area is between 10% and 14% of the building's gross floor area, and at least 45 Btu/degree F for each square foot of south glazing when the south area glazing exceeds 14 percent of gross floor area. In buildings with south glazing area between 10% and 14% of gross floor area, the heat capacity provided by a four inch concrete slab shall be deemed sufficient. This heat storage capacity shall be located inside the insulated shell of the structure and not covered with insulation materials, such as carpet, which yield an R value of 1.0 or greater. If the storage medium is not within the space containing the south glazing, an approved natural or mechanical means of transferring the heat to the heat storage medium shall be provided. Heat storage capacity shall be calculated using the below equation and/or accepted analytical methods:

$$HS = D \times SH \times V$$

Where:

HS = Heat Storage. The heat storage capacity available inside the insulated space.

V = Volume of heat storage components.

D = Density of material inside the insulated shell of the building to a depth yielding a thermal resistance of R-1, except in the case of slab floors where only the slab itself is credited. Mass located in conditioned or unconditioned basements without solar glazing shall not be counted (lbs/cu ft).

SH = Specific heat of the material (Btu/lb/°F).

- (j) Ventilation: Enclosed joist or rafter spaces formed where ceilings are applied directly to the under side of roof joists or rafters must have joists or rafters of sufficient size to provide a minimum of one inch clear vented air space above the insulation (see also Section 3205 (c) of UBC). Ceiling insulation may be tapered or compressed at the perimeter to permit proper venting.

#### AMENDATORY SECTION (Amending Order 86-04, filed 5/13/86)

#### WAC 51-12-602 SECTION 602. LOW-RISE RESIDENTIAL BUILDING MECHANICAL SYSTEMS.

All HVAC devices, components and their elements shall conform to the requirements of this section.

##### (a) Heating and Mechanical Cooling Devices.

1. All heating and mechanical cooling devices shall meet the required efficiency factor specified herein or in Tables 4-12, 4-13, 4-14, and 4-15, 6-3, and 6-4, for the specific type of device.
2. Combustion Heating Equipment. All gas and oil-fired heating equipment shall meet the minimum combustion efficiencies as specified in Table 6-4.
3. Fireplaces shall be provided with:
  - A. Tightly fitting flue dampers, operated with a readily accessible manual or approved automatic control.

EXCEPTION: Fireplaces with gas logs installed in accordance with UMC 803 shall be equipped with tightly fitting glass or metal doors.

- B. An outside source for combustion air. The duct shall be at least six square inches in area, and shall be provided with a readily operable damper.
4. Solid fuel burning appliances shall be provided with combustion air ducted directly to the appliance. Combustion air shall be provided as per manufacturers specifications.

EXCEPTIONS: Combustion air may be supplied to the room in which the solid fuel burning appliance is located in lieu of direct ducting, in an existing home, provided that:

- A. The solid fuel burning appliance is not designed for directly connected outside combustion air or;
- B. The existing construction prohibits the introduction of outside combustion air directly to the solid fuel burning appliance.
- C. The combustion air source shall be located as close to the solid fuel burning appliance as possible.

shall be provided with a backdraft damper, and shall be no less than six inches in diameter.

5. Calculation of Heating and Cooling Loads. Heating and cooling design loads for the purpose of sizing HVAC systems are required and shall be calculated in accordance with accepted engineering practice. The design parameters specified in Chapter 3 shall apply for all computations.

HVAC equipment for low-rise residential buildings shall be sized no greater than 150 percent of the design load as calculated above.

EXCEPTION: The following exemption from the sizing limit shall be allowed, however, in all cases heating and/or cooling design load calculations shall be submitted. For equipment which provides both heating and cooling in one package unit, including heat pumps with electric heating and cooling and gas-pack units with gas heating and electric cooling, compliance need only be demonstrated for either the space heating or space cooling system size.

(b) Temperature Control.

Each heating system shall be provided with at least one thermostat for the regulation of temperature. Each thermostat shall be capable of being set as follows:

Where used to control heating only--55-75°;

Where used to control cooling only--70-85°;

Where used to control both heating and cooling, it shall conform to the requirements of Section 415.

(c) Zoning for Temperature Control.

1. Group R-3 Occupancy

At least one thermostat for regulation of space temperature shall be provided for each separate HVAC system. In addition, a readily accessible manual or automatic means shall be provided to partially restrict or shut off the heating or cooling input to each zone or floor.

EXCEPTION: Nonconditioned basements and garages.

2. Group R-1 Occupancy.

For multifamily dwellings, each individual dwelling unit shall be considered separately and shall meet the requirements of Section 602. Spaces other than living units shall meet the requirements of section 415 (c) 3.

3. Control Setback and Shutoff: Group R-1 and R-3.

The thermostat required in (a) and (b) or an alternate means such as a switch or clock, shall provide a readily accessible, manual or automatic means for reducing the energy required for heating and cooling during periods of nonuse or reduced need such as, but not limited to, unoccupied periods and sleeping hours. Lowering thermostat set points to reduce energy consumption of heating systems shall not cause energy to be expended to reach the reduced setting.

4. Duct Insulation.

All ducts, plenums and enclosures installed in or on buildings shall be thermally insulated and constructed in accordance with Section 416.

5. Pipe Insulation.

All piping installed to serve buildings or within buildings shall be thermally insulated in accordance with Table 4-17.

EXCEPTION: For service water heating systems, see Section 603.

AMENDATORY SECTION (Amending Order 85-14, filed 11/26/85)

WAC 51-12-605 SECTION 605. BUILDING ENVELOPE REQUIREMENTS FOR OTHER THAN LOW-RISE RESIDENTIAL BUILDINGS.

- (a) Opaque Envelope Criteria. Roof/ceilings, exterior walls, floors over unconditioned space, below grade walls and slab on grade floors enclosing heated spaces shall be insulated to not less than the nominal R value specified for roof/ceilings, exterior walls, floors over unconditioned space, below grade walls and slab on grade floors, respectively, in Table No. 6-5. Roof/ceilings enclosing mechanically cooled spaces shall be insulated to not less than the nominal R value specified for roof/ceilings in Table No. 6-5. 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.

Installation of materials shall comply with Section 402 (~~((d)-and~~) (e) and (f). In addition, below grade wall insulation shall extend from the top of the wall to the top of the footing or floor slab. Slab on grade floor insulation shall be installed along the entire perimeter of slab on grade floors, except for any part of slab which extends into an unconditioned space such as a garage, and shall extend downward from the top of the slab to the top of the footing or to the bottom of the thickened edge of a monolithic slab or for a minimum distance of 24 inches or downward to the bottom of the slab then horizontally beneath the slab for a minimum total distance of 24 inches and shall be an approved type.

- (b) Glazing Criteria. All glazing shall be, at a minimum, double glazing. Insulating glass with at least (~~((7/4))~~) one-half (1/2) inch air space or approved storm sash will be considered as complying. The total glazing area shall not exceed the percentage of gross exterior wall area specified in Table No. 6-5.

EXCEPTION: Single glazing in doors may be installed provided that the glazing area is doubled for the purpose of demonstrating compliance with the glazing area requirements.

- (c) Air Leakage. All buildings shall comply with the air leakage requirement of Section 405.

AMENDATORY SECTION (Amending Order 86-04, filed 5/13/86)

WAC 51-12-608 SECTION 608. ELECTRICAL POWER AND LIGHTING REQUIREMENTS FOR OTHER THAN LOW-RISE RESIDENTIAL BUILDINGS.

All electrical power and lighting systems shall comply with the requirements of Sections 424 to 426, inclusive.

TABLE 6-1

Low-rise Residential Buildings  
Minimum (average) Allowed R Values<sup>1</sup>

Space Heat Type	Climatic		Roof			Slab on <sup>3</sup>
	Zone	Ceilings <sup>2</sup>	Decks	Walls	Floors	Grade
Electric Resistance	I	38	38	19	19	((8)) <u>7</u>
Electric, Passive Solar	I	30	30	19	19	((8)) <u>7</u>
Other	I	30	30	19	19	((8)) <u>7</u>
Other, Passive Solar	I	30	30	19	19	((8)) <u>7</u>
Electric Resistance	II	38	38	19	25	10
Electric, Passive Solar	II	30	30	19	19	10
Other	II	30	30	19	19	10
Other, Passive Solar	II	30	30	19	19	10

<sup>1</sup>R values, except for walls, are for installed insulation material only.

<sup>2</sup>R-30 in single rafter, joist vaulted ceilings.

<sup>3</sup>Insulation shall be water-resistant material manufactured for this use.

TABLE 6-2

Low-rise Residential Buildings  
Classes of Glazing

Class	U-Value	Window Thermal Testing Requirement <sup>1</sup>
90	.90	Untested
90	Greater than .75	Tested
75	.61 to .75	Tested
60	Less than .61	Tested

<sup>1</sup>See DEFINITIONS, Section 223. WINDOW THERMAL TESTING.



TABLE 6-3

Low-rise Residential Buildings  
Heat Pump Minimum Efficiencies

Source and Outdoor Temperature (°F)	Class 1		Class 2	
	COP	HSPF	COP	HSPF
Air Source - 47 dB/43 WB	2.7		2.5	
Air source - 17 dB/15 WB	1.8		1.5	
Air Source		6.35		5.60
Water Source - 60 entering	3.0		2.5	
Ground Source	3.0		3.0	

TABLE 6-4

Low-rise Residential Buildings  
Glazing and Furnace  
Efficiency Requirements

Space Heat Type	Climate Zone	Maximum Percentage		AFUE*	Heat Pump Class
		of Floor Area in Glazing	Glazing Class		
Electric Resistance	I	21%	60	n/a	n/a
Electric, Passive					
Solar	I	21%	60	n/a	n/a
Other	I	21%	75	.65	2
Other	I	21%	90	.74	1
Other, Passive Solar	I	21%	90	.65	2
Electric Resistance	II	17%	60	n/a	n/a
Electric, Passive					
Solar	II	17%	60	n/a	n/a
Other	II	17%	75	.65	2
Other	II	17%	90	.74	1
Other, Passive Solar	II	17%	90	.65	2

\*AFUE applies only to central heating equipment. All other types of heating equipment fueled by gas, oil, or propane must be equipped with an intermittent ignition device in order to use Class 90 glazing.

TABLE NO. 6-5

All Other than Low-rise Residential Buildings  
Component Requirements

Component	Zone I	Zone II
Space Conditioning System Type	Any	Any
Opaque Envelope Minimum Nominal R Value		
Roof/Ceilings	R-30	R-30

Component	Zone I	Zone II
Exterior Walls	R-11	R-11
Floors over Unconditioned Space	R-11	R-11
Below Grade Walls <sup>1</sup>	R-4	R-5
Slab on Grade Floors <sup>1</sup>	((R-8)) <u>R-7</u>	R-10
Glazing		
Type	Double	Double
Maximum Total Area (Percent of Gross Exterior Wall)	32%	22%

<sup>1</sup>Insulation shall be water-resistant material manufactured for this use.