RULES CERTIFICATE

Department of Commerce

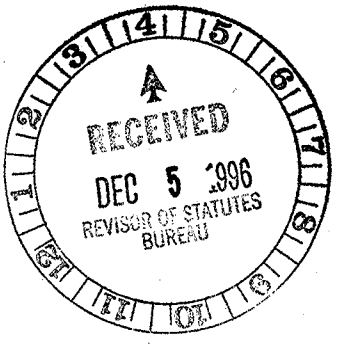
TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETINGS:

I, William McCoshen, Secretary of the Department of Commerce, and custodian of the official records of said department, do hereby certify that the annexed rule(s) relating to

Energy Conservation and Ventilation
(Subject)

were duly approved and adopted by this department.

I further certify that said copy has been compared by me with the original on file in the department and that the same is a true copy thereof, and of the whole of such original.



IN TESTIMONY WHEREOF, I have hereunto set my hand at 1:15pm in the city of Madison, this 5TH day of DECEMBER A.D. 19 94

Pat Osborne
for Secretary

4-1-97

ORDER OF ADOPTION

Department of Commerce

Pursuant to authority vested in the Department of Commerce by section(s) 101.02 (1) and (15)

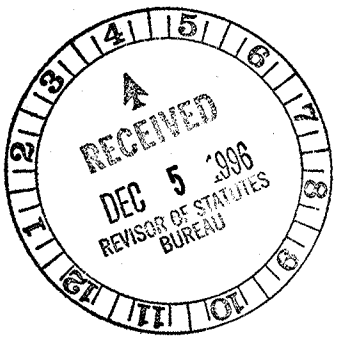
_____ Stats., the Department of Commerce [x] creates; [x] amends;

[x] repeals and recreates; [x] repeals and adopts rules of Wisconsin Administrative Code chapter(s):

(number)	(Title)
ILHR 2	Fee Schedule
ILHR 50 to 64	Building and Heating, Ventilating and Air Conditioning
ILHR 66	Uniform Multifamily Dwellings
ILHR 72	Intermittent Ignition Devices
ILHR 82	Design, Construction, Installation, Supervision and Inspection of Plumbing

The attached rules shall take effect on April 1, 1997

_____ pursuant to section 227.22, Stats.



Adopted at Madison, Wisconsin this

date: 12/5/96

DEPARTMENT OF COMMERCE

Secretary

State of Wisconsin \ Department of Commerce

RULES in FINAL DRAFT FORM

As Adopted with Germane Modifications
December 5, 1996

(pages 32, 120-123 were replaced, revisions were made to 60.16(2) and 5.ILHR 64.19.)

Rule No.: Chs. ILHR 63 & 64

Relating to: Energy Conservation and Ventilation

Clearinghouse Rule No.: 96-144

The Wisconsin Department of Commerce proposes an order to repeal ILHR 52.54, ILHR 54.14, ILHR 55.29, ILHR 56.15, ILHR 57.14, ILHR 58.62, ILHR 60.37, ILHR 62.32 , ILHR 62.78, ILHR 62.965, ILHR A64.06(1), Chapter ILHR 72; to amend the effective date clause of Clearinghouse Rule No. 94-116; to repeal and recreate Table 2.31-1, Table 2.31-2, ILHR 50.03 (2), ILHR 50.12 (3)(c), ILHR 50.12 (4)(b) and (c), ILHR 51.01 (7), ILHR 51.01 (102), ILHR 51.01 (153a), Table 51.03-B, ILHR 51.08, ILHR 51.25, ILHR 52.53, ILHR 54.145, ILHR 55.05, ILHR 56.145, ILHR 57.13 (2)(b), ILHR 57.145, ILHR 58.02, ILHR 58.18 (1), ILHR 58.24, ILHR 58.25 (1)(a) and (b), ILHR 58.44, ILHR 59.22, ILHR 60.10, ILHR 60.18 (2), ILHR 60.19 Note, ILHR 62.23, ILHR 62.93, ILHR 62.995, Chapter ILHR 63, Chapter ILHR 64, ILHR 66.14 (3)(c), ILHR 66.14 (3)(d), ILHR 66.46, ILHR 66.47, ILHR 82.40 (5)(b) and to create ILHR 2.31(1)(a)2.g., and ILHR 51.01 (29m), (29n) and (29o) relating to energy conservation and ventilation.

* *

Analysis of Proposed Rules

Statutory Authority: ss. 101.02 (1) and (15), Stats.
Statutes Interpreted: ss. 101.02 (15) and 101.12, Stats.

Under s. 101.02 (15) and s. 101.12, Stats., the Department of Industry, Labor and Human Relations has the responsibility of protecting public health, safety and welfare relative to the construction of public buildings and places of employment. A key element of fulfilling this responsibility has been promulgation of the commercial building code, chapters ILHR 50 to 64.

The effect of the proposed rule change is primarily a revision of ch. ILHR 63, Energy Conservation, and ch. ILHR 64, Heating Ventilating and Air Conditioning (HVAC) in the code edition that was published in December, 1995 which has not yet become effective (Clearinghouse Rule No. 94-116).

Chapters ILHR 63 and 64 are based on standards published by the American Society of Heating and Refrigerating Engineers (ASHRAE). As newer editions of those standards are issued, the code needs to be updated to be consistent with current technology and building practices.

The purpose of the December, 1995 edition of the rules was to improve indoor air quality in buildings and to comply with the federal Energy Policy Act of 1992 (EPACT) which requires all states to revise their commercial building codes to meet or exceed the American Society of Heating Refrigerating and Air-Conditioning Engineers/Illuminating Engineering Society (ASHRAE/EIS) standard 90.1-1989. A summary of the major changes made in the December, 1995 edition of the code follows the discussion of the proposed rule changes.

After adoption of the December 1995 edition of the rules, but before the effective date, information was provided to the department that indicates that two of the provisions of the rules would cause excessive costs for building owners without commensurate benefit. The two

provisions were: the requirement for ventilation systems to be sized to accommodate the maximum building capacity when the intended use is for fewer occupants; and the requirement that buildings that are used as factories and warehouses that are not conditioned for human comfort be insulated to the same level as buildings for other uses.

The Department reconvened its Energy/HVAC Code Advisory Committee to review the issues and revise the rules. The major revisions to the rules in the proposal are summarized below.

The scope sections of both chapters have been expanded to provide more guidance and detail on how the rules are applied to additions and alterations of existing buildings.

The proposal revises the code so that factories and warehouses that are not conditioned to provide human comfort may be constructed in accordance with the thermal envelope requirements contained in the code that is currently in effect (published January 1994).

In factories, although there may be some space heating for occupant comfort, the primary energy use is usually associated with manufacturing or commercial or industrial processing. The ASHRAE/EIS standard recognizes that the levels of insulation appropriate for other building types may not be appropriate for factories. The requirements for insulation of building thermal envelopes under the ASHRAE/EIS standard 90.1-1989 are based on the assumption that the primary energy use in the building is to provide human comfort.

The requirements for building thermal envelopes have been reformatted in the proposed rules to achieve the same level of energy efficiency with greater ease of use. Easier methods are provided for trade-offs between the insulation levels in opaque portions of walls and roofs and for trade-offs between the opaque portions of walls and windows.

The exemption of high efficiency lighting from the exterior lighting budget is inconsistent with the EPACT law and is repealed.

The ventilation system requirements are revised so that the design and operation of the system may be based on the actual occupant load in the entire area served by the system, with outside air supplied at 7.5 cubic feet per minute per person. This eliminates the requirement to oversize the system.

The term "air movement" is replaced by "air change" or "air change rate" throughout the chapter.

The fee code, ch. ILHR 2, has also been revised to allow lighting documents or worksheets to be submitted as a component of the architectural plans for no additional fee or to be submitted alone for a lower fee.

The proposed rules were developed after consultation with the Energy/HVAC Code Advisory Committee. The current membership of the committee is given below.

ENERGY/HVAC COMMITTEE

Gary Ambach, Wisconsin Utilities Association
Michael Broge, Wisconsin Association of Consulting Engineers
Jim Edelson, Wisconsin Environmental Decade
Bert Fredericksen, Jr., Public
Curt Hastings, Associated General Contractors of America, Wis. Chapter
Russ Lerum, Department of Health and Social Services
Michael Mamayek, Mechanical Contractors Association of Wisconsin
James Mapp, Division of Energy and Intergovernmental Relations
Michael Mesenbourg, Building Owners & Managers Assoc. of Milwaukee, Inc.
Harold Olsen, Self - Private Consultant
Charles Opferman, Associated General Contractors of Greater Milwaukee
Dave Osborne, Wisconsin Builders Association
John Paulson, Self - Private Consultant
George Robak, Wisconsin Society of Architects/AIA
Jim Schey, Department of Administration
Randy Sikkema, Wisconsin Chapter ASHRAE
Carol Stemrich, Public Service Commission
David Stockland, Associated Builders & Contractors of Wisconsin, Inc.
Harry Sulzer, City of Madison Planning & Development Department
Robert Wiedenhoefer, Sheet Metal & Air Conditioning Contractors' National Association, Madison Chapter

A synopsis of the major code revisions that were made in the December, 1995 edition follows.

In the December, 1995 edition, ch. ILHR 63 was revised to consist of seven subchapters: Subchapter I - Scope and Purpose; Subchapter II - Definitions; Subchapter III - Building Envelope; Subchapter IV - Equipment and Systems; Subchapter V - Lighting Power; Subchapter VI - Non-Depletable Energy; and Subchapter VII - System Analysis Design. The previous edition of the code contained a subchapter on water heating, those requirements were updated and added to the Wisconsin Administrative Plumbing Code in a separate rulemaking action.

Subchapter I - Scope and Purpose, was revised to include new rules on those alterations, including lighting system alterations, that would fall within the scope of the code.

Subchapter II - Definitions, was completely rewritten to include definitions to go with the revised code requirements. A majority of the definitions were taken directly from the ASHRAE/EIS 90.1 standard.

Subchapter III - Building Envelope, contains the building envelope requirements from the ASHRAE/EIS 90.1 standard with some simplifications and Wisconsin-specific modifications. Subchapter III contains basic requirements for moisture migration, infiltration and skylights that must be met in any case. After that, code users are given a choice between a prescriptive

"components standards" option or a "system standards" option. As an additional alternative, a whole building analysis including all energy conserving features could be done under Subchapter VII.

The components standards option consists of alternative component packages (ACPs) for the three climate conditions found in the state. Each package summarizes the envelope requirements on a single page including the insulation levels for the roof, exterior walls, floors, and below grade surfaces.

The system standards method was incorporated in a computer program and adds more flexibility for the design of exterior walls and vertical fenestration.

Subchapter IV - Equipment and Systems, contains efficiency standards only for HVAC equipment that is not covered by the federal Department of Energy Rules, 10 cfr Part 430 Energy Conservation Program for Consumer Products. The standards for the equipment covered by the code were taken from ASHRAE/EIS 90.1 without modification. This subchapter also addresses the following factors that effect HVAC system efficiency:

Reducing system losses from ductwork and piping;
Reducing system operation through the use of automatic time controls and zone operation;
Reducing system inefficiencies by minimizing simultaneous heating and cooling;
Reducing system inefficiencies by shutting off outdoor ventilation during set-back and warm-up;
Reducing system operation through requirements for zone controls;
Reducing distribution losses, limiting HVAC fan and pump energy demand and requiring efficient balancing practices;
Requiring systems to take advantage of cool weather to provide free cooling or heat recovery.

Subchapter V - Lighting Power, specifies interior and exterior lighting power allowances and minimum criteria for lighting controls. The December, 1995 edition of the code expanded the ASHRAE/EIS format to offer code users an additional method for determining the interior lighting power allowance. The three alternatives for calculating the interior lighting allowance are the Complete Building Method, the Area Category Method, and the Activity Method.

The complete building method is used for buildings in which at least 80 percent of the space is devoted to the same use. Under the area category method, a separate allowance is calculated for various areas of a building based on occupancy or use, and then summed. Under the activity method, a separate allowance is calculated for various areas of a building based on the specific task or activity, and then summed. Whichever method is used, the lighting power allowance is then compared to the total interior lighting power to be installed in the building. The December, 1995 edition of the code allows exemptions for types of lighting considered to be essential and credits are given for the use of automatic controls.

In the December, 1995 code, no substantive changes were made to Subch. VI - Non-Depletable Energy, nor Subch. VII - System Analysis Design. These subchapters were renumbered to fit in the revised format of the proposal.

The revisions to Ch. ILHR 64 in the December, 1995 code were based on requests for various changes submitted by code users. Some provisions of the 1989 edition of ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality were also used in the update.

The ventilation requirements of previous edition of the code were based on a previous edition of the ASHRAE standard which allowed 5 cubic feet per minute (cfm) of outside air per person. The ASHRAE 62-1989 standard indicates 15 to 60 cfm of outside air per person, depending on occupancy or use. Most spaces need 15 or 20 cfm per person under the ASHRAE standard. The required amounts of outside air are intended to maintain an acceptable level of indoor air quality where the major source of contamination is human occupancy. The December, 1995 edition of the code would require outside air to be provided as a specified cfm per square foot of floor area, based on 7.5 cfm per person. This requirement is to be revised by the proposed rules.

The following sections were also revised in the December, 1995 edition of the code:

ILHR 64.06 specifies a minimum air movement between one and 3 air changes per hour for some occupancies when air conditioning is provided. The design requirements for air conditioning systems are given in s. ILHR 63.23 (2) as 78 degrees and 70 percent relative humidity.

ILHR 64.12 requires tempered make-up air to be provided when the volume of exhaust exceeds 1/2 air change per hour in the area served by the exhaust.

ILHR 64.18(1)(c) restricts the transfer of environmental tobacco smoke between dwelling units.

ILHR 64.19(1)(a) includes new requirements for clearances between exhaust vents and intakes of packaged rooftop units or operable windows.

Table 64.21 was revised so that it includes all isolation requirements for heating equipment. Isolation requirements are made to be uniform for all occupancies: one-hour fire-rated enclosures for gas and oil-fired equipment; and two-hour fire-rated enclosures for solid fuel equipment. Isolation of hazard requirements of other chapters throughout the code were amended as well.

ILHR 64.22(10) recognizes the use of water heaters for space heating and sets appropriate equipment standards.

ILHR 64.34 was revised to clarify where nonmetal and combustible ducts may be used.

ILHR 64.42 requirements for ducts that pierce fire-resistive construction were revised.

ILHR 64.63(2)(d) requirements for intermittent ventilation of garages were revised and now include a nitrogen dioxide limit and a requirement for minimum operation of the system.

ILHR 64.65 ventilation requirements for general sanitation and service areas were revised and include a requirement for mechanical exhaust ventilation for bathrooms with tub or shower facilities to be consistent with the Uniform Dwelling Code.

* *

SECTION 1. ILHR 2.31(1)(a)2.g. is created to read:

ILHR 2.31(1)(a)2.g. Lighting energy efficiency plan check documents.

SECTION 2. Table 2.31-1 is repealed and recreated to read:

Table 2.31-1

Area (Square Feet)	Fees: Building & HVAC	Fees: Building Area Only	Fees: HVAC or Lighting Area Only
Less than 2,500	$ 320	$ 270	$ 190
2,501-5,000	430	320	240
5,001-10,000	580	480	270
10,001-20,000	900	630	370
20,001-30,000	1,280	900	480
30,001-40,000	1,690	1,220	690
40,001-50,000	2,280	1,590	900
50,001-75,000	3,080	2,120	1,220
75,001-100,000	3,880	2,600	1,690
100,001-200,000	5,940	4,240	2,120
200,001-300,000	12,200	7,430	4,700
300,001-400,000	17,190	11,140	6,900
400,001-500,000	21,220	13,790	9,020
Over 500,000	22,810	14,850	10,080

Type of Submittal	
Miscellaneous plans (see subd. 3.)	$250
Permissions to start [see par. (c)]	80
Revisions [see par. (d)]	100

SECTION 3. Table 2.31-2 is repealed and recreated to read:

Table 2.31-2

Area (Square Feet)	Fees		
	Building & HVAC	Building Area Only	HVAC or Lighting Area Only
Less than 2,500	$ 290	$ 240	$ 170
2,501-5,000	390	290	220
5,001-10,000	520	430	240
10,001-20,000	810	570	330
20,001-30,000	1,150	810	430
30,001-40,000	1,530	1,100	630
40,001-50,000	2,060	1,440	810
50,001-75,000	2,780	1,910	1,100
75,001-100,000	3,500	2,350	1,530
100,001-200,000	5,350	3,830	1,910
200,001-300,000	11,000	6,700	4,310
300,001-400,000	15,500	10,050	6,220
400,001-500,000	19,140	12,440	8,130
Over 500,000	20,570	13,400	9,090

SECTION 4. ILHR 50.03 (2) is repealed and recreated to read:

ILHR 50.03 (2) ALTERATIONS TO BUILDINGS. The provisions of this code shall apply to all remodeling or alterations in any building or structure which affect the structural strength, fire hazard, exits, required natural lighting or replacement of major equipment. The provisions of this code shall apply to remodeling and alterations that effect energy efficiency as specified in s. ILHR 63.001. These provisions do not apply to minor repairs necessary for the maintenance of any building or structure nor to buildings exempt, as listed in s. ILHR 50.04.

SECTION 5. ILHR 50.12 (3)(c) is repealed and recreated to read:

ILHR 50.12(3)(c) Heating, ventilating and air conditioning plans. Heating, ventilating and air conditioning plans shall indicate the layout of the system, including location of equipment and

size of all piping, ductwork, dampers (including fire dampers), chimneys, vents and controls. The quantity of outside air introduced to each zone, and the quantity of supply air and exhaust air for each room shall be listed on the plans. The type of equipment and capacity (including the input and output) shall be indicated on the plans or equipment schedules, unless indicated in the specifications. Justification for the number of persons used as the basis for the HVAC system design shall be provided when required by s. ILHR 64.05 (5).

SECTION 6. ILHR 50.12 (4)(b) and (c) are repealed and recreated to read:

ILHR 50.12 (4)(b) Energy conservation data. Calculations and specifications shall be submitted in accordance with s. ILHR 63.01 for the types of projects outlined in s. ILHR 63.001 on forms provided by the department or other forms approved by the department.

Note: See A50.12 of the appendix for sample copies of forms.

(c) Heating and ventilating data. A description of the construction for the walls, floors, ceilings and roof, and the transmission coefficients of the construction materials shall be furnished. The calculations shall include heat losses for the individual rooms (including transmission and infiltration and/or ventilation losses, whichever are greater), a summary of the total building heat loss expressed in Btu/hour or watts, heat gain calculations for air conditioning systems, ventilation calculations including outside air requirements for each space and ventilation system expressed in cubic feet per minute or liters per second, and percent of outside air at maximum and minimum flow rates when the building is occupied.

Note: If the code does not specify a required calculation method, the department will accept as the basis for calculations and design data, the methods and standards recommended by the Mechanical Contractors' Association of America; the American Society of Heating, Refrigerating and Air Conditioning Engineers; and the Institute of Boiler and Radiator Manufacturers.

SECTION 7. ILHR 51.01 (7) is repealed and recreated to read:

ILHR 51.01 (7) "Automatic" means functions without human intervention. Automatic as applied to a fire protective device is one which functions without human intervention and is actuated as a result of the predetermined temperature rise, rate of rise of temperature, combustion product or smoke density, such as an automatic fire sprinkler system, automatic fire door, automatic fire shutter, or automatic fire vent.

SECTION 8. ILHR 51.01 (29m), (29n) and (29o) are created to read:

ILHR 51.01 (29m)"Damper (ceiling)" means a device to limit radiant heat transmission through an air outlet or inlet opening in the ceiling membrane of a floor/roof-ceiling assembly having an assembly fire resistance rating of not less than 1-hour.

(29n) "Damper (fire)"means a device, installed in an air distribution system, designed to close automatically upon detection of heat, to interrupt migratory airflow, and to restrict the passage of flame. a combination fire and smoke damper meets the requirements of both.

(29o) "Damper (smoke)" means a device installed in an air distribution system to control the movement of smoke.

SECTION 9. ILHR 51.01 (102) is repealed and recreated to read:

ILHR 51.01 (102) "Piping, hazardous" means any service piping conveying flammable or toxic gases or liquids.

SECTION 10. ILHR 51.01 (153a) is repealed and recreated to read:

ILHR 51.01 (153a) "Warehouse" means a building or structure used primarily for the reception and storage of goods and merchandise.

SECTION 11. Table 51.03-B is repealed and recreated to read:

TABLE 51.03-B
MAXIMUM TOTAL ALLOWABLE AREA OF WINDOWS OR OTHER WALL OPENINGS IN PERCENT OF TOTAL EXPOSED EXTERIOR WALL SURFACE

Setback From Property Line, or Other Walls on Same Property[1,4]	Class of Construction 1. Fire-Resistive "A" 2. Fire-Resistive "B" 3. Metal Frame Protected 4. Heavy Timber 5. Exterior Masonry		6. Metal Frame Unprotected	7. Wood Frame Protected	8. Wood Frame Unprotected
	Bearing Wall	Nonbearing Wall			
Less than 5 feet	No Openings	No Openings	No Openings	Not Permitted	Not Permitted
5 feet to less than 10 feet	20%[2] Fire Window Required[3]	30%[2] Fire Window Required[3]	30%[1,2]	Not Permitted	Not Permitted
10 feet to less than 30 feet	30%[1]	40%[2]	40%[2]	40%[2]	40%[2]
30 feet or over	No Limit	No Limit	No Limit	No Limit	No Limit

[1] Does not apply to property lines along streets.

[2] Tabulated percentage of openings shall be applied to each 100 lineal feet of wall. This tabulation will not allow wing walls or high parapets, etc., to be used to increase exposed wall areas and thereby increase allowable total area of openings. Where openings are permitted, such openings protected with approved automatic-closing, 3-hour fire door or shutter assemblies--No Limit.

[3] Fire windows shall be as required for moderate fire exposure--see ILHR 51.048.

Note: The window area may also be restricted by other code requirements such as thermal performance requirements specified in ch. ILHR 63.

[4] Setbacks shall be measured as specified in s. ILHR 51.01 (115).

SECTION 12. ILHR 51.08 is repealed and recreated to read:

ILHR 51.08 (title) OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES. (1) When a building is used for more than one purpose, each part of the building comprising a distinct occupancy division shall be separated from any other occupancy division in accordance with Table 51.08-1.

(2) Hazards shall be enclosed in accordance with Table 51.08-2.

(3) Openings in occupancy separations or hazard enclosures shall be protected by fire-door assemblies as specified in s. ILHR 51.047 or by fire-window assemblies as specified in s. ILHR 51.048 or as specified in s. ILHR 51.049.

TABLE 51.08-1
OCCUPANCY SEPARATIONS
MINIMUM FIRE-RESISTIVE RATINGS IN HOURS

Occupancies	Ch 54	Ch 55		Ch 56	Ch 57	Ch 58		Ch 59				Ch 60	Ch 61	Ch 62 Open Park'g. Struc.
		Occu-pants ≤ 750	Occu-pants > 750			Health Care	Deten-tion	≤ 500 sq ft		500 sq ft				
								Storage	Repair	Storage	Repair			
Ch 54	0	3[n]	4[n]	0	i	2[n]	2[b]	1[c, d]	2	2[c, d]	3	0	0	NC-2
Ch 55														
≤ 750 occupants	3[n]	3[e]	4[e]	3[f, g]	3	3[a]	3[b]	3	4	3	4	3[h]	3	3
> 750 occupants	4[n]	4[e]	4[e]	4[f, g]	4	4[a]	4[b]	4	4	4	4	4[h]	4	4
Ch 56	0	3[f, g]	4[f, g]	0	i	2[a]	2[b]	2	3	2	3	0	0	NC-2
Ch 57	i	3	4	i	i	2[a]	2[b]	1[c]	2	2[c, f]	3	i	i	NC-2
Ch 58														
Health Care	2[a]	3[a]	4[a]	2[a]	2[a]	0	2[b]	3	4	3	4	2	2	NC-2
Detention	2[b]	3[b]	4[b]	2[b]	2[b]	2[b]	0	3	4	3	4	2	2	NC-2
Ch 59														
Storage ≤ 500 sq ft	1[c, d]	3	3	2	1[c]	3	3	0	1[k]	1[k]	1[k]	i	m	1[k]
Repair ≤ 500 sq ft	2	4	4	3	2	4	4	1[k]	0	1[k]	1[k]	2	2	1[k]
Storage > 500 sq ft	2[c, d]	3	3	2	2[c, j]	3	3	1[k]	1[k]	0	1[k]	2	m	1[k]
Repair > 500 sq ft	3	4	4	3	3	4	4	1[k]	1[k]	1[k]	0	3	3	1[k]
Ch 60	0	3[n]	4[n]	0	i	2	2	i	i	2	3	0	0	NC-2
Ch 61	0	3	4	0	i	2	2	m	2	m	3	0	0	NC-2
Ch 62														
Open Parking Structures	NC-2	3	4	NC-2	NC-2	NC-2	NC-2	1[k]	1[k]	1[k]	1[k]	NC-2	NC-2	0

Keys and Examples: NC = Noncombustible construction; 0 = 0 (No hourly rating); NC-2 = Noncombustible construction 2-hour rating.

FOOTNOTES TO TABLE 51.08-1:

a. Auditoriums, chapels, residential facilities and other similar areas provided for the patients or employes of health care facilities need not be separated from the health care facility. Also, administrative offices, doctors' offices, medical clinics and laboratories which are intended primarily to provide in-house services or support to the health care facility need not be separated from the health care facility. Doctor's offices, medical clinics and other similar areas which are intended to provide out-patient services independent of the health care facility shall be separated in accordance with the table.

b. Auditoriums, chapels, residential facilities, administrative offices, medical clinics, educational facilities, workshops and other similar areas which are provided for the residents or employes of the detention facility need not be separated from the facility.

c. An occupancy separation need not be provided within a fire station or other similar facility to separate vehicles from other areas of the building, if the vehicles are directly and permanently related to the functions of the building.

d. An occupancy separation need not be provided within an office, factory or warehouse occupancy to separate a storage garage accommodating one or 2 vehicles which are directly related to the functions of that occupancy. If a storage garage accommodating one or 2 vehicles within an office, factory or warehouse occupancy is part of a multioccupancy/multitenant building (i.e., strip shopping center), the occupancy separation shall be provided at least at the adjoining tenants' walls.

e. An occupancy separation need not be provided to separate two adjoining assembly hall areas or functions located within the same building, if the operation or control of the two assembly areas are under the same owner or tenant.

f. An occupancy separation need not be provided between a church and a day school operated by the church provided both occupancies conform with the most restrictive requirements of chs. ILHR 55 and 56.

g. An occupancy separation need not be provided between an assembly hall or theater and an instructional facility regulated under ch. ILHR 56 if the operation and control of the two occupancies is under the same owner.

h. An occupancy separation need not be provided to separate a day care center from an assembly hall occupancy, if the day care center conforms with the more stringent requirements of ch. ILHR 55.

i. See s. ILHR 57.01 concerning living unit separations.

j. Storage garages, attached to residential occupancies under the scope of ch. ILHR 57, may be separated from a residential occupancy by at least one-hour fire-resistive construction, if the storage garage is divided by walls with at least one-hour fire-resistive ratings into spaces with floor areas not exceeding 600 square feet.

k. An occupancy separation need not be provided to separate adjoining storage garages, repair garages or open parking structures which are located within the same building, if the entire building conforms to the most stringent occupancy requirements of chs. ILHR 59 and 62, subch. I.

m. Storage garages, attached to CBRF occupancies under the scope of ch. ILHR 61, may be separated from a CBRF by:

- Common walls between the garage and the CBRF protected with not less than one layer of 5/8-inch Type X gypsum board with taped joints, or equivalent, on the garage side and with not less than one layer of 1/2-inch gypsum board with taped joints, or equivalent, on the CBRF side;
- Floor-ceiling assemblies between garage and the CBRF protected with not less than one layer of 5/8-inch Type X gypsum board on the garage side of the ceiling or roof framing; and

- Openings between the garages and the CBRF protected by self-closing, 1 3/4-inch solid wood core doors or with self-closing doors of equivalent fire-resistive rating.

n. Public mausoleums constructed adjacent to or as part of an assembly hall need not be provided with an occupancy separation.

o. All openings in occupancy separations involving detention facilities shall be protected by fire-resistive door assemblies as specified in s. ILHR 58.60.

See s. ILHR 61.10 (2) concerning detached garages serving CBRF's.

Department of Health and Social Services has stricter requirements for buildings with joint occupancies. See DHSS 83.41 (12).

TABLE 51.08-2

Occupancies	Hazard Isolation Flammable and combustible liquids, trash collection rooms, maintenance shops, generators, woodworking shops, clothes dryers, and similar hazards determined by the department		Exceptions See ch. ILHR 10 for flammable/combustible liquid requirements See exceptions in footnotes 1, 2, 3, 4, and 5
	≤ 3 stories	> 3 stories	
Ch 54	2	2	1-hour isolation permitted for 1-story bldgs <3,000 sq ft
Ch 55 ≤ 750 occupants > 750 occupants	3	3	2-hour isolation permitted for bldgs with a capacity of ≤ 300 people
Ch 56	4	4	2-hour isolation permitted for 1-story bldg
Ch 57	1	2	
Ch 58 Health care Detention	2	3	
Ch 59 Storage ≤ 500 sq ft Repair ≤ 500 sq ft Storage > 500 sq ft Repair > 500 sq ft	2	2	
Ch 60	1	2	
Ch 61	N/A	N/A	N/A
Ch 62 Open parking structures	2	2	
Ch 62 Assembly seating facilities	2	2	
Ch 62 Greenhouses	1	N/A	
Ch 62 Ministorage Buildings	2	2	1-hour isolation permitted for 1-story bldgs <3,000 sq ft

Footnotes To Table 51.08-2:

(1) Fuel-Fired Heating Equipment. All gas- and oil-fired boilers, furnaces and water heaters shall be provided with a 1-hour fire-resistive-rated enclosure. Solid fuel burning equipment shall be provided with a 2 hour fire-resistive-rated enclosure. All openings in the enclosure shall be protected as specified in ss. ILHR 51.047 and ILHR 64.42. Use of hold open devices is prohibited. All fire-rated construction shall comply with ss. ILHR 51.04 to 51.049.

(2) Combustible and Flammable Liquids. Combustible and flammable liquids shall be isolated in accordance with ch. ILHR 10.

(3) Clothes Dryers. All gas, oil, or electric clothes dryers shall be isolated by 2-hour construction. The following exceptions apply to chs. ILHR 54, 55, 56, 57, 59 and 60:

a. Up to 2 co-located residential clothes dryers that each have a rated capacity of 37,000 Btu/hour or less, may be used without a fire-resistive-rated enclosure, provided that any associated gas piping includes a full-flow automatic shut-off valve.

b. Isolation of clothes dryers is not required where automatic fire sprinkler protection is provided for the clothes dryer and a full-flow automatic shut-off valve is provided for any associated gas piping.

(4) Standby Emergency Generators. Fuel-fired emergency generators shall be isolated by 2-hour fire-resistive construction. Emergency generators required by ILHR Table 16.46 (referenced by s. ILHR 52.20) shall be located separately in a 2-hour fire-resistive-rated room with no other equipment or electrical service equipment which is not a part of the emergency and standby power system.

(5) Fire-resistive ratings may be reduced as per s. ILHR 51.02 (22).

SECTION 13. ILHR 51.25 is repealed and recreated to read:

ILHR 51.25 Incorporation of standards by reference. (1) CONSENT. Pursuant to s. 227.21, Stats., the attorney general and the revisor of statutes have consented to the incorporation by reference of the standards listed in sub. (4).

(2) COPIES. Copies of the adopted standards are on file in the offices of the department, the secretary of state and the revisor of statutes. Copies of the standards may be purchased through the respective organizations listed in Tables 51.25-1 to 51.25-21.

(3) INTERIM AMENDMENTS. Interim amendments of the adopted standards shall have no effect in the state until such time as this section is correspondingly revised to reflect the changes.

(4) ADOPTION OF STANDARDS. The standards referenced in Tables 51.25-1 to 51.25-21 are hereby incorporated by reference into this chapter.

Note: The tables in this section provide a comprehensive listing of all of the standards adopted by reference in this code. For requirements or limitations in how these standards are to be applied, refer to the code section that requires compliance with the standard.

TABLE 51.25-1

AA	Aluminum Association 900 19th Street NW Washington, D.C. 20006
Standard Reference Number	Title
SAS-30	Specifications for Aluminum Structures Aluminum Construction Manual, Section 1, 1986.

TABLE 51.25-2

ACI	American Concrete Institute P.O. Box 19150 Detroit, Michigan 48219
Standard Reference Number	Title
1. 318-89 (Revised 1992)	Building Code Requirements for Reinforced Concrete.
2. 318.1-89 (Revised 1992)	Building Code Requirements for Structural Plain Concrete and Commentary.
3. 530-88/ASCE 5-88	Building Code Requirements for Masonry Structures
4. 530.1-88/ASCE 6-88	Specifications for Masonry Structures

TABLE 51.25-3

AIA	The American Institute of Architects Order Department 9 Jay Gould Court P.O. Box 753 Waldorf, MD 20601
Standard Reference Number	**Title**
R673	Guidelines for Construction and Equipment of Hospital and Medical Facilities, 1987 edition.

TABLE 51.25-4

AISC	American Institute of Steel Construction 400 North Michigan Avenue Chicago, IL 60611
Standard Reference Number	**Title**
S326	Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings, with Commentary, November 1, 1978, with supplement #1.

TABLE 51.25-5

AITC	American Institute of Timber Construction 11818 S.E. Mill Plain Blvd., Suite 415 Vancouver, Washington 98684
Standard Reference Number	Title
1. 117.87	Design Standard Specifications for Structural Glued Laminated Timber of Softwood Species
2. 119-85	Standard Specifications for Hardwood Glued Laminated Timber

TABLE 51.25-6

AISI	American Iron and Steel Institute 1133 15th Street, N.W. Suite 300 Washington, D.C. 20005
Standard Reference Number	Title
1. SG-671	Specification for the Design of Coldformed Steel Structural Members, August, 1986.
2.	Manual for Structural Applications of Steel Cables for Buildings, 1973.

TABLE 51.25-7

ANSI	American National Standards Institute, Inc. 1430 Broadway New York, New York 10018
Standard Reference Number	**Title**
1. Z21.10.1-1993	Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less.
2. Z21.10.3-1993	Gas Water Heaters, Volume III, Storage, with Input Ratings Above 75,000 Btu per Hour, Circulating and Instantaneous Water Heaters.
3. Z21.47-1993	Gas-Fired Central Furnaces (except Direct-Vent Central Furnaces).
4. Z83.4-1991, with Z83.4a-1992 Addendum	Direct Gas-Fired Make-up Air Heaters.
5. Z83.8-1990, with Z83.8a-1990 and Z83.8b-1992 Addenda	Gas Unit Heaters.
6. Z83.9-1990	Gas-Fired Duct Furnaces.
7. Z83.18-1990, with Z83.18a-1991 Addendum	Direct Gas-Fired Industrial Air Heaters.
8. Z97.10-1994	Safety Glazing Materials Used in Buildings.
9. 101-93	ANSI/AAMA Aluminum Poly (Vinyl Chloride) (PVC) Prime Windows and Glass Doors.
10. I.S.2-87	ANSI/NWWDA Wood Windows.
11. I.S.3-88	ANSI/NWWDA Wood Sliding Patio Doors.

Table 51.25-8

APA	American Plywood Association P.O. Box 11700 7011 South 19th Street Tacoma, Washington 98460
Standard Reference Number	**Title**
1. PS 1-83U.S.	Product Standard for Construction and Industrial Plywood, Revised October, 1988.

TABLE 51.25-9

ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. 1791 Tullie Circle, NE Atlanta, Georgia 30329
Standard Reference Number	**Title**
1. 81850	Handbook of Fundamentals, 1993.
2. 52-76	Methods of Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter
3. 90.1-1989	Energy Efficient Design of New Buildings Except Low Rise Residential Buildings.

TABLE 51.25-10

ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, Pennsylvania 19103
Standard Reference Number	Title
1. A6-87d	General requirements for rolled steel plates, shapes, sheet piling and bars for structural use.
2. A36-87	Structural steel.
3. A82-85	Plain steel wire for concrete reinforcement.
4. A116-87	Zinc-coated (galvanized) steel woven wire fence fabric.
5. A153-82 (1987)	Zinc coating (hot-dip) on iron and steel hardware.
6. A615-87a	Deformed and plain billet-steel bars for concrete reinforcement.
7. A616-87	Rail-steel deformed and plain bars for concrete reinforcement.
8. A617-87	Axle-steel deformed and plain bars for concrete reinforcement.
9. C22-83	Gypsum.
10. C25-88	Chemical analysis of limestone, quicklime, and hydrated lime.
11. C34-84	Structural clay load-bearing wall tile.
11a. C36-91	Specification for gypsum wallboard.
12. C39-86	Compressive strength of cylindrical concrete specimens.
13. C42-84a	Obtaining and testing drilled cores and sawed beams of concrete.
14. C50-86	Sampling, inspection, packing, and marking of lime and limestone products.
15. C55-85	Concrete building brick.

Table 51.25-10
(Continued)

ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, Pennsylvania 19103
Standard Reference Number	Title
16. C56-71 (1986)	Structural clay non-load-bearing tile.
17. C57-57 (1983)	Structural clay floor tile.
18. C62-87	Building brick (solid masonry units made from clay or shale).
19. C67-87	Sampling and testing brick and structural clay tile.
20. C90-85	Hollow load-bearing concrete masonry units.
21. C91-87a	Masonry cement.
22. C97-83	Absorption and bulk specific gravity of natural building stone.
23. C99-87	Modulus of rupture of natural building stone.
24. C110-87	Physical testing of quicklime, hydrated lime, and limestone.
25. C140-75 (1980)	Sampling and testing concrete masonry units.
26. C144-87	Aggregate for masonry mortar.
27. C145-75 (1981)	Solid load-bearing concrete masonry units.
28. C150-86	Portland cement.
29. C170-87	Compressive strength of natural building stone.
30. C177-85	Test method for steady-state heat flux measurements and thermal transmission properties by means of the guarded-hot-plate apparatus.
31. C207-79 (1984)	Hydrated lime for masonry purposes.
32. C236-87	Test method for steady-state thermal performance of building assemblies by means of a guarded hot box.

Table 51.25-10
(Continued)

ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, Pennsylvania 19103
Standard Reference Number	Title
33. C270-88	Mortar for unit masonry.
34. C317-87	Gypsum concrete.
35. C335-84	Test method for steady state heat transfer properties of horizontal pipe insulations.
36. C457-82a	Microsopical determination of air-void content and parameters of the air-void system in hardened concrete.
37. C471-87	Chemical analysis of gypsum and gypsum products.
38. C472-84	Physical testing of gypsum plasters and gypsum concrete.
39. C473-87a	Physical testing of gypsum board products and gypsum lath.
40. C476-83	Grout for reinforced and nonreinforced masonry.
41. C518-85	Test method for steady-state heat flux measurements and thermal transmission properties by means of the heat flow meter apparatus.
42. C652-87a	Hollow brick (hollow masonry units made from clay or shale).
43. C666-84	Resistance of concrete to rapid freezing and thawing.
44. C952-86	Bond strength of mortar to masonry units.
45. C956-81 (1986)	Installation of cast-in-place reinforced gypsum concrete.
46. C976-82	Test method for thermal performance of building assemblies by means of a calibrated hot box.
47. D245-81	Establishing structural grades and related allowable properties for visually graded lumber.

Table 51.25-10
(Continued)

ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, Pennsylvania 19103
Standard Reference Number	Title
48. D635-81	Rate of burning and/or extent and time of burning of self-supporting plastics in a horizontal position.
49. D1037-87	Evaluating the properties of wood-base fiber and particle panel materials.
50. D1143-81 (1987)	Testing piles under static axial compressive load.
51. D1929-77 (1985)	Ignition properties of plastics.
52. D2843-77	Density of smoke from the burning or decomposition of plastics.
53. D4099-87	Specification for polyvinyl chloride (PVC) prime windows.
54. E72-80	Conducting strength tests of panels for building construction.
55. E84-87	Surface burning characteristics of building materials.
56. E108-87	Fire tests of roof coverings.
57. E119-88	Fire tests of building construction and materials.
58. E136-82	Behavior of materials in a vertical tube furnace at 750°C.
59. E152-81a	Fire tests of door assemblies.
60. E163-84	Fire tests of window assemblies.
61. E283-84	Rate of air leakage through exterior windows, curtain walls and doors.
62. E447-84	Compressive strength of masonry prisms.
63. E648-88	Critical radiant flux of floor covering systems using a radiant heat energy source.

TABLE 51.25-11

AWS	American Welding Society P.O. Box 351040 Miami, Florida 33135
Standard Reference Number	Title
1. D1.1-88	Structural Welding Code-Steel
2. D1.3-89	Structural Welding Code-Sheet Steel

TABLE 51.25-12

AWPA	American Wood Preservers Association P.O. Box 286 Woodstock, Maryland 21163-0286
Standard Reference Number	Title
1. C1-1993	All Timber Products
2. C2-1988	Lumber, Timbers, Bridge Ties and Mine Ties - Preservative Treatment by Pressure Processes
3. C4-1989	Poles - Preservative Treatment by Pressure Processes
4. C9-1993	Plywood

TABLE 51.25-13

AWPB	American Wood Preservers Bureau P.O. Box 5283 Springfield, Virginia 22150
Standard Reference Number	**Title**
1. LP-2 1988	Standards for Softwood Lumber, Timber and Plywood Pressure Treated with Water-Borne Preservatives for Above Ground Use.
2. LP-22 1988	Standards for Softwood Lumber, Timber and Plywood Pressure Treated with Water-Borne Preservatives for Ground Contact Use.
3. FDN 1988	Quality Control Program For Softwood Lumber, Timber and Plywood Pressure Treated With Water-Borne Preservatives, For Ground Contact Use in Residential and Light Commercial Foundations.

TABLE 51.25-13M

DOE	U.S. Department of Energy U.S. Government Printing Office Washington, DC 20585 Telephone: 202/512-1800
Standard Reference Number	**Title**
1. 21 CFR, Section 1002.10 (1994)	None
2. 47 CFR, Part 5 (1993)	Experimental Radio Services

TABLE 51.25-14

FM	Factory Mutual Research Corporation 1151 Boston-Providence Turnpike Norwood, Mass. 02062
Standard Reference Number	Title
4450, Revised Aug. 5, 1977	Approval Standard for Class I Insulated Steel Deck Roofs.

TABLE 51.25-15

GA	Gypsum Association 810 First Street NE, #510 Washington, DC 20002
Standard Reference Number	Title
GA-600-88	Fire Resistance Design Manual

TABLE 51.25-16

NiDI	Nickel Development Institute 15 Toronto Street, Suite 402 Toronto, Ontario, Canada M5C 2E3
Standard Reference Number	Title
9023	Stainless Steel Cold-Formed Structural Design Manual, 1974 edition

TABLE 51.25-17

NFiPA	National Fire Protection Association One Batterymarch Park Quincy, Massachusetts 02169
Standard Reference Number	Title
1. 10-1988	Standard for portable fire extinguishers.
2. 13-1994	Standard for the installation of sprinkler systems.
3. 13R-1994	Standard for the installation of sprinkler systems in residential occupancies up to and including four stories in height.
4. 15-1990	Standard for water spray fixed systems for fire protection.
5. 20-1987	Standard for the installation of centrifugal fire pumps.
6. 22-1987	Standard for water tanks for private fire protection.
7. 24-1987	Standard for the installation of private fire service mains and their appurtenances.
8. 25-1992	Standard for the inspection, testing, and maintenance of water-based fire protection systems.
9. 31-1987	Standard for the installation of oil-burning equipment.
10. 54-1992	National fuel gas code.
11. 71-1987	Standard for the installation, maintenance and use of protective signaling systems.
12. 72A-1990	Standard for the installation, maintenance and use of local protective signaling systems for guard's tour, fire alarm and supervisory service.
13. 72E-1987	Standard on automatic fire detectors.
14. 74-1989	Standard for the installation, maintenance and use of household fire warning equipment.

TABLE 51.25-17
(Continued)

NFiPA	National Fire Protection Association One Batterymarch Park Quincy, Massachusetts 02169
Standard Reference Number	Title
15. 90A-1985	Standard for the installation of air conditioning and ventilating systems.
16. 96-1994	Standard for the installation of equipment for the removal of smoke and grease-laden vapors from commercial cooking equipment.
17. 211-1988	Standard for chimneys, fireplaces, vents and solid fuel burning appliances.
18. 231-1990	Standard for general storage.
19. 231C-1990	Rack storage of materials.

TABLE 51.25-17M

NFRC	National Fenestration Rating Council 962 Wayne Ave., Suite 750 Silver Spring, Maryland 29010
Standard Reference Number	Title
1. 100-91	Procedure for Determining Fenestration Product Thermal Properties.
2. LAP1-92, PCP1-92 and CAP1-92	Fenestration Thermal Performance Rating Certification and Labeling Program.

TABLE 51.25-18

NF_0PA	National Forest Products Association 1250 Connecticut Avenue, N.W., #200 Washington, DC 20036

Standard Reference Number	Title
1. NDS	National Design Specification for Wood Construction, 1991 Edition, including Design Values for Wood Construction, a 1991 supplement to the 1991 Edition of National Design Specification for Wood Construction.
2. Technical Report No. 7	The Permanent Wood Foundation System, Basic Requirements, Revised January, 1987.

TABLE 51.25-18M

SMACNA	Sheet Metal and Air Conditioning Contractors National Association Vienna, Virginia 22180

Standard Reference Number	Title
	HVAC Duct Leakage Test Manual, 1st Ed, 1985.

TABLE 51.25-19

SJI	Steel Joist Institute Suite A 1205 48th Ave., North Myrtle Beach, South Carolina 29577

Standard Reference Number	Title
	Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders, 1988.

TABLE 51.25-20

TPI	Truss Plate Institute, Inc. 583 D'Onofrio Dr., Suite 200 Madison, Wisconsin 53719
Standard Reference Number	Title
TPI-85	Design Specification for Metal Plate Connected Wood Trusses, Including 1987 Supplement and Errata Addendum Sheet.

TABLE 51.25-21

UL	Underwriters Laboratories, Inc. Publication Stock 333 Pfingsten Road Northbrook, Illinois 60062
Standard Reference Number	Title
1. 181-1981	Factory-Made Air Ducts and Connectors, Including revisions dated March 19, 1994.
2. 1256-1985	Fire Test of Roof Deck Constructions.

SECTION 14. ILHR 52.53 is repealed and recreated to read:

ILHR 52.53 LOCATION, LIGHT AND VENTILATION. (1) Toilet rooms shall be ventilated in accordance with the provisions of s. ILHR 64.65.

(2) Toilet rooms may not have ventilation openings in an elevator shaft or inner court that has windows of habitable rooms above unless the shaft or court has an area greater than 1,250 square feet and a least dimension greater than 20 feet.

SECTION 15. ILHR 52.54 is repealed.

SECTION 16. ILHR 54.14 is repealed.

SECTION 17. ILHR 54.145 is repealed and recreated to read:

ILHR 54.145 OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES. Occupancies within the scope of this chapter shall be separated from other occupancies or uses in accordance with s. ILHR 51.08. Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 18. ILHR 55.05 is repealed and recreated to read:

ILHR 55.05 OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES. Occupancies within the scope of this chapter shall be separated from other occupancies or uses in accordance with s. ILHR 51.08. Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 19. ILHR 55.29 is repealed.

SECTION 20. ILHR 56.145 is repealed and recreated to read:

ILHR 56.145 OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES. Occupancies within the scope of this chapter shall be separated from other occupancies or uses in accordance with s. ILHR 51.08. Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 21. ILHR 56.15 is repealed.

SECTION 22. ILHR 57.13 (2)(b) is repealed and recreated to read:

ILHR 57.13 (2)(b) Habitable rooms in motels and hotels and similar sleeping rooms in buildings accommodating transients shall not be required to be provided with openable doors and windows for ventilation purposes if the rooms are provided with mechanical ventilation system supplying tempered outside air and air movement as specified in s. ILHR 64.05 and 64.06.

SECTION 23. ILHR 57.14 is repealed.

SECTION 24. ILHR 57.145 is repealed and recreated to read:

ILHR 57.145 OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES. Occupancies within the scope of this chapter shall be separated from other occupancies or uses in accordance with s. ILHR 51.08. Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 25. ILHR 58.02 is repealed and recreated to read:

ILHR 58.02 OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES. Occupancies within the scope of this chapter shall be separated from other occupancies or uses in accordance with s. ILHR 51.08. Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 26. ILHR 58.18 (1) is repealed and recreated to read:

ILHR 58.18 (1) EXIT SIGNS. Every required exit shall be identified with an internal illuminated, red or green exit sign bearing the word "EXIT" or "OUT" in plain letters not less than 6 inches high, with the principal strokes or letters not less than 3/4 inches.

SECTION 27. ILHR 58.24 is repealed and recreated to read:

ILHR 58.24 PROTECTION FROM HAZARDS. (1) SEPARATIONS. All hazards listed in Table 58.24 shall be vertically separated from other areas of the building with fire-resistive rated construction as specified in Table 58.24. All openings shall be protected with fire-resistive door assemblies as specified in s. ILHR 51.047.

TABLE 58.24

HAZARDS	FIRE-RESISTIVE RATING IN HOURS
† Soiled Linen Rooms	1
Kitchens[1]	1
Handicraft Shops[1]	1
† Carpenter Shops	1
Repair Shops[1]	1
† Paint Shops	1
† Trash Collection Rooms	1
† Storage Rooms (containing quantities of flammable or combustible material exceeding 1 lb. of material per square foot of floor area)	1
Gift Shops[1]	1
† Laboratories (containing quantities of flammable or combustible material exceeding 1 lb. of material per square foot of floor area)	1
All other laboratories[1]	1
Employe Locker Rooms[1]	1

† These areas are required to be protected with an automatic sprinkler system in addition to the fire-resistive enclosure requirements specified in the table.

[1] The minimum hourly ratings specified may be reduced to a smoke separation with a self-closing door in buildings protected by a complete automatic sprinkler system.

(2) FIREPLACES. Fireplaces shall be permitted in health care facilities provided:

(a) The fireplace is installed and used in areas other than patient sleeping areas which are separated from the patient sleeping areas by construction having at least a one-hour fire-resistive rating;

(b) The fireplace is equipped with safety screens and a heat tempered glass fireplace enclosure capable of withstanding temperatures of 650°F.; and

(c) Combustion air for the fireplace is taken directly from outside the building.

SECTION 28. ILHR 58.25 (1)(a) and (b) are repealed and recreated to read:

ILHR 58.25 (1)(a) All rubbish chutes may discharge into trash collecting rooms, which are used for no other purpose and are enclosed as specified in Table 58.24. The incinerator shall not be directly flue-fed nor shall any floor discharging chute directly connect with the combustion chamber.

(b) All laundry chutes shall discharge into laundry rooms or laundry collecting rooms, which are used for no other purpose and are enclosed as specified in Tables 51.08-2 and 58.24.

SECTION 29. ILHR 58.44 is repealed and recreated to read:

ILHR 58.44 SEPARATION FROM OTHER OCCUPANCIES AND HAZARD ENCLOSURES. (1) OCCUPANCY SEPARATION. Occupancies not within the scope of this subchapter, built in connection with any detention or correctional facility shall be separated from any such detention or correctional facility in accordance with s. ILHR 51.08. Auditoriums, chapels, dining rooms, residential facilities and other similar areas provided for the residents need not be separated with rated construction. Class of construction separations shall comply with s. ILHR 51.02 (20).

(2) GARAGES. (a) Storage garages and repair garages shall be separated from detention and correctional facilities as specified in s. ILHR 59.22.

(b) Areas accommodating vehicles for the purpose of loading or unloading persons or material need not be separated from detention and correctional facilities. Storage or repair of the vehicles is prohibited in the loading and unloading areas, unless the type of construction meets the requirements for a garage.

(3) HAZARD ENCLOSURES. Hazards shall be enclosed in accordance with s. ILHR 51.08.

(4) EXITING FROM MIXED OCCUPANCIES. Required means of egress from all detention and correctional occupancies may exit through nondetention and noncorrectional occupancies provided the means of egress complies with the requirements specified in this subchapter.

SECTION 30. ILHR 58.62 is repealed.

SECTION 31. ILHR 59.21 is repealed.

SECTION 32. ILHR 59.22 is repealed and recreated to read:

ILHR 59.22 OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES.
Occupancies within the scope of this chapter shall be separated from other occupancies or uses in accordance with s. ILHR 51.08. Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 33. ILHR 60.10 is repealed and recreated to read:

ILHR 60.10 OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES.
Occupancies within the scope of this chapter shall be separated from other occupancies or uses in accordance with s. ILHR 51.08. Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 34. ILHR 60.18 (2) is repealed and recreated to read:

ILHR 60.18 (2) Outside air at the rate of 7.5 cfm per person or as specified in s. ILHR 64.05 shall be provided for centers that do not comply with the openable window requirements of s. ILHR 60.13 (2).

SECTION 35. ILHR 60.19 Note is repealed and recreated to read:

Note: NFPA Standard No. 30 is a mandatory standard for the storage of flammable and combustible liquids within the scope of ch. ILHR 10.

SECTION 36. ILHR 60.37 is repealed.

SECTION 37. ILHR 62.23 is repealed and recreated to read:

ILHR 62.23 OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES.
Occupancies within the scope of this chapter shall be separated from other occupancies or uses in accordance with s. ILHR 51.08. Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 38. ILHR 62.32 is repealed.

SECTION 39. ILHR 62.78 is repealed.

SECTION 40. ILHR 62.93 is repealed and recreated to read:

ILHR 62.93 OCCUPANCY SEPARATIONS AND HAZARD ENCLOSURES. Occupancies within the scope of this chapter shall be separated from other occupancies or uses in accordance with s. ILHR 51.08. Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 41. ILHR 62.965 is repealed.

SECTION 42. ILHR 62.995 is repealed and recreated to read:

ILHR 62.995 MINI-STORAGE BUILDINGS. (1) SCOPE. This subchapter provides the minimum requirements for the design and construction of mini-storage buildings.

(2) HEIGHT, AREA AND CLASS OF CONSTRUCTION. Mini-storage buildings shall be limited to one story and shall not exceed the class of construction and the corresponding area limitations of Table 59.12-1 or 59.12-2 for one story storage garages.

(3) COMPARTMENTALIZATION. Mini-storage buildings shall be divided into areas not greater than 3,000 square feet by 2-hour fire- resistive walls extending from the noncombustible floor to the underside of the roof deck.

(4) CONTENTS. Mini-storage buildings may be utilized for low or moderate hazard material and motor vehicle storage. Storage of high hazard material is prohibited. Uses other than for storage is prohibited, except that a rental or manager's office for the storage facility may be provided, subject to the provisions of ch. ILHR 54.

Note: See s. A52.011 of Appendix A for further explanatory material.

(5) NUMBER AND LOCATION OF EXITS. (a) Each compartment of a mini-storage building shall be provided with at least one standard exit or overhead door to the outside.

(b) One exit is permitted from a mezzanine floor level, provided the mezzanine is:

1. Open on at least one side to the floor below;

2. Not more than 12 feet above the floor below; and

3. Served by a stairway as specified in s. ILHR 51.16, except that the stairway width may be reduced to 3 feet 0 inches.

(c) Exits shall be provided and distributed as follows:

1. No area of a mini-storage building may be more than 100 feet from an exit, unless the entire building is protected by an automatic sprinkler system.

2. No area of a mini-storage building entirely protected by an automatic fire sprinkler system may be more than 200 feet from an exit.

SECTION 43. Chapter ILHR 63 is repealed and recreated to read:

Subchapter I — Scope and Purpose

ILHR 63.001 Scope. (1) GENERAL. The provisions of this chapter shall apply to all public buildings and places of employment. These provisions are not retroactive unless specifically stated in the administrative rule. Where different sections of this chapter specify different requirements, the most restrictive requirement shall govern.

(2) EXEMPT BUILDINGS AND STRUCTURES. Buildings and structures, or portions thereof, without space heating or cooling, service water heating, or illumination are exempt from the requirements of this chapter that apply to those systems.

(3) APPLICATIONS TO EXISTING BUILDINGS. (a) 1. Additions to existing buildings or structures may be made without making the entire building or structure comply, but the addition shall comply with the requirements of this chapter

2. If a system serves both the existing building and the addition, any portion of the system or equipment that is altered shall comply with subch. IV.

(b) 1. Any change of occupancy of a building that would increase the required minimum inside temperature as specified in Table 64.05 shall not be permitted unless the building is made to comply with the requirements of this chapter.

2. Any change of use of a building or space within a building that would increase the minimum inside temperature as specified in Table 64.05 shall not be permitted unless the building or space is altered to comply with the requirements of this chapter.

3. Alterations to the building envelope governed by subch. III shall comply with one of the following:

a. The alteration shall not increase the rate of heat loss through the portion of the thermal envelope containing the alteration; or

b. The alteration shall not increase the annual energy use from heat gain or loss through the entire thermal envelope; or

c. The thermal envelope shall be brought into compliance with the requirements of subch. III.

4. Any alteration to the equipment and systems governed by subch. IV shall not be permitted unless the portion of the governed equipment or system being altered is brought into compliance with the requirements of subch IV.

(c) 1. Heating and cooling equipment replacement shall comply with the requirements of this chapter.

2. Rooftop fan systems that are replaced shall be provided with economizers that comply with the requirements of this chapter.

Note: It is the intent of the department to have every new building or addition and every change of occupancy meet the energy conservation requirements of this chapter. It is not the intent to prevent a previously built building from installing air conditioning, nor to cause equipment with several years of remaining service to be discarded due to not being able to meet the required efficiencies of this chapter. However, occupancy changes such as building a warehouse and later remodeling it into an office space will not be permitted unless all the requirements of this chapter are met.

(d) 1. New lighting systems installed in conjunction with an increase of conditioned floor area, such as the addition of a mezzanine, shall meet the requirements of this chapter.

2. Alterations to existing lighting systems that increase the connected lighting load of the building or replace more than 50 percent of the lighting fixtures in the area of the alteration shall meet the requirements of this chapter.

ILHR 63.002 PURPOSE. The purpose of this chapter is to provide design requirements which will promote efficient utilization of energy in public buildings and places of employment.

(1) GENERAL. The intent of this chapter is to provide minimum requirements for construction and equipment to conserve energy.

(2) FLEXIBILITY IN USE. It is intended that this chapter be flexible and permit the use of innovative approaches and techniques to achieve effective utilization of energy.

(3) CONFLICT WITH OTHER RULES. This chapter is not intended to conflict with any safety or health requirements. Where such conflict occurs, the safety and health requirements shall govern.

ILHR 63.01 PLANS AND SPECIFICATIONS. Architectural and mechanical plans and specifications shall be submitted in accordance with the requirements outlined in ss. ILHR 50.07 and 50.12 and shall contain details and data to demonstrate compliance with the requirements of this chapter. Such information shall include, but is not limited to: design criteria, exterior

envelope component materials, and resistance values of insulating materials. Size and type of equipment, system and equipment controls and equipment efficiencies shall be submitted with the mechanical plans.

Note: The resistance values for insulating materials are expressed in Fahrenheit degrees per Btu/(hour)(square foot). See A50.12 of the appendix for sample copies of forms.

Subchapter II — Definitions

ILHR 63.05 DEFINITIONS. In this chapter: (1) "Ambient Lighting" is lighting designed to provide a substantially uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect. When designed for lower-than-task illuminance used in conjunction with other specific task lighting systems, it is also called "general" lighting.

(2) "Automatic" means self-acting, operating by its own mechanism when actuated by some impersonal influence, such as, a change in current strength, pressure, temperature, or mechanical configuration.

(3) "Automatic time switch control devices" means control devices that are capable of automatically turning loads off and on based on time schedules.

(4) "Building envelope" means the elements of a building that enclose conditioned spaces through which thermal energy may be transferred to or from the exterior or to or from unconditioned spaces.

(5) "Comfort cooling" or "comfort heating" means treating air to control one or more of the following: temperature, relative humidity, or distribution to meet the comfort requirements of the human occupants of the conditioned space.

(6) "Conditioned floor area" or "CFA" means the floor area in square feet of enclosed conditioned space on all floors of a building, as measured at the floor level of the exterior surfaces of exterior walls enclosing the conditioned space.

(7) "Conditioned space" means a cooled space, heated space, or indirectly conditioned space.

(8) "Cooled space" means an enclosed space within a building that is conditioned by a cooling system with a sensible capacity that either exceeds 5 Btu/hr sq ft or is capable of maintaining a space dry-bulb temperature of 90°F or less at design conditions.

(9) "Daylighting control" means a device that automatically regulates the power input to electric lighting near the fenestration to maintain the desired workplace illumination, thus taking advantage of direct or indirect sunlight.

(10) "Deadband" means the range of values within which an input variable can be varied without initiating any noticeable change in the output variable.

(11) "Degree day" means a unit based upon temperature difference and time, used in estimating annual heating or cooling energy consumption. One degree day accrues for each degree of difference between the daily mean temperature and a reference temperature.

(12) "Display lighting" means lighting confined to the area of a display that provides a higher level of illuminance than the level of surrounding ambient illuminance.

(13) "Daylit area" means the space on the floor that is the larger of par. (a) or par. (b) as follows:

(a) 1. For areas daylit by vertical glazing, the daylit area has the length of 15 feet, or the distance on the floor, perpendicular to the glazing, to the nearest 60-inch or higher opaque partition, whichever is less; and a width of the window plus either 2 feet on each side, the distance to an opaque partition, or one-half the distance to the closest skylight or vertical glazing, whichever is least.

2. For areas daylit by horizontal glazing, the daylit area is the footprint of the skylight plus, in each of the lateral and longitudinal dimensions of the skylight, the lesser of the floor-to-ceiling height, the distance to the nearest 60-inch or higher opaque partition, or one-half the horizontal distance to the edge of the closest skylight or vertical glazing.

(b) The daylit area calculated using a method acceptable to the department.

Note: See Appendix A for additional illustrative information.

(14) "Economizer, air" means a ducting arrangement and automatic control system that allows a cooling supply fan to supply outside air to reduce or eliminate the need for mechanical refrigeration during mild or cold weather.

(15) "Economizer, water" means a system by which the supply air of a cooling system is cooled directly or indirectly or both by evaporation of water or other appropriate fluid in order to reduce or eliminate the need for mechanical refrigeration during some time periods.

(16) "Effective aperture" or "EA" means (1) for windows, the visible light transmittance times the window wall ratio; and (2) for sky lights, the well efficiency times the visible light transmittance times the sky light area times 0.85 divided by the gross exterior roof area.

(17) "Efficacy" means the ratio of light from a lamp to the electrical power consumed, including ballast losses, expressed in lumens per watt.

(18) "Emissivity" means the ratio of the rate of radiant heat energy emitted by a body at a given temperature to the rate of radiant heat energy emitted by a standard called a blackbody, at the same temperature in the same surroundings.

(19) "Exterior envelope" has the same meaning as "building envelope."

(20) "Exterior roof or ceiling" means an exterior partition, or partition separating a conditioned space from an enclosed unconditioned space, that has a slope less than 60 degrees from horizontal, that has conditioned space below, and that is not an exterior door or skylight.

(21) "Exterior roof or ceiling area" means the area of the exterior surface of exterior roof or ceiling.

(22) "Exterior wall" means an exterior partition that is not an exterior floor or soffit, exterior door, exterior roof or ceiling, window, or skylight.

(23) "Exterior wall area" means the area of the opaque exterior surface of exterior walls.

(24) "Fenestration" means any light-transmitting section in a building wall or roof. The fenestration includes glazing material, which may be glass or plastic, framing such as mullions, muntins, and dividers, external shading devices, internal shading devices, and integral or between glass shading devices.

(25) "Fenestration area" means the total area of fenestration measured using the rough opening and including the glazing material, sash, and frame.

(26) "General lighting" means lighting designed to provide a substantially uniform level of illumination throughout an area, exclusive of any provision for special visual tasks or decorative effect. When designed for lower-than- task illuminance used in conjunction with other specific task lighting systems, it is also called "ambient" lighting.

(27) "Gross exterior wall area" means the gross area of exterior walls separating a conditioned space from the outdoors or from unconditioned spaces as measured on the exterior above grade. It consists of the opaque wall, excluding vents and grills, including between floor spandrels, peripheral edges of flooring, window areas including sash, and door areas.

(28) "Gross floor area" means the sum of the floor areas of the conditioned spaces within the building including basements, mezzanine and intermediate-floored tiers, and penthouses of headroom height 7.5 ft or greater. It is measured from the exterior faces of exterior walls or from the centerline of walls separating buildings, excluding covered walkways, open roofed-over areas, porches and similar spaces, pipe trenches, exterior terraces or steps, chimneys, roof overhangs, and similar features.

(29) "Gross floor area over outside or unconditioned spaces" means the gross area of a floor assembly separating a conditioned space from the outdoors or from unconditioned spaces as

measured from the exterior faces of exterior walls or from the center line of walls separating buildings. The floor assembly shall be considered to include all floor components through which heat may flow between indoor and outdoor or unconditioned environments.

(30) "Gross lighted area" or "GLA" means the sum of the total lighted areas of a building measured from the inside of the perimeter walls for each floor of the building.

(31) "Gross roof area" means the gross area of a roof assembly separating a conditioned space from the outdoors or from unconditioned spaces, measured from the exterior faces of exterior walls or from the centerline of walls separating buildings. The roof assembly shall be considered to include all roof or ceiling components through which heat may flow between indoor and outdoor environments including skylights but excluding service openings.

(32) "Gross exterior roof area" means the sum of the skylight area and the exterior roof/ceiling area.

(33) "Gross exterior wall area" means the sum of the window area, door area and exterior wall area.

(34) "Heat capacity" or "HC" means the amount of heat necessary to raise the temperature of a given mass one degree. Numerically, it is the mass multiplied by the specific heat.

(35) "Heated space" means an enclosed space within a building that is conditioned by a heating system with an output capacity either exceeds 10 Btu/hr sq ft or is capable of maintaining a space dry-bulb temperature of 50°F or more at design conditions.

(36) "Heating, ventilating, and air conditioning system" or "HVAC system" means the equipment, distribution network, and terminals that provide either collectively or individually the process of heating, ventilating, or air conditioning to a building.

(37) "Humidistat" means a device that is capable of being set to prevent the use of fossil fuel or electricity to humidify air above 30 percent relative humidity or dehumidify air to below 60 percent relative humidity, or both.

(38) "Indirectly conditioned space" means an enclosed space including, but not limited to, unconditioned volume in atria, that is not directly conditioned space; and either has an area-weighted heat transfer coefficient to directly conditioned space exceeding that to the outdoors or to unconditioned space, or is a space through which air from directly conditioned spaces is transferred at a rate exceeding three air changes per hour.

(39) "Listed space area" or "LS" means any interior space with an identified area of activities for which a lighting power budget is calculated and listed in the lighting power allowance determination.

(40) "Lumen maintenance control device" means a device capable of automatically adjusting the light output of a lighting system throughout a continuous range to provide a preset level of illumination.

(41) "Luminaire" means a complete lighting unit consisting of at least one lamp and the parts designed to distribute the light, to position and protect the lamp, to connect the lamp to the power supply and ballasting, when applicable. Luminaires are commonly referred to as "lighting fixtures" or "instruments."

(42) "Manual" means capable of being operated by personal intervention.

(43) "Mass wall" means a wall assembly with a heat capacity (HC) greater than or equal to 5 Btu/ft^2·°F.

(44) "Mass wall insulation position" means: (a) Exterior insulation position: a wall having all or nearly all of its mass exposed to the room air with the insulation on the exterior of that mass.

(b) Integral insulation position: a wall having mass exposed to both room and outside air with substantially equal amounts of mass on the inside and outside of the insulation layer.

(c) Interior insulation position: a wall not meeting either par. (a) or (b), particularly a wall having most of its mass external to an insulation layer.

(45) "Medical and clinical care" means the promotion of the condition of being sound in body or mind through medical, dental or psychological examination and treatment.

(46) "Multiscene dimming system" means a lighting control device that has the capability of setting light levels throughout a continuous range, and that has pre-established settings within the range.

(47) "Occupant-sensing device" means a device that automatically controls the lights based on occupancy.

(48) "Opaque areas" means all exposed areas of a building envelope which enclose conditioned space except fenestration areas and building service openings such as vents and grilles.

(49) "Ornamental chandeliers" means ceiling-mounted, close-to-ceiling, or suspended decorative luminaires that use glass, crystal, ornamental metals, or other decorative material and that typically are used in hotels/motels, restaurants, or churches as a significant element in the interior architecture.

(50) "Precision commercial or industrial work" means an art, craft, or manufacturing operation requiring a certain degree of refinement.

(51) "Private driveways, walkways, and parking lots" means exterior transit areas that are associated with a commercial or residential building and intended for use solely by the employes or tenants and not by the general public.

(52) "Public driveways, walkways, and parking lots" means exterior transit areas that are intended for use by the general public.

(53) "Recooling" means lowering the temperature of air that has been previously heated by a heating system.

(54) "Recovered energy" means energy utilized from an energy-using system which would otherwise be wasted or not contribute to a desired end use.

(55) "Reduced flicker operation" means the operation of a light, in which the light has a visual flicker less than 30 percent for frequency and modulation.

(56) "Reheating" means raising the temperature of air that has been previously cooled either by refrigeration or an economizer system.

Note: Introducing outdoor air necessary to meet ventilation requirements or to assure adequate indoor air quality is not considered to be cooling.

(57) "Reset" means adjustment of the controller set point to a higher or lower value automatically or manually.

(58) "Sconce" means a wall mounted decorative light fixture.

(59) "Shading coefficient" or "SC_x" means the ratio of solar heat gain through fenestration, with or without integral shading devices, to that occurring through unshaded 1/8-in. thick clear double strength glass.

(60) "Shell building" means a building for which the envelope is designed, constructed, or both prior to knowing the occupancy type.

Note: See also speculative building.

(61) "Speculative building" means a building for which the envelope is designed, constructed, or both prior to the design of the lighting, HVAC systems, or both. A speculative building differs from a shell building in that the intended occupancy is known for the speculative building.

Note: See also shell building.

(62) "Support area" means an area for functions that are different from but necessary to accomplish the main activity or purpose of other listed space areas.

(63) "Tandem wiring" means pairs of luminaires operating with one lamp in each luminaire powered from a single two-lamp ballast contained in the other luminaires.

(64) "Task oriented lighting" means lighting that is designed specifically to illuminate a task location, and that is generally confined to the task location.

(65) "Thermal break" means an element of low thermal conductivity placed in an assembly to reduce the flow of heat between highly conductive materials.

(66) "Thermal conductance" or "C" means the constant time rate of heat flow thorough a unit area of a body induced by a unit temperature difference between the surfaces, expressed in Btu/h·ft^2·°F or equivalent units. It is the reciprocal of thermal resistance.

(67) "Thermal resistance" or "R" means the reciprocal of thermal conductance, 1/C expressed in h·ft^2·°F/Btu or equivalent units. The total thermal resistance of an assembly is $1/U_o$.

(68) "Thermal transmittance" or "U" means the overall coefficient of heat transfer from fluid to fluid. It is the time rate of heat flow per unit area under steady conditions from the fluid on the warm side of the barrier to the fluid on the cold side, per unit temperature difference between the two fluids, expressed in Btu/h·ft^2·°F or equivalent units.

(69) "Thermal transmittance, overall" or "U_o" means the gross overall (area weighted average) coefficient of heat transfer from air to air or fluid to fluid for a gross area of the building envelope, expressed in Btu/h·ft^2·°F or equivalent units. 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 building envelope components such as walls, floors, and roof or ceiling.

(70) "Thermostat" means an automatic control device responsive to temperature.

(71) "Throw distance" means the distance between the luminaire and the center of the plane on a subject lit by the luminaire.

(72) "Unconditioned space" means a space within a building that is not a conditioned space.

Note: See conditioned space.

(73) "Unlisted space" means the difference in area between the gross lighted area and the sum of all listed space areas.

(74) "Variable air volume HVAC system" or "VAV HVAC system" means HVAC systems that control the dry-bulb temperature within a space by varying the volume of air supply to the space.

(75) "Visible light transmittance" or "VLT" means the ratio expressed as a decimal of visible light that is transmitted through a glazing material to the light that strikes the material.

(76) "Wall heat capacity" or "HC" means the sum of products of the mass of each individual material in the wall per unit area of wall surface times its individual specific heat, Btu/(ft^2 °F).

(77) "Well efficiency" means the ratio of the amount of visible light leaving a skylight well to the amount of visible light entering the skylight well and is calculated as follows:

(a) for rectangular wells:

$$\left(\frac{\text{Well height (well length + well width)}}{\text{2 x well length x well width}}\right) = \text{the well index}$$

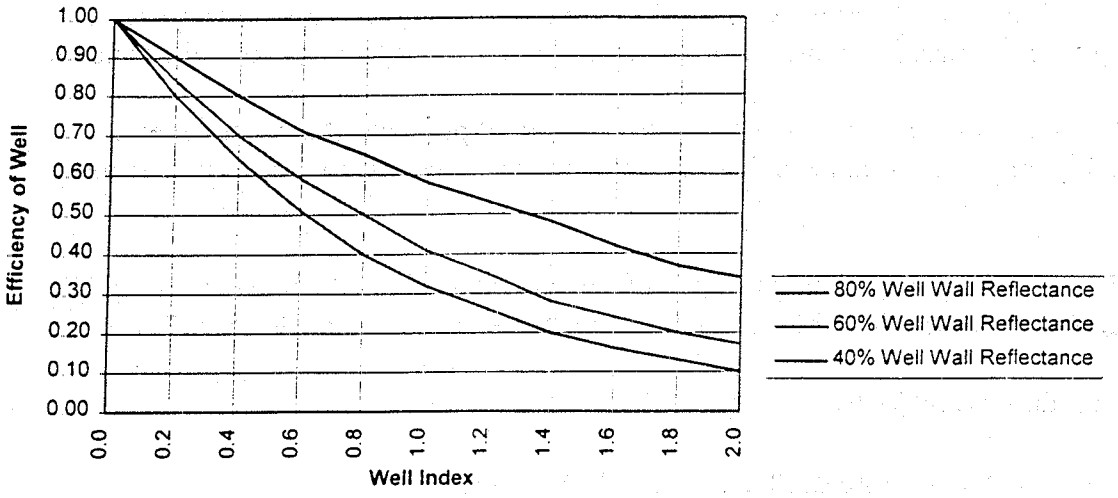
; or

(b) for irregular shaped wells:

$$\left(\frac{\text{Well height x well perimeter}}{\text{4 x well area}}\right) = \text{the well index}$$

(c) The length, width, perimeter, and area expressed in pars. (a) and (b) are measured at the bottom of the well. The well index and the weighted average well wall reflectance are used in Figure 63.02 to determine the well efficiency.

Figure 63.02 Well Efficiency



Information taken from: Fig 7-38, IES Lighting Handbook, 1984 Reference

(78) "Window" means glazing that is not a skylight.

(79) "Window area" means the area of the surface of a window, plus the area of the frame, sash, and mullions.

(80) "Window wall ratio" means the ratio of the window area, including glazed areas of doors, to the gross exterior wall area.

(81) "Zone" means a space or group of spaces within a building with any combination of heating, cooling, or lighting requirements sufficiently similar so that desired conditions can be maintained throughout by a single controlling device.

Subchapter III — Building Envelope

ILHR 63.10 EXEMPT BUILDINGS. This subchapter applies to buildings or separately enclosed identifiable areas that have a mechanical space heating or air conditioning system.

Part 1 - General Requirements

ILHR 63.11 AIR LEAKAGE AND MOISTURE MIGRATION. (1) GENERAL. The requirements of this section apply to those building components that separate interior building

conditioned space from the outdoors or from unconditioned spaces or crawl spaces. Compliance with the criteria for air leakage through building components shall be determined by tests conducted in accordance with specified standards.

(2) AIR LEAKAGE REQUIREMENTS FOR FACTORY MANUFACTURED FENESTRATION AND DOORS. (a) Factory manufactured fenestration shall meet one of the following standards for air leakage as adopted in s. ILHR 51.25:

1. ANSI/AAMA 101 Aluminum and Poly Vinyl Chloride (PVC) Prime Windows and Glass Doors.

2. ASTM D 4099 Specification for Poly Vinyl Chloride (PVC) Prime Windows.

3. ANSI/NWWDA I.S.2 Wood Windows (Improved Performance Rating Only).

(b) Factory manufactured sliding doors shall meet one of the following standards for air leakage:

1. ANSI/AAMA 101 Aluminum and Poly Vinyl Chloride (PVC) Prime Windows and Glass Doors.

2. ANSI/NWWDA I.S.3 Wood Sliding Patio Doors.

(c) Factory manufactured commercial entrance swinging or revolving doors shall limit air leakage to a rate not to exceed 1.25 cfm/ft^2 of door area when tested at standard test conditions in accordance with ASTM E283.

(d) Factory manufactured residential swinging doors shall limit air leakage to a rate not to exceed 0.5 cfm/ft^2 of door area when tested at standard test conditions in accordance with ASTM E283.

Note: The term "factory manufactured" does not apply to units constructed or fabricated in the field or to units assembled from individual components at a lumber yard or building material center.

(3) AIR LEAKAGE REQUIREMENTS FOR EXTERIOR ENVELOPE JOINTS AND PENETRATIONS. Exterior joints, cracks, and holes in the building envelope shall be caulked, gasketed, weather stripped, or otherwise sealed. Such joints include the following:

(a) Around window or door frames.

(b) Between wall or floor and foundation.

(c) Between wall and roof or roof decking.

(d) Through wall panels and top and bottom plates in exterior walls.

(e) At penetrations of utility services or other service entry through walls, floors, and roofs.

(f) Between wall panels particularly at corners and changes in orientation.

(g) Between wall and floor where floor penetrates wall.

(h) Around penetrations made through the insulated envelope by chimneys, flue vents, or attic hatches.

Note: Sealing methods should be designed to be compatible with the chimney or vent listing.

(4) MOISTURE CONDENSATION. The design of buildings shall not create conditions of accelerated deterioration from moisture condensation.

Note: Vapor retarders and ventilation should be considered to prevent moisture from collecting within the envelope. The principles of ASHRAE Handbook, Fundamentals Volume, may be used as a guide.

ILHR 63.12 DAYLIGHT CREDITS FOR SKYLIGHTS. (1) When determining building roof compliance using either the component standards of s. ILHR 63.15 or the system standards of s. ILHR 63.16, daylight credits for skylights may be used if the criteria of this section are met.

Note: Skylights used in conjunction with automatic lighting controls for daylighting can significantly reduce the lighting energy consumption thereby more than offsetting the increase in envelope heat transfer.

(2) Skylights for which daylight credit is taken may be excluded from the calculations of the overall thermal transmittance value of the roof assembly (U_{or}) if all of the following conditions are met:

(a) The opaque roof thermal transmittance value U_{or} does not exceed the values determined for the roof within the appropriate Alternate Component Package (ACP) table selected under s. ILHR 63.15 (1) or by s. ILHR 63.16.

(b) The criteria of section 8.4.8 of ASHRAE Standard 90.1 are met.

(c) Areas for vertical glazing, or glazing within 30 degrees of vertical of clerestories or roof monitors shall be included in the wall fenestration calculation of s. ILHR 63.15 or 63.16.

Note: See A63.12 of the appendix for general information on the criteria of section 8.4.8 of ASHRAE Standard 90.1.

Part 2 - Thermal Performance

ILHR 63.14 BUILDING ENVELOPE THERMAL PERFORMANCE. (1) Except as provided in subs. (2) and (3), building envelopes shall comply with either the

component standards of s. ILHR 63.15 or the system standards of s. ILHR 63.16. The calculation procedures of s. ILHR 63.18 shall be used to show compliance.

(2) Buildings and areas of buildings that are used as factories shall comply with s. ILHR 63.165.

(3) Buildings and areas of buildings that are used as warehouses that have documentation provided to verify that the HVAC system to be installed does not use energy primarily to provide human comfort shall comply with s. ILHR 63.165.

Note: See s. ILHR 63.10 for exempt buildings and spaces.

SECTION 6. ILHR 63.15 is amended to read:

ILHR 63.15 COMPONENT STANDARDS OPTION. This section describes the component standards for building envelope thermal performance. Because component requirements consider the effect of solar gain as well as conductive heat transfer, the requirements for each component shall be met independently under this option. The wall and roof trade-off exception in sub. (3) may be used with this option. The System Analysis Design Method of Subchapter III shall be used to demonstrate the acceptability of trade-offs between component energy-conserving features. Separate occupancies in the same building shall meet the requirements of this section independently.

(1) DETERMINATION OF APPROPRIATE ACP TABLE. The appropriate alternate component package or ACP table shall be determined based on building location using Figure 63.15.

(2) MAXIMUM ALLOWABLE WINDOW WALL RATIO. The percentage of windows, including glazed areas of doors, relative to the gross external wall area of the building shall be less than or equal to the maximum allowable window wall ratio chosen from the appropriate ACP table for the glazing type of the building. The window wall ratio is the total area of window assemblies, including glazed areas of doors, divided by the total gross exterior wall area, considering all elevations of the building. The maximum allowable window wall ratio shall be determined using the following steps:

(a) Select the Shading Coefficient (SC_x) range that is no less than the fenestration SC_x including permanently installed internal, integral and external shading devices, but excluding the effect of external shading projections. Note that this includes curtains, shades, or blinds that are permanently installed. For a shell or speculative building for which the envelope is designed or constructed prior to the design of the lighting, HVAC systems, or both, only those shading devices that are part of the design when it is being evaluated for compliance shall be considered when determining compliance.

Note: Refer to ASHRAE Handbook, Fundamentals Volume, Chapter 27 for more information on shading coefficients. Shading coefficients for fenestration are obtained from the manufacturer. See also s. ILHR 63.18 (4).

(b) Select appropriate fenestration type. This is determined by the thermal transmittance value (U_{of}) of the fenestration assembly. The U_{of} of all assemblies must fall within the range, or lower, to determine the maximum window wall ratio, or an area-weighted average thermal transmittance value may be used.

(3) WALL AND ROOF TRADE-OFF. Trade-offs between the above grade exterior wall opaque areas and the gross roof area shall be allowed if either of the following conditions are met:

(a) The thermal transmittance, overall value (Uo) for any above grade exterior opaque wall area or gross roof area may be increased or decreased, provided that the total annual energy use due to heat gain and loss for the building envelope shall be less than or equal to the total annual energy use due to heat gain and loss resulting from the use of the values in the appropriate ACP table given in Figure 63.15.

Note: The latest version of the ENVSTD computer program may be used to determine required thermal transmittance values in lieu of the ACP tables. ENVSTD is the computer program included in the ASHRAE Standard 90.1.

(b) A submittal to the department for review and approval, incorporating recognized engineering practices, that the annual energy use due to heat gain and loss for the building envelope shall be less than or equal to that established in sub. (A).

(4) THERMAL TRANSMITTANCE VALUES FOR ROOFS, WALLS NEXT TO UNCONDITIONED SPACES, AND FLOORS OVER UNCONDITIONED SPACES. (a) The U-values for the building roofs, walls next to unconditioned spaces, and floors over unconditioned spaces shall be less than or equal to those listed in the appropriate ACP table given in Figure 63.15.

(b) Skylights for which daylight credit cannot be taken in accordance with s. ILHR 63.12 shall be included in the calculation of the overall thermal transmittance value of the roof assembly (U_{or}).

(c) Unconditioned below-grade spaces that have floor or ceiling assemblies insulated as specified on the appropriate ACP table do not require below-grade wall insulation.

(5) THERMAL RESISTANCE VALUE FOR SLAB-ON-GRADE FLOORS. (a) Unheated slab-on-grade floors shall have insulation around the perimeter of the floor with the thermal resistance (R_u) of the insulation as listed in the appropriate ACP table.

(b) For heated slabs-on-grade, the required minimum R-value shall be the R-value for the unheated slab-on-grade plus 2.0.

(c) The slab insulation specified shall extend either in a vertical plane downward from the top of the slab for the minimum distance given in the appropriate ACP table or downward to the bottom of the slab then in a horizontal plane beneath the slab or outward from the building for the minimum distance given in the ACP table. Vertical insulation shall not be required to extend below the foundation footing.

(d) The R-value and dimensions required for slabs refer only to the building insulation materials. Insulative continuity shall be maintained in the design of slab edge insulation systems. Continuity shall be maintained from the wall insulation through the intersection of the slab, wall and footing to the body of the slab edge insulation.

Figure 63.15
Degree Day Regions

REGIONS	ACP TABLE
1,2,4	A
3,5,6,7,8	B
9,10,11	C

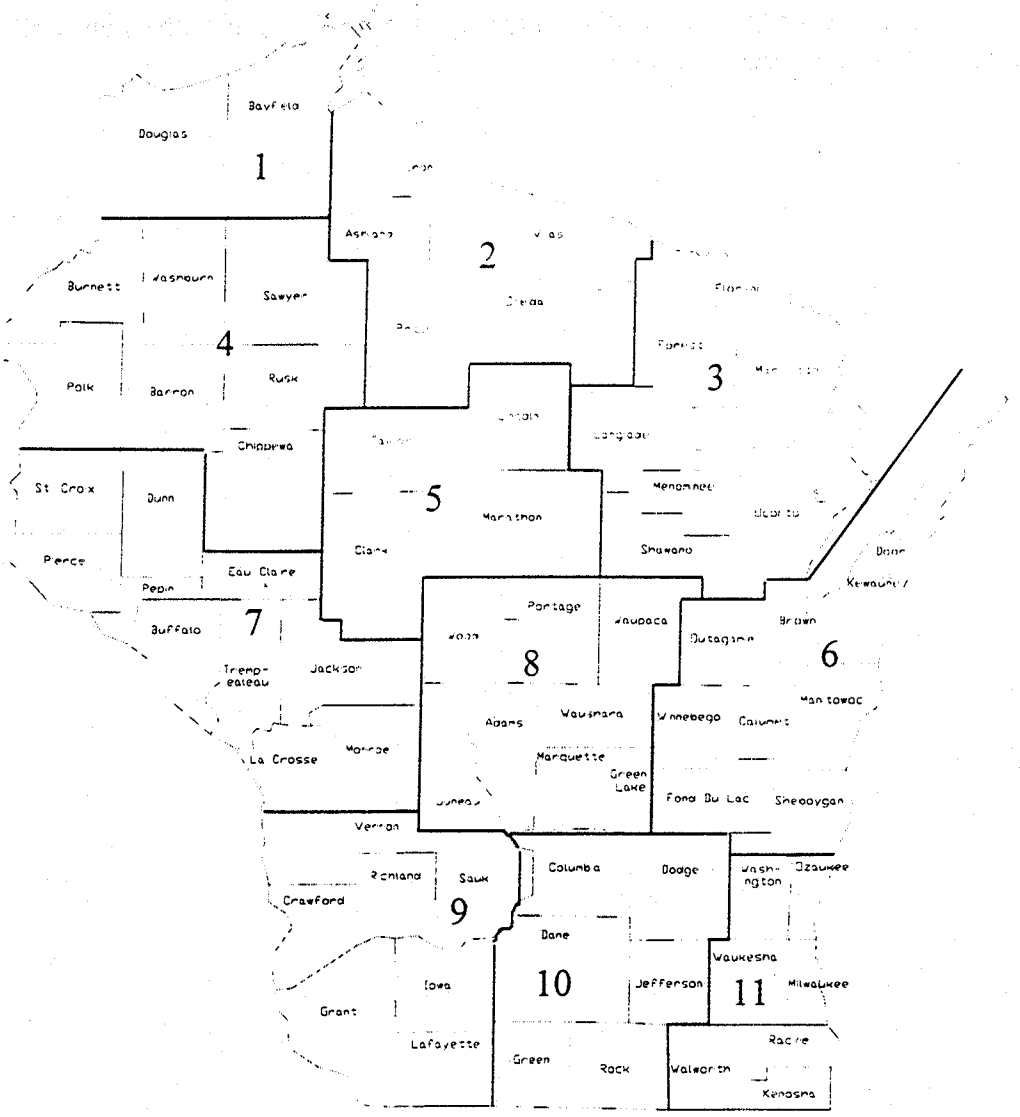


Figure 63.15 (Continued)
Alternate Component Package
ACP Table A

Part A1: Maximum Window Area / Gross External Wall Area						
External Wall U_o	Shading Coefficient Range SC_x	U_{of} Range				
		0.60 to 0.56	0.55 to 0.51	0.50 to 0.46	o.45 to 0.41	≤ 0.40
≤ 0.06	0.80 - 0.71	0.20	0.21	0.23	0.25	0.27
	0.70 - 0.61	0.20	0.22	0.24	0.26	0.28
	0.60 - 0.51	0.21	0.22	0.25	0.27	0.30
	0.50 - 0.41	0.21	0.23	0.25	0.28	0.31
	≤ 0.40	0.21	0.23	0.26	0.29	0.33
0.061 to 0.070	0.80 - 0.71	0.18	0.20	0.21	0.23	0.25
	0.70 - 0.61	0.18	0.20	0.22	0.24	0.27
	0.60 - 0.51	0.19	0.21	0.23	0.25	0.28
	0.50 - 0.41	0.19	0.21	0.23	0.26	0.30
	≤ 0.04	0.19	0.21	0.24	0.27	0.31
0.071 to 0.080	0.80 - 0.71	0.16	0.18	0.20	0.22	0.24
	0.70 - 0.61	0.17	0.18	0.20	0.23	0.25
	0.60 - 0.51	0.17	0.19	0.21	0.23	0.26
	0.50 - 0.41	0.17	0.19	0.21	0.24	0.27
	≤ 0.40	0.18	0.19	0.22	0.25	0.28
0.081 to 0.090	0.80 -0.71	0.15	0.16	0.18	0.20	0.22
	0.70 - 0.61	0.15	0.17	0.18	0.21	0.23
	0.60 - 0.51	0.15	0.17	0.19	0.21	0.24
	0.50 - 0.41	0.16	0.17	0.19	0.22	0.25
	≤ 0.40	0.16	0.17	0.20	0.22	0.26

Part A2: Other Criteria
Roof Max U_o = 0.040
Wall Adjacent to Unconditioned Space Max U_o = 0.10
Floor Over Unconditioned Space Max U_o = 0.040
Wall Below Grade Min R-Value = 13

Part A3: Unheated Slab-On-Grade Minimum R-Value			
Insulation Orientation	Length of Insulation		
	24"	36"	48"
Horizontal	R=18	R=15	R=11
Vertical	R=8	R=6	R=4

Figure 63.15 (Continued)
Alternate Component Package
ACP Table B

Part B1: Maximum Window Area / Gross External Wall Area						
External Wall U_o	Shading Coefficient Range SC_x	U_{of} Range				
		0.60 to 0.56	0.55 to 0.51	0.50 to 0.46	0.45 to 0.41	≤ 0.40
≤ 0.06	0.80 - 0.71	0.20	0.21	0.22	0.23	0.24
	0.70 - 0.61	0.21	0.22	0.24	0.25	0.27
	0.60 - 0.51	0.22	0.24	0.25	0.27	0.29
	0.50 - 0.41	0.24	0.25	0.27	0.30	0.32
	≤ 0.40	0.25	0.27	0.29	0.32	0.35
0.061 to 0.070	0.80 - 0.71	0.19	0.20	0.21	0.22	0.23
	0.70 - 0.61	0.20	0.21	0.22	0.24	0.25
	0.60 - 0.51	0.21	0.23	0.24	0.26	0.28
	0.50 - 0.41	0.22	0.24	0.26	0.28	0.31
	≤ 0.04	0.24	0.26	0.28	0.31	0.34
0.071 to 0.080	0.80 - 0.71	0.18	0.19	0.20	0.21	0.23
	0.70 - 0.61	0.19	0.20	0.21	0.23	0.24
	0.60 - 0.51	0.20	0.21	0.23	0.25	0.27
	0.50 - 0.41	0.21	0.23	0.25	0.27	0.29
	≤ 0.40	0.22	0.24	0.27	0.29	0.32
0.081 to 0.090	0.80 -0.71	0.17	0.18	0.19	0.20	0.21
	0.70 - 0.61	0.18	0.19	0.20	0.21	0.23
	0.60 - 0.51	0.19	0.20	0.21	0.23	0.25
	0.50 - 0.41	0.20	0.21	0.23	0.25	0.28
	≤ 0.40	0.21	0.23	0.25	0.27	30

Part B2: Other Criteria
Roof Max U_o = 0.045
Wall Adjacent to Unconditioned Space Max U_o = 0.11
Floor Over Unconditioned Space Max U_o = 0.040
Wall Below Grade Min R-Value = 12

Part B3: Unheated Slab-On-Grade Minimum R-Value			
Insulation Orientation	Length of Insulation		
	24"	36"	48"
Horizontal	R=18	R=15	R=11
Vertical	R=8	R=6	R=4

Figure 63.15 (Continued)
Alternate Component Package
ACP Table C

Part C1: Maximum Window Area / Gross External Wall Area						
External Wall U_o	Shading Coefficient Range SC_x	U_{of} Range				
		0.60 to 0.56	0.55 to 0.51	0.50 to 0.46	0.45 to 0.41	≤ 0.40
≤ 0.06	0.80 - 0.71	0.20	0.21	0.22	0.22	0.23
	0.70 - 0.61	0.22	0.23	0.24	0.25	0.26
	0.60 - 0.51	0.23	0.25	0.26	0.27	0.29
	0.50 - 0.41	0.25	0.27	0.29	0.30	0.32
	≤ 0.40	0.27	0.29	0.32	0.34	0.37
0.061 to 0.070	0.80 - 0.71	0.19	0.20	0.21	0.22	0.23
	0.70 - 0.61	0.21	0.22	0.23	0.24	0.25
	0.60 - 0.51	0.22	0.24	0.25	0.26	0.28
	0.50 - 0.41	0.24	0.26	0.27	0.29	0.31
	≤ 0.04	0.26	0.28	0.30	0.33	0.35
0.071 to 0.080	0.80 - 0.71	0.18	0.19	0.20	0.21	0.22
	0.70 - 0.61	0.20	0.21	0.22	0.23	0.24
	0.60 - 0.51	0.21	0.23	0.25	0.26	0.27
	0.50 - 0.41	0.23	0.25	0.26	0.28	0.30
	≤ 0.40	0.25	0.27	0.29	0.31	0.34
0.081 to 0.090	0.80 -0.71	0.17	0.18	0.19	0.20	0.21
	0.70 - 0.61	0.19	0.20	0.21	0.22	0.23
	0.60 - 0.51	0.20	0.22	0.23	0.24	0.26
	0.50 - 0.41	0.22	0.23	0.25	0.27	0.29
	≤ 0.40	0.24	0.26	0.28	0.30	0.33

Part C2: Other Criteria
Roof Max U_o = 0.049
Wall Adjacent to Unconditioned Space Max U_o = 0.11
Floor Over Unconditioned Space Max U_o = 0.040
Wall Below Grade Min R-Value = 11

Part C3: Unheated Slab-On-Grade Minimum R-Value			
Insulation Orientation	Length of Insulation		
	24"	36"	48"
Horizontal	R=18	R=15	R=11
Vertical	R=8	R=6	R=4

ILHR 63.16 SYSTEM STANDARDS OPTION. To comply with the system standards for building envelope thermal performance, the building shall comply with section 8.6 of ASHRAE standard 90.1 as adopted in s. ILHR 51.25 or with the system analysis design of s. ILHR 63.70 to 63.72 applied to the thermal envelope alone. Building site climate data shall be determined using Wisconsin Division of State Energy Statistics or other source acceptable to the department.

Note: Section 8.6 of ASHRAE 90.1 requires use of the latest version of the ENVSTD computer program. ENVSTD is the computer program included in the ASHRAE 90.1 Standard.

ILHR 63.165 DESIGN CRITERIA. (1) THERMAL PERFORMANCE. (a) Except as provided in par. (b), the thermal performance values for the exterior envelope of buildings or areas of buildings that are warehouses that meet the criteria of s. ILHR 63.14 (3), or that are factories shall not exceed the values in Table 63.165-1. The calculation procedures of s. ILHR 63.18 shall be used to show compliance.

Table 63.165-1
Thermal Performance Values

Number of Stories	Thermal Performance Values*
1-2	12
3-4	13
5-7	16
8-12	18
13-20	20
Over 20	21

*Expressed in Btu/hour/square foot of above-grade exterior envelope. See s. ILHR 63.23 (2) and (3) for design conditions.

(b) The thermal performance values specified in par. (a) may be increased or decreased provided the U-value for other components is decreased or increased so the total heat gain or loss for the entire building envelope and floor area does not exceed the total heat gain or loss resulting from conformance to the values specified in this section.

(2) FLOORS OVER UNCONDITIONED SPACES. The overall heat transmission coefficient (U-value) for floors of heated or mechanically cooled spaces over unconditioned spaces shall not exceed 0.08 Btu/°F. Sq. Ft. hour.

(3) SLAB-ON-GRADE PERIMETER INSULATION. For slab-on-grade floors with or without a grade beam, a foundation bearing wall or a foundation frost wall, the thermal resistance of the insulation around the perimeter of the floor shall not be less than the values shown in Table 63.165-2. The insulation shall extend 48 inches in the vertical or horizontal direction or combination thereof with a total dimension of 48 inches. Slab-on grade perimeter insulation shall be moisture resistant.

Table 63.165-2
Perimeter Insulation Requirements[1]

Slab-on-grade Perimeter Insulation		Zone 1	Zone 2	Zone 3	Zone 4
R = °F Sq. Ft. Hour Btu	Unheated Slabs	6.7	6.2	5.9	5.2
	Heated Slabs[2]	9.3	9.0	8.6	8.2

1 See Fig. 63.23 for zone definitions.
2. Heated slabs have piping, duct work or other heat distribution system components embedded in or under them.

Part 3 - Calculations and Standards

ILHR 63.17 MATERIAL PROPERTIES. (1) When available, information on thermal properties, performance of building envelope sections, and components and heat transfer shall be obtained from ASHRAE Handbook, Fundamentals Volume, adopted in s. ILHR 51.25.

(2) (a) When the information is not available from ASHRAE Handbook, Fundamentals Volume, the data may be obtained from manufacturer's information or laboratory or field test measurements. If laboratory or field test measurements are used for envelope heat transmission, they shall be obtained using one of the following test methods adopted in s. ILHR 51.25.

1. GUARDED HOT PLATE: ASTM C 177;

2. HEAT FLOW METER: ASTM C 518;

3. GUARDED HOT BOX: ASTM C 236; or

4. CALIBRATED HOT BOX: ASTM C 976.

5. PIPE INSULATION: ASTM 335.

(b) For foam plastic insulations that use a gas other than air as the insulating medium, laboratory or field tests shall be conducted on representative samples that have been aged for the equivalent of 5 years or until the R-Value has stabilized. The tests shall be conducted by an independent third party and shall be submitted for department review and approval in accordance with s. ILHR 50.19.

ILHR 63.18 REQUIRED CALCULATION PROCEDURES. The following procedures shall be used to calculate the thermal performance of above- and below-grade envelope sections of any building that is heated or mechanically cooled.

(1) OVERALL THERMAL TRANSMITTANCE (U_o). The overall thermal transmittance of the building envelope assembly shall be calculated in accordance with the equation given below.

$$U_o = \Sigma U_i A_i / A_o$$
$$= (U_1A_1 + U_2A_2 + \bullet\bullet\bullet\bullet + U_nA_n)/A_o$$

where:

U_o = The area-weighted average thermal transmittance of the gross area of an envelope assembly, that is the exterior wall assembly including fenestration and doors, the roof and ceiling assembly, and the floor assembly, Btu/h•ft^2•°F.

A_o = The gross area of the envelope assembly, ft^2.

U_i = The thermal transmittance of each individual path of the envelope assembly, for example, the opaque portion of the wall assembly, Btu/h•ft^2•°F. U_i also equals 1/Ri where Ri is the total resistance to heat flow of an individual path through an envelope assembly.

A_i = The area of each individual element of the envelope assembly, ft^2.

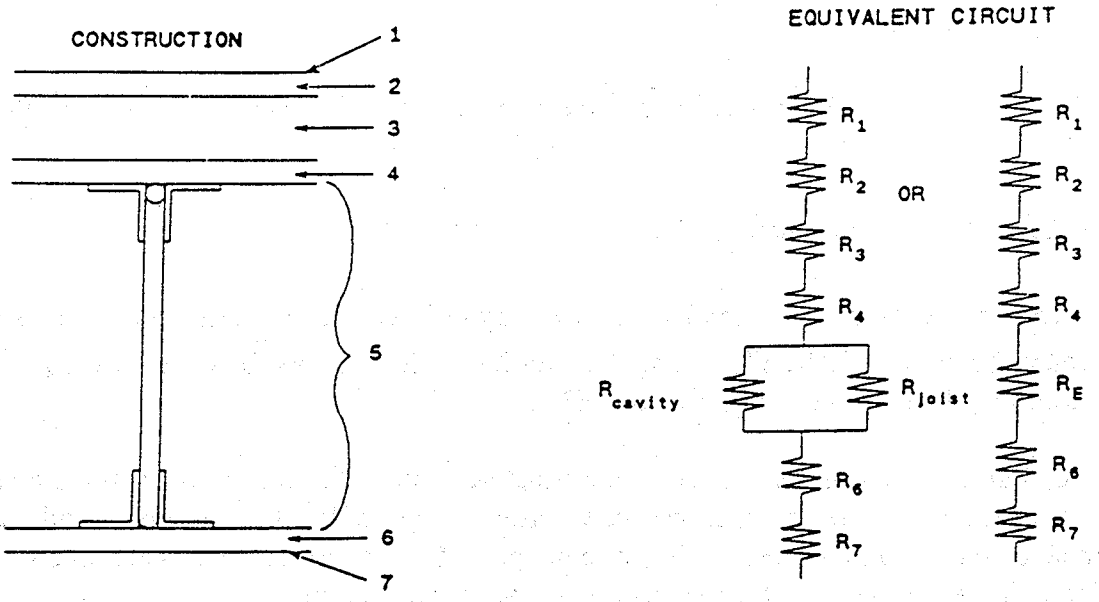
(2) THERMAL TRANSMITTANCE (U_i) OF AN INDIVIDUAL PATH THROUGH AN ENVELOPE ASSEMBLY. The thermal transmittance of each envelope shall be determined with consideration of all major series and parallel heat flow paths through the elements of the assembly and film coefficients. Compression of insulation shall be considered in determining the thermal resistance.

(a) Thermal transmittance of opaque elements. The thermal transmittance of opaque elements of assemblies shall be determined using a series path procedure with correction for the presence of parallel paths within an element of the envelope assembly such as wall cavities with parallel paths through insulation and studs. An acceptable procedure shall be used, as specified in Figure 63.18-1. Figure 63.18-2 illustrates a typical roof assembly.

Figure 63.18-1 Calculation Procedures for Evaluating Major Series and Parallel Heat Flow Paths

Acceptable Procedures for Determining Ui for Opaque Elements		
Sheathing	Framing	
	Metal	Nonmetal
Metal on One or Both Sides	Tests - s. ILHR 63.18 (2)(a) 1.a. Thermal Bridges - s. ILHR 63.18 (2)(a) 1.c.	Tests - s. ILHR 63.18 (2)(a) 1.a. Series or Parallel Path - s. ILHR 63.18 (2)(a) 2.
Nonmetal on Both Sides	Tests - s. ILHR 63.18 (2)(a) 1.a. Parallel Path Correction Factor - s. ILHR 63.18 (2)(a) 1.b. Zone Method - s. ILHR 63.18 (2)(a) 1.d.	Tests - s. ILHR 63.18 (2)(a) 1.a. Series or Parallel Path - s. ILHR 63.18 (2)(a) 2.

Figure 63.18-2 Calculation Procedure for Thermal Resistance of a Typical Roof Assembly



Where $1/R_e = \frac{(1 - \%\ joist)}{R\ cavity} + \frac{\%\ Joist}{R\ joist}$ or $R_e = R\ cavity \times F_c$

R_e is the equivalent resistance of the element contacting the parallel path. F_c is the parallel path correction factor.

1. For envelope assemblies containing metal framing, the U_i shall be determined by using one of the following methods:

a. Results from laboratory or field test measurements. One of the procedures specified in s. ILHR 63.17 shall be used.

b. The thermal resistance of those roof and wall assemblies listed in Tables 63.18-1 and 63.18-2 shall be corrected using the following parallel path correction factor procedure:

Considering the total resistance of the series path:

$$U_i = 1/R_t$$

$$R_t = R_i + R_e$$

where:

R_t = The total resistance of the envelope assembly.

R_i = The resistance of the series elements (for i = 1 to n) excluding the parallel path element(s)

R_e = The equivalent resistance of the element containing the parallel path, the value of R_e is:

R_e = R-value of insulation x F_c

The Parallel Path Correction Factors (F_c) may be obtained from tests conducted using procedures listed in s. ILHR 63.17. Parallel Path Correction Factors for some envelope assemblies are listed in Tables 63.18-1 and 63.18-2.

c. For elements with internal metallic structures bonded on one or both sides to a metal skin or covering, the calculation procedure specified in the ASHRAE Handbook, Fundamentals Volume, or specified in ASHRAE 90.1, or other procedure acceptable to the department shall be used to include the effects of thermal bridges in metal construction.

d. For elements other than those covered above, the zone method described in the ASHRAE Handbook, Fundamentals Volume shall be used for calculation.

Table 63.18-1

Roofs

Parallel Path Correction Factors[a]

Bridged R-Value	0	5	10	15	20	25	30	35	40	45	50	55
Correction Factor	1.0	0.96	0.92	0.88	0.85	0.81	0.79	0.76	0.73	0.71	0.69	0.67

[a] Table values are based upon metal trusses with 4-foot spacing that penetrate the insulation, and 0.66-inch diameter cross members every 1 foot.

Table 63.18-2

Wall Sections With Metal Studs
Parallel Path Correction Factors

Size of Members	Gauge of Stud[a]	Spacing of Framing, in.	Cavity Insulation R-Value	Correction Factor	Effective Framing/Cavity R-Values
2 x 4	18-16	16 o.c.	R-11	0.50	R-5.5
			R-13	0.46	R-6.0
			R-15	0.43	R-6.4
2 x 4	18-16	24 o.c.	R-11	0.60	R-6.6
			R-13	0.55	R-7.2
			R-15	0.52	R-7.8
2 x 6	18-16	16 o.c.	R-19	0.37	R-7.1
			R-21	0.35	R-7.4
2 x 6	18-16	24 o.c.	R-19	0.45	R-8.6
			R-21	0.43	R-9.0
2 x 8	18-16	16 o.c.	R-25	0.31	R-7.8
2 x 8	18-16	24 o.c.	R-25	0.38	R-9.6

[a] These factors can be applied to metal studs of this gauge or thinner.

2. For assemblies containing nonmetal framing, the U_i shall be determined from one of the laboratory or field test measurements specified in s. ILHR 63.17 or from the ASHRAE series-parallel method. Formulas in the ASHRAE Handbook, Fundamentals Volume, shall be used for these calculations.

3. The opaque portions of doors shall be considered to be a part of the opaque wall assembly in the calculation of the average thermal transmittance. The thermal transmittance of the entire opaque door assembly including the frame shall be included in the calculation.

Note 1: See Appendix A for sample U-values for doors and explanatory information.

Note 2: See s. ILHR 51.045 for thermal barrier requirements for foam plastics.

(b) Thermal transmittance of fenestration. Values of U_{of} shall be determined using one of the following methods:

1. The National Fenestration Rating Council (NFRC) 100 Procedure for Determining Fenestration Product Thermal Properties. The thermal performance values shall be certified through the NFRC Fenestration Thermal Performance Rating Certification and Labeling Program as described in the NFRC Product Certification Program LAP 1, PCP 1, and CAP 1.

2. The values for the appropriate product type given in Table 63.18-3 may be used.

Note 1: Interpolation between tables for glazing other than 0°, 45° and 90° is acceptable.

Note 2: In order to use the component standards option of s. ILHR 63.15, the U-value of fenestration must be 0.52 or less.

Table 63.18-3, Part 1
Window U-Values

Glazing Type	Aluminum Frame--	Aluminum Frame--	Wood or Vinyl
Glass	1.23	1.10	0.98
1/8 in. acrylic	1.16	1.03	0.92
Double glass, air filled			
1/4 in. air space	0.78	0.65	0.55
3/8 in. air space	0.74	0.60	0.51
1/2 in. and greater	0.72	0.59	0.49
Double glass, low emissivity = 0.4 on surface 2 or 3			
1/4 in. air space	0.73	0.59	0.50
3/8 in. air space	0.67	0.54	0.45
1/2 in. and greater	0.65	0.52	0.42
Double glass, low emissivity = 0.15 on surface 2 or 3			
1/4 in. air space	0.68	0.55	0.46
3/8 in. air space	0.62	0.48	0.39
1/2 in. and greater	0.60	0.46	0.37
Double glass, argon filled			
1/4 in. argon space	0.74	0.61	0.51
3/8 in. argon space	0.71	0.57	0.48
1/2 in. and greater	0.69	0.56	0.47
Double glass, low emissivity = 0.4 on surface 2 or 3, argon filled			
1/4 in. argon space	0.67	0.54	0.45
3/8 in. argon space	0.63	0.49	0.40
1/2 in. and greater	0.62	0.48	0.39
Double glass, low emissivity = 0.15 on surface 2 or 3, argon filled			
1/4 in. argon space	0.62	0.48	0.39
3/8 in. argon space	0.57	0.43	0.34
1/2 in. and greater	0.55	0.42	0.33
Double glazing, 1/8 in. acrylic or polycarbonate			
1/4 in. air space	0.74	0.61	0.51
3/8 in. air space	0.71	0.57	0.48
1/2 in. and greater	0.69	0.56	0.47
Double glazing, 1/4 in. acrylic or polycarbonate			
1/4 in. air space	0.71	0.57	0.48
3/8 in. air space	0.68	0.54	0.45
1/2 in. and greater	0.66	0.53	0.43
Triple glass			
1/4 in. air space	0.64	0.50	0.41
3/8 in. air space	0.60	0.46	0.38
1/2 in. and greater	0.58	0.45	0.36
Triple glass or double glass with polyester film suspended in between, low emissivity = 0.15 on surface 2, 3, 4, or 5			
1/4 in. air space	0.59	0.45	0.37
3/8 in. air space	0.54	0.41	0.32
1/2 in. and greater	0.52	0.39	0.30
Triple glass, argon filled			
1/4 in. argon space	0.60	0.46	0.38
3/8 in. argon space	0.57	0.44	0.35
1/2 in. and greater	0.56	0.42	0.34
Triple glass or double glass with polyester film suspended in between, low emissivity = 0.15 on surface 2, 3, 4, or 5			
1/4 in. argon space	0.54	0.41	0.32
3/8 in. argon space	0.51	0.37	0.29
1/2 in. and greater	0.50	0.36	0.28

Table 63.18-3, Part II
Skylight U-Values - 45 Degree Slope

Glazing Type	Aluminum Frame--	Aluminum Frame--	Wood or Vinyl
Glass	1.36	1.22	1.09
1/8 in. acrylic	1.29	1.14	1.02
Double glass, air filled			
1/4 in. air space	0.88	0.74	0.63
3/8 in. air space	0.83	0.68	0.58
1/2 in. and greater	0.81	0.67	0.56
Double glass, low emissivity = 0.4 on surface 2 or 3			
1/4 in. air space	0.82	0.67	0.57
3/8 in. air space	0.76	0.61	0.52
1/2 in. and greater	0.74	0.59	0.49
Double glass, low emissivity = 0.15 on surface 2 or 3			
1/4 in. air space	0.77	0.63	0.53
3/8 in. air space	0.70	0.55	0.46
1/2 in. and greater	0.68	0.53	0.44
Double glass, argon filled			
1/4 in. argon space	0.83	0.69	0.58
3/8 in. argon space	0.80	0.65	0.55
1/2 in. and greater	0.78	0.64	0.54
Double glass, low emissivity = 0.4 on surface 2 or 3, argon filled			
1/4 in. argon space	0.76	0.61	0.52
3/8 in. argon space	0.71	0.56	0.47
1/2 in. and greater	0.70	0.55	0.46
Double glass, low emissivity = 0.15 on surface 2 or 3, argon filled			
1/4 in. argon space	0.70	0.55	0.46
3/8 in. argon space	0.65	0.50	0.40
1/2 in. and greater	0.63	0.49	0.39
Double glazing, 1/8 in. acrylic or polycarbonate			
1/4 in. air space	0.83	0.69	0.58
3/8 in. air space	0.80	0.65	0.55
1/2 in. and greater	0.78	0.64	0.54
Double glazing, 1/4 in. acrylic or polycarbonate			
1/4 in. air space	0.80	0.65	0.55
3/8 in. air space	0.77	0.61	0.52
1/2 in. and greater	0.75	0.60	0.50
Triple glass			
1/4 in. air space	0.72	0.57	0.48
3/8 in. air space	0.68	0.53	0.45
1/2 in. and greater	0.66	0.52	0.43
Triple glass or double glass with polyester film suspended in between, low emissivity = 0.15 on surface 2, 3, 4, or 5			
1/4 in. air space	0.67	0.52	0.44
3/8 in. air space	0.61	0.48	0.38
1/2 in. and greater	0.59	0.46	0.36
Triple glass, argon filled			
1/4 in. argon space	0.68	0.53	0.45
3/8 in. argon space	0.65	0.51	0.42
1/2 in. and greater	0.64	0.49	0.40
Triple glass or double glass with polyester film suspended in between, low emissivity = 0.15 on surface 2, 3, 4, or 5			
1/4 in. argon space	0.61	0.48	0.38
3/8 in. argon space	0.58	0.44	0.35
1/2 in. and greater	0.57	0.43	0.34

Table 63.18-3, Part III
Skylight U-Values - Horizontal

Glazing Type	Aluminum Frame--	Aluminum Frame--	Wood or Vinyl
Glass	1.38	1.25	1.12
1/8 in. acrylic	1.31	1.17	1.06
Double glass, air filled			
1/4 in. air space	0.91	0.77	0.67
3/8 in. air space	0.86	0.72	0.62
1/2 in. and greater	0.84	0.71	0.60
Double glass, low emissivity = 0.4 on surface 2 or 3			
1/4 in. air space	0.85	0.71	0.61
3/8 in. air space	0.79	0.65	0.56
1/2 in. and greater	0.77	0.63	0.53
Double glass, low emissivity = 0.15 on surface 2 or 3			
1/4 in. air space	0.80	0.67	0.57
3/8 in. air space	0.74	0.59	0.50
1/2 in. and greater	0.72	0.57	0.48
Double glass, argon filled			
1/4 in. argon space	0.86	0.73	0.62
3/8 in. argon space	0.83	0.69	0.59
1/2 in. and greater	0.81	0.68	0.58
Double glass, low emissivity = 0.4 on surface 2 or 3, argon filled			
1/4 in. argon space	0.79	0.65	0.56
3/8 in. argon space	0.75	0.60	0.51
1/2 in. and greater	0.74	0.59	0.50
Double glass, low emissivity = 0.15 on surface 2 or 3, argon filled			
1/4 in. argon space	0.74	0.59	0.50
3/8 in. argon space	0.69	0.54	0.44
1/2 in. and greater	0.67	0.53	0.43
Double glazing, 1/8 in. acrylic or polycarbonate			
1/4 in. air space	0.86	0.73	0.62
3/8 in. air space	0.83	0.69	0.59
1/2 in. and greater	0.81	0.68	0.58
Double glazing, 1/4 in. acrylic or polycarbonate			
1/4 in. air space	0.83	0.69	0.59
3/8 in. air space	0.80	0.65	0.56
1/2 in. and greater	0.78	0.64	0.54
Triple glass			
1/4 in. air space	0.76	0.61	0.52
3/8 in. air space	0.72	0.57	0.49
1/2 in. and greater	0.70	0.56	0.47
Triple glass or double glass with polyester film suspended in between, low emissivity = 0.15 on surface 2, 3, 4, or 5			
1/4 in. air space	0.71	0.56	0.48
3/8 in. air space	0.65	0.52	0.42
1/2 in. and greater	0.63	0.50	0.40
Triple glass, argon filled			
1/4 in. argon space	0.72	0.57	0.49
3/8 in. argon space	0.69	0.55	0.46
1/2 in. and greater	0.68	0.53	0.44
Triple glass or double glass with polyester film suspended in between, low emissivity = 0.15 on surface 2, 3, 4, or 5			
1/4 in. argon space	0.65	0.52	0.42
3/8 in. argon space	0.62	0.48	0.39
1/2 in. and greater	0.61	0.47	0.38

* Note to Table 63.18-3: 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/ft^2/F°;

b. The thermal break material shall not be less than 0.210 inches; and

c. All metal framing members of the product to interior and exterior air must incorporate a thermal break meeting the criteria in a. and b. above.

(3) GROSS AREA OF ENVELOPE COMPONENTS. (a) Roof assembly. The gross area of a roof assembly consists of the total surface of the roof assembly exposed to outside air or unconditioned spaces. The roof assembly shall be considered to include all roof or ceiling components through which heat may flow between indoor and outdoor environments including skylight surfaces but excluding service openings. For thermal transmittance purposes when return air ceiling pleonasm are employed, the roof or ceiling assembly shall not include the resistance of the ceiling or the plenum space as part of the total resistance of the assembly.

(b) Floor assembly. The gross area of a floor assembly over outside or unconditioned spaces consists of the total surface of the floor assembly exposed to outside air or unconditioned space. The floor assembly shall include all floor components through which heat may flow between indoor and outdoor or unconditioned space environments.

(c) Exterior walls. The gross area of exterior walls enclosing a heated or cooled space is measured on the exterior and consists of the opaque wall including between floor spandrels, peripheral edges of flooring, window areas including sash, and door areas, but excluding vents, grilles, and pipes.

(4) SHADING COEFFICIENTS. The Shading Coefficient (SCx) for fenestration shall be obtained from the ASHRAE Handbook, Fundamentals Volume or from manufacturer's test data. SC_X is the Shading Coefficient of the fenestration including permanently installed internal and external shading devices but excluding the effect of external shading projections, which is calculated separately. The Shading Coefficient used for louvered shade screens shall be determined using a profile angle of 30° as found in the ASHRAE Handbook, Fundamentals Volume.

Note: Manufacturers should be able to provide shading coefficients for their products.

ILHR 63.19 PROHIBITION OF HEATED SIDEWALKS. The installation or use of heated sidewalks is prohibited as specified in s. 101.124, Stats.

Note: Section 101.124, Stats., reads as follows:

101.124 Heated Sidewalks Prohibited. In this section "exterior pedestrian traffic surface" means any sidewalk, ramp, stair, stoop, step, entrance way, plaza or pedestrian bridge not fully enclosed within a building and "heated" means heated by electricity or energy derived from the combustion of fossil fuels, but not including the use of waste thermal energy. "Exterior pedestrian traffic surface" does not include any means of ingress or egress by the physically disabled required under s. 101.13 (2). No person may construct a heated exterior pedestrian traffic surface. The department or any city, village, town or county is prohibited from approving any plan under s. 101.12 which includes such heated surface. The department shall order any existing heated exterior pedestrian traffic surface in operation to be shut off. This section does not apply to any inpatient health care facility as defined in s. 50.135 (1), or community-based residential facility, as defined in s. 50.01 (1g).

Subchapter IV — Equipment And Systems

Part 1 - Equipment Efficiencies

ILHR 63.20 MINIMUM EQUIPMENT EFFICIENCIES. (1) Space heating or cooling equipment that is not covered by 10 CFR Part 430, Energy Conservation Program for Consumer Products, shall have a minimum efficiency at the specified rating conditions not less than the values given in ASHRAE 90.1, section 10.4.1.

Note: Equipment that is covered by the federal regulation 10 cfr Part 430 is not included under the scope of this code. Efficiencies required by that standard are reprinted in Appendix A. Efficiencies required by ASHRAE 90.1-1989 are also printed in Appendix A.

(2) Equipment ratings shall be certified under a nationally recognized certification program or rating procedure or data furnished by the equipment manufacturer to show compliance with the minimum efficiency requirements.

Note: The following certification programs are accepted by the department: GAMMA and ARI.

(3) Compliance with minimum efficiency requirements specified for HVAC equipment shall include compliance with part-load requirements where indicated as well as standards for full-load requirements. The part-load efficiency shall be determined as specified in the ARI standards specified in ASHRAE 90.1.

(4) Space heating or cooling equipment used to provide additional functions such as water heating for plumbing, as part of a combination or integrated system shall comply with minimum performance requirements for the appropriate space heating or cooling equipment category.

(5) Equipment providing water heating for plumbing that is used to provide additional functions, such as space heating, as part of a combination or integrated system shall comply with minimum performance requirements for water heating equipment as specified in s. ILHR 84.20 (5)(n).

(6) Combination space and plumbing water heating equipment may only be used when at least one of the following conditions is met:

(a) The annual space heating energy is less than 50% of the annual water heating energy for plumbing.

(b) The energy input or storage volume of the combined boiler or water heater is less than twice the energy input or storage volume of the smaller of the separate boilers or water heaters otherwise required.

(c) The combined system uses no more energy than separate systems that meet the requirements of this section.

(d) The input to the combined boiler or water heater system is less than 150,000 Btu/h.

Note: See s. ILHR 64.22 (10) for additional requirements for combined systems.

(7) Equipment that is not used for comfort cooling or comfort heating is exempt from the energy efficiency requirements of this chapter.

Note: Omission of minimum performance requirements for certain classes of HVAC equipment does not preclude use of that equipment.

ILHR 63.21 FIELD-ASSEMBLED EQUIPMENT AND COMPONENTS. When components such as indoor or outdoor coils are used from more than one manufacturer as parts of air-conditioning or heating equipment, component efficiencies shall be specified based on data provided by the component manufacturers.

ILHR 63.22 EQUIPMENT CONTROLS. (1) Heat pumps equipped with supplementary heaters shall be installed with controls to prevent heater operation when the heating load can be met by the heat pump, except under the conditions listed below:

(a) Where it can be shown that supplementary heating reduces energy consumption.

(b) Supplementary heater operation is permitted during short transient periods of less than 15 minutes during defrost cycles.

(2) The setback recovery and tempering of indoor air during defrost cycles shall be controlled so as to minimize use of supplemental heat.

Part 2 - System Design

ILHR 63.23 LOAD CALCULATIONS FOR SIZING. (1) CALCULATION PROCEDURES. Heating and cooling system design loads for the purpose of sizing systems and equipment shall be determined in accordance with the procedures described in the ASHRAE Handbook, Fundamentals Volume, or a similar computation procedure approved by the

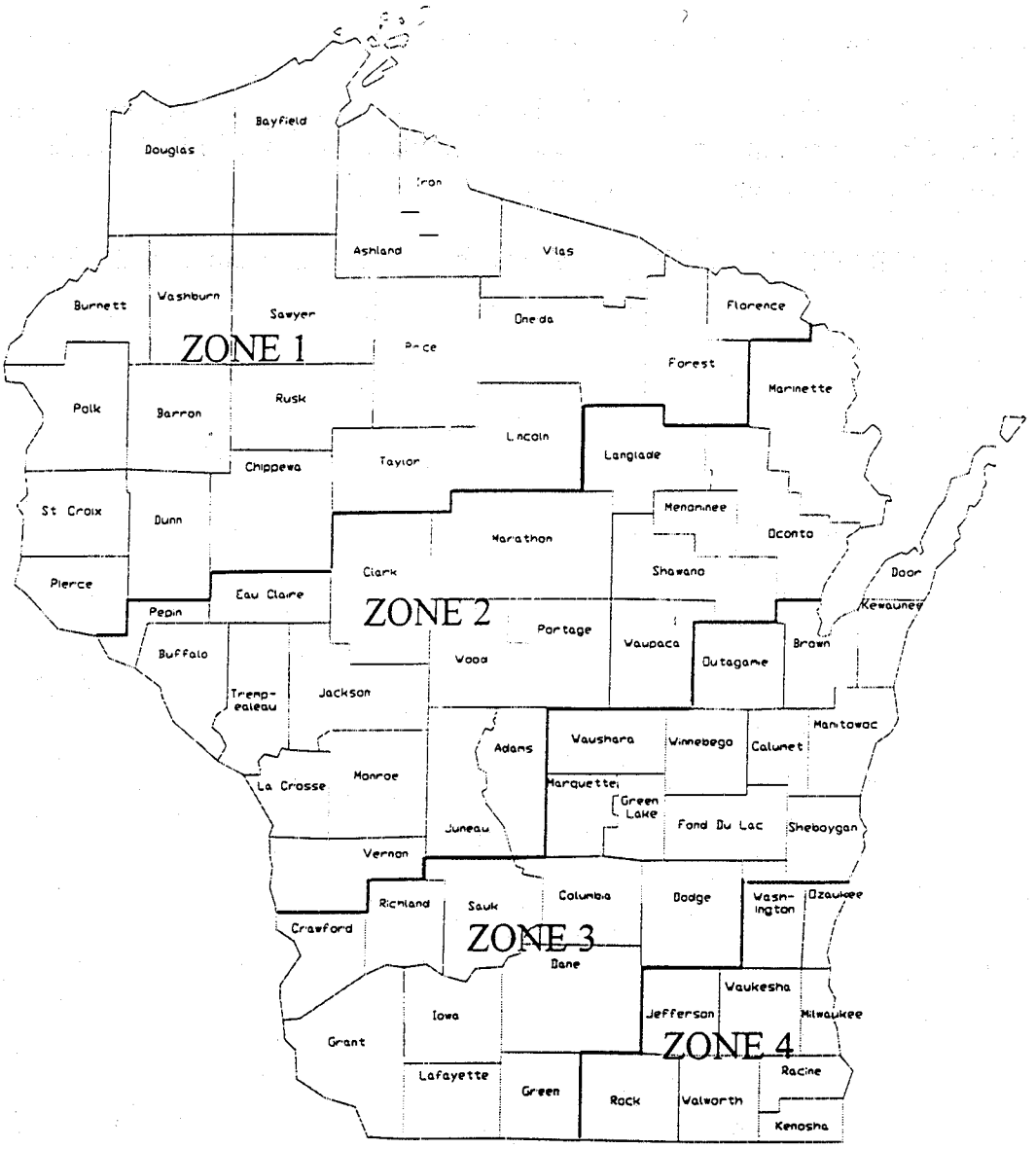
department. For those design parameters addressed in subs (2) to (7), the values specified shall be used.

Note: This section does not require the installation of cooling equipment.

(2) INDOOR DESIGN CONDITIONS. The winter indoor design temperature is specified in Table 64.05. When air conditioning is provided in accordance with s. ILHR 64.06 (2)(b), the summer indoor design temperature is 78°F or lower.

(3) OUTDOOR DESIGN CONDITIONS. Outdoor design temperatures shall be taken from Figure 63.23.

Figure 63.23
Outdoor Design Conditions



Zone	Winter Design Temp. (°F)	Summer Dry Bulb (°F)	Summer Wet Bulb (°F)
1	-25	86	75*
2	-20	87	75
3	-15	87	75
4	-10	89	77

*Exception: For Douglas, Bayfield, Ashland and Iron Counties, use 70°F summer wet bulb design temperature.

(4) VENTILATION. Outdoor air ventilation loads shall be based on ventilation rates specified in s. ILHR 64.05.

(5) ENVELOPE. Envelope heating and cooling loads shall be based on envelope characteristics such as thermal conductance, shading coefficient, and air leakage consistent with the values used to demonstrate compliance with subchapter III.

(6) LIGHTING. Lighting loads shall be based on actual design lighting levels or power budgets consistent with Subchapter V. Lighting loads may not be included for the purpose of calculating design heating loads.

(7) PICK-UP LOADS. Transient loads such as warm-up or cool-down loads which occur after off-hour setback or shutoff may be calculated from principles based on the heat capacity of the building and its contents, the degree of setback, and desired recovery time; or may be assumed to be up to 30% for heating and 10% for cooling of the steady-state design loads.

ILHR 63.24 SYSTEM AND EQUIPMENT SIZING. HVAC systems and equipment shall be sized to provide the minimum space and system loads calculated in accordance with s. ILHR 63.23.

ILHR 63.25 SEPARATE AIR DISTRIBUTION SYSTEMS. (1) Except as provided in sub. (2), zones with special process temperature requirements, humidity requirements, or both, shall be served by air distribution system separate from those serving zones requiring only comfort conditions; or shall include supplementary provisions so that the primary systems may be specifically controlled for comfort purposes only.

(2) As an exception to sub. (1), zones requiring only comfort heating or comfort cooling that are served by a system primarily used for process temperature and humidity control need not be served by a separate system if the total supply air to these comfort zones is no more than 25% of the total system supply air or the total conditioned floor area of the zones is less than 1,000 square feet.

ILHR 63.26 TEMPERATURE CONTROLS. (1) SYSTEM CONTROL. Each HVAC system shall include at least one temperature control device.

(2) ZONE CONTROLS. (a) 1. Except as provided in subd. 2., the supply of heating and cooling energy to each zone shall be controlled by individual thermostatic controls responding to temperature within the zone.

2. Independent perimeter systems that are designed to offset only envelope heat losses or gains or both may serve one or more zones also served by an interior system with the following limitations:

a. The perimeter system shall include at least one thermostatic control zone for each building exposure having exterior walls facing only one orientation for 50 contiguous feet or more; and

b. The perimeter system heating and cooling supply shall be controlled by thermostats located within the zones served by the system.

(b) Where used to control comfort heating, zone thermostatic controls shall be capable of being set locally or remotely by adjustment or selection of sensors down to 55°F or lower.

(c) Where used to control comfort cooling, zone thermostatic controls shall be capable of being set locally or remotely by adjustment or selection of sensors up to 85°F or higher.

(d) Except as provided in subds. 1. to 3., zone thermostatic controls used to control both comfort heating and cooling shall be capable of providing a temperature range, or deadband, of at least 5°F within which the supply of heating and cooling energy to the zone is shut off or reduced to a minimum.

1. Deadbands are not required for special occupancy, special usage, or code-required systems where deadband controls are not appropriate.

2. Deadbands are not required for buildings complying with the ASHRAE energy cost budget method under Subchapter VII if, in the proposed building energy analysis, heating and cooling thermostat set-points are set to the same value between 70°F and 75°F inclusive and assumed to be constant throughout the year.

3. Deadbands may be omitted for thermostats that have manual changeover between heating and cooling modes.

ILHR 63.27 ZONE CONTROLS. (1) Except as provided in sub. (2), zone thermostatic and humidistatic controls shall be capable of operating in sequence to supply heating and cooling energy to the zone. Such controls shall prevent:

(a) Reheating;

(b) Recooling;

(c) Mixing or simultaneous supply of air that has been previously mechanically heated and air that has been previously cooled, either by mechanical refrigeration or by economizer systems; or

(d) Other simultaneous operation of heating and cooling systems to the same zone.

(2) The following systems and zones are exempt from this section:

(a) Variable air volume (VAV) systems which, during periods of occupancy, are designed to reduce the air supply to each zone to a minimum before reheating, recooling, or mixing takes place. This minimum volume shall be no greater than the largest of the following:

1. 30% of the peak supply volume;

2. The minimum required to meet ventilation requirements of s. ILHR 64.05;

3. 0.4 cfm/square foot of zone conditioned floor area.

(b) Zones where special pressurization relationships or cross-contamination requirements are such that the cost of controls for variable air volume systems exceeds the value of the energy saved, such as some areas of hospitals and laboratories;

(c) Where at least 75% of the energy for reheating or for providing warm air in mixing systems is provided from a site-recovered or site-solar energy source.

(d) Zones where specified humidity levels are required to satisfy process needs, such as computer rooms and museums; and

(e) Zones with a peak supply air quantity of 150 cfm or less.

(f) Multiple reheat systems serving multiple zones, other than those employing variable air volume for temperature control, that are provided with controls that will automatically reset the system cold air supply to the highest temperature level that will satisfy the zone requiring the coolest air.

(g) Dual duct and multizone systems that are provided with controls that will automatically reset:

1. The cold duct air supply to the highest temperature that will satisfy the zone requiring the coolest air; and

2. The hot duct air supply to the lowest temperature that will satisfy the zone requiring the warmest air.

(h) Systems in which heated air is recooled, directly or indirectly, to maintain space temperature that are provided with controls that will automatically reset the temperature to which the supply air is heated to the lowest level that will satisfy the zone requiring the warmest air.

(i) A multiple zone heating, ventilating and air-conditioning system that employs reheating or recooling for control of not more than 5,000 cfm or 20% of the total supply air of the system, whichever is less.

(3) OFF-HOUR CONTROLS. Except as provided in pars. (a) to (c), mechanical HVAC systems shall be equipped with automatic controls capable of accomplishing a reduction of energy use through control setback or equipment shutdown during periods of nonuse or alternate use of the zones served by the system. The following systems are exempt from this subsection:

(a) Systems serving areas expected to operate continuously;

(b) Where it can be shown that setback or shutdown will not result in a decrease in overall building energy costs; or

(c) Equipment with full load demands of 2 kW or 6826 Btu/h or less may be controlled by readily accessible manual off-hour controls.

ILHR 63.28 HUMIDITY CONTROL. If a system is equipped with a means for adding moisture to maintain specific humidity levels in a zone or zones, a humidistat shall be provided.

ILHR 63.29 INSULATION, MATERIALS AND CONSTRUCTION. (1) GENERAL. Insulation required by subs. (2) and (3) shall be suitably protected from damage.

Note: Insulation should be installed in accordance with practices acceptable to the department such as MICA Commercial and Industrial Insulation Standards.

(2) PIPING INSULATION. Except as provided in pars. (a) to (c), recirculating plumbing system piping, plumbing piping in the first 8 feet from storage tanks for noncirculating systems, any piping served by a self-regulating electric heating cable, HVAC system piping, and related HVAC fluid conveying conduit, such as heat exchanger bodies, shall be thermally insulated in accordance with Table 63.29-1 or equivalent. The following piping or conduit is exempted from this subsection:

(a) Factory-installed piping or conduit within HVAC equipment tested and rated in accordance with s. ILHR 63.20;

(b) Piping or conduit for which no insulation is specified in Table 63.29-1.

(c) Where it can be shown that the heat gain or heat loss to or from piping or conduit without insulation will not increase building energy use.

Note: For equivalent insulation levels using alternative insulation types, the calculation procedure specified in A63.29 of Appendix A is acceptable to the department.

Table 63.29-1

Plumbing and HVAC Piping Minimum Insulation (in.)[a,b]

Fluid Operating Temperature Range, °F	Nominal Pipe Diameter (in.)					Insulation Conductivity	
	1 and Less	1-1 1/4 to 2	2-1/2 to 4	5 and 6	8 and up	Conductivity Range Btu•in./(h•ft^3•°F)	Mean Rating Temperature °F
Hot Systems (Steam, Steam Condensate, and Hot Water)							
Above 350	2.5	2.5	3.0	3.5	3.5	0.32 - 0.34	250
251 - 350	2.0	2.5	2.5	3.5	3.5	0.29 - 0.31	200
201 - 250	1.5	1.5	2.0	2.0	3.5	0.27 - 0.30	150
141 - 200	1.5	1.5	1.5	1.5	1.5	0.25 - 0.29	125
105 - 140	1.0	1.0	1.0	1.5	1.5	0.24 - 0.28	100
80 - 104	0.5	0.5	0.5	1.0	1.0	0.24 - 0.28	100
Cold Systems (Chilled Water, Brine, and Refrigerant)[c]							
40 - 55	0.5	0.75	1.0	1.0	1.0	0.23 - 0.27	75
Below 40	1.0	1.5	1.5	1.5	1.5	0.23 - 0.27	75

[a] For minimum thicknesses of alternative insulation types, see Appendix A.

[b] Plumbing piping systems without a heat trap to prevent circulation due to natural convection shall be considered circulating systems.

[c] The required minimum thicknesses do not consider water vapor transmission and condensation. Additional insulation, vapor retarders, or both, may be required to limit water vapor transmission and condensation.

(3) AIR-HANDLING SYSTEM INSULATION. All air-handling ducts and plenums installed as part of an HVAC air distribution system shall be thermally insulated in accordance with Table 63.29-2, except where it can be shown that the heat gain to or heat loss from ducts without insulation will not increase building energy use.

Table 63.29-2

Minimum Duct Insulation[a]

Duct Location	Cooling[b] Insulation R-Value[d] (h•ft^2•°F)/Btu	Heating[c] Insulation R-Value[d] (h•ft^2•°F)/Btu
Exterior of Building	5.0	9.0
Interior[g]		
Td[e]≤15	None Required	None Required
40 ≥ Td[e]>15	3.3	3.3
Td[e]>40	5.0[f]	5.0[f]

[a] Insulation R-values shown are for the insulation as installed and do not include film resistance. The required minimum thicknesses do not consider water vapor transmission and condensation. Additional insulation, vapor retarders, or both, may be required to limit vapor transmission and condensation. For ducts which are designed to

convey both heated and cooled air, duct insulation shall be as required by the most restrictive condition. Where exterior walls are used as plenum walls, wall insulation shall be as required by the most restrictive condition of this section or Subchapter III.

[b] Cooling ducts are those designed to convey cooled air or return ducts in such systems.

[c] Heating ducts are those designed to convey heated air or return ducts in such systems.

[d] Insulation resistance measured on a horizontal plane in accordance with ASTM C518 at a mean temperature of 75°F at the installed thickness.

[e] TD is defined as the temperature difference at design conditions (see s. ILHR 63.25) between the space within which the duct is located and the design air temperature in the duct.

[f] Insulation resistance for runouts to terminal devices less than 10 feet in length need not exceed 3.3 (h ft^2 °F)/Btu.

[g] Interior ducts include any ducts inside the building thermal envelope. Exterior ducts include ducts in unconditioned spaces such as crawlspaces and attics.

ILHR 63.31 ECONOMIZER CONTROLS. (1) Except as provided in sub. (2), each fan system shall be designed and capable of being controlled to take advantage of favorable weather conditions to reduce mechanical cooling requirements. The system shall include either of the following:

(a) A temperature or enthalpy air economizer system which is capable of automatically modulating outside air and return air dampers to provide 100% of the design supply air quantity as outside air for cooling;

(b) A water economizer system which is capable of cooling supply air by direct evaporation, indirect evaporation, or both. Such a system shall be designed and capable of being controlled to provide 100% of the expected system cooling load at outside air temperatures of 50°F dry-bulb/45°F wet-bulb and below.

(2) The following systems are exempt from this subsection:

(a) Individual fan-cooling units with a supply capacity of less than 2,000 cfm or a total system cooling capacity of less than 62,000 Btu/hour for split systems or less than 55,000 Btu/hour for all other types. The total capacity of all such units complying by use of this exception shall not exceed 600,000 Btu/hour per building or 10% of the total installed cooling capacity, whichever is larger;

(b) Systems with air or evaporatively cooled condensers for which it can be shown that the use of outdoor air cooling affects the operation of other systems, such as humidification, dehumidification, or supermarket refrigeration systems, so as to increase overall building energy costs;

Note: Other areas that may use controlled humidification or dehumidification are computer rooms, museums, library stacks and drafting rooms.

(c) Where the overall building energy use resulting from alternative designs, such as internal to external zone heat recovery systems, can be shown to be less than those resulting from an economizer system.

ILHR 63.32 ELECTRICAL MOTORS. (1) Any permanently wired motor that meets all of the criteria specified in pars. (a) through (g) shall meet the efficiency requirements specified in Table 63.32 and the requirements of this section.

(a) The motor is used in a HVAC fan or pumping system;

(b) The motor is polyphase;

(c) The motor is one horsepower or more;

(d) The motor is a design A or B squirrel-cage, foot-mounted, T-frame induction motor that has synchronous speeds of 3600, 1800, 1200, and 900 rpm;

(e) The motor is expected to operate more than 1000 hours per year;

(f) The motor is not a multispeed motor used in a system designed to use more than one speed; and

(g) The motor is not a component of equipment that meets the efficiency requirements of s. ILHR 63.20 and the motor input is included in the determination of the equipment efficiency.

(2) The motor nameplate shall list the minimum nominal full-load motor efficiency.

Note: Motors that are classified as "energy efficient" under the National Electric Manufacturer's Association Standard MG 12.55, dated 3-14-91, are acceptable to the department as meeting the efficiency requirements of this section.

Table 63.32
Minimum Acceptable Nominal Full-Load Motor Efficiency For Single-Speed Polyphase Squirrel-Cage Induction Motors Having Synchronous Speeds of 3600, 1800, 1200 and 990 rpm

Full-Load Efficiencies—Open Motors								
HP	2-Pole		4-Pole		6-Pole		8-Pole	
	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
1.0	--	--	82.5	81.5	80.0	78.5	74.0	72.0
1.5	82.5	81.5	84.0	82.5	84.0	82.5	75.5	74.0
2.0	84.0	82.5	84.0	82.5	85.5	84.0	85.5	84.0
3.0	84.0	82.5	86.5	85.5	86.5	85.5	86.5	85.5
5.0	85.5	84.0	87.5	86.5	87.5	86.5	87.5	86.0
7.5	87.5	86.5	88.5	87.5	88.5	87.5	88.5	87.5
10.0	88.5	87.5	89.5	88.5	90.2	89.5	89.5	88.5
15.0	89.5	88.5	91.0	90.2	90.2	89.5	89.5	88.5
20.0	90.5	89.5	91.0	90.2	91.0	90.2	90.2	89.5
25.0	91.0	90.2	91.7	91.0	91.7	91.0	90.2	89.5
30.0	91.0	90.2	92.4	91.7	92.4	91.7	91.0	90.2
40.0	91.7	91.0	93.0	92.4	93.0	92.4	91.0	90.2
50.0	92.4	91.7	93.0	92.4	93.0	92.4	91.7	91.0
60.0	93.0	92.4	93.6	93.0	93.6	93.0	92.4	91.7
75.0	93.0	92.4	94.1	93.6	93.6	93.0	93.6	93.0
100.0	93.0	92.4	94.1	93.6	94.1	93.6	93.6	93.0
125.0	93.6	93.0	94.5	94.1	94.1	93.6	93.6	93.0
150.0	93.6	93.0	95.0	94.5	94.5	94.1	93.6	93.0
200.0	94.5	94.1	95.0	94.5	94.5	94.1	93.6	93.0

Full-Load Efficiencies—Enclosed Motors								
HP	2-Pole		4-Pole		6-Pole		8-Pole	
	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency	Nominal Efficiency	Minimum Efficiency
1.0	75.5	74.0	82.5	81.5	80.0	78.5	74.0	72.0
1.5	82.5	81.5	84.0	82.5	85.5	84.0	77.0	75.5
2.0	84.0	82.5	84.0	82.5	86.5	85.5	82.5	81.5
3.0	85.5	84.0	87.5	86.5	87.5	86.5	84.0	82.5
5.0	87.5	86.5	87.5	86.5	87.5	86.5	85.5	84.0
7.5	88.5	87.5	89.5	88.5	89.5	88.5	85.5	84.0
10.0	89.5	88.5	89.5	88.5	89.5	88.5	88.5	87.5
15.0	90.2	89.5	91.0	90.2	90.2	89.5	88.5	87.5
20.0	90.2	89.5	91.0	90.2	90.2	89.5	89.5	88.5
25.0	91.0	90.2	92.4	91.7	91.7	91.0	89.5	88.5
30.0	91.0	90.2	92.4	91.7	91.7	91.0	91.0	90.2
40.0	91.7	91.0	93.0	92.4	93.0	92.4	91.0	90.2
50.0	92.4	91.7	93.0	92.4	93.0	92.4	91.7	91.0
60.0	93.0	92.4	93.6	93.0	93.6	93.0	91.7	91.0
75.0	93.0	92.4	94.1	93.6	93.6	93.0	93.0	92.4
100.0	93.6	93.0	94.5	94.1	94.1	93.6	93.0	92.4
125.0	94.5	94.1	94.5	94.1	94.1	93.6	93.6	93.0
150.0	94.5	94.1	95.0	94.5	95.0	94.5	93.6	93.0
200.0	95.0	94.5	95.0	94.5	95.0	94.5	94.1	93.6

Subchapter V — Lighting Power

ILHR 63.40 SCOPE. Sections 63.41 to 63.51 shall apply to the following rooms, spaces and areas:

(1) Interior spaces of buildings;

(2) Building exteriors and exterior areas such as entrances, exits, loading docks; and

(3) Roads, grounds, parking, and other exterior areas where lighting is energized through the building electrical service.

Note: See Appendix for worksheets.

ILHR 63.41 EXTERIOR LIGHTING POWER REQUIREMENT. The exterior lighting power of a building or a group of buildings in a multibuilding facility calculated in accordance with s. ILHR 63.42 shall be no greater than the lighting power allowance calculated in accordance with s. ILHR 63.43.

ILHR 63.42 CALCULATION OF EXTERIOR LIGHTING POWER. The calculated exterior lighting power is the sum of the power for all exterior luminaires that are included in the scope of this subchapter, s. ILHR 63.40, minus the power for exempted exterior lighting as specified in subs. (1) to (5):

(1) Task lighting for outdoor activities such as manufacturing, commerce, and processing facilities.

(2) Lighting power for theatrical productions.

(3) Lighting for outdoor athletic facilities, including playing and seating areas.

(4) Lighting for dwelling units that is controlled within the dwelling unit.

(5) Exit way or egress lighting required by Ind 19.21 that has switching regulated by Article 700 of the National Electrical Code as adopted by reference in Ch. ILHR 16.

ILHR 63.43 EXTERIOR LIGHTING POWER ALLOWANCE. (1) CALCULATION METHOD. The exterior lighting power allowance for a building or a multibuilding facility is the sum of all the allowed lighting powers for all exterior areas. The lighting power for each area is calculated by multiplying the unit power allowance from Table 63.43 by the applicable length or area.

(2) APPLICABLE AREAS AND LENGTHS. The applicable areas and lengths used with Table 63.43 to calculate the exterior lighting power allowance are described in pars. (a) to (d).

(a) Horizontal areas of grounds, driveways, lots, gardens or parks may be calculated as if they were flat, or the actual area of the surfaces of contours may be used.

(b) Canopied areas are the area of the horizontal surface under the canopy. A canopy includes an exterior awning, soffit or ornamental or functional structure signifying a main entrance to a building.

(c) The linear length of door openings is measured in plan view and includes the door opening only. Sidelights and other portions of the door which do not open are not included.

(d) The applicable area of the building facade includes all vertical and horizontal areas that are intended to be illuminated.

Table 63.43

Exterior Lighting Unit Power Allowances

Area Description	Allowances
Exit (with or without canopy)	25 W/lin ft of door opening
Entrance (without canopy)	30 W/lin ft of door opening
Entrance (with canopy)	
High traffic (retail, hotel, airport, theater, etc.)	10 W/ft^2 of canopied area
Light traffic (hospital, office, school, etc.)	4 W/ft^2 of canopied area
Loading area	0.40 W/ft^2
Loading door	20 W/lin ft of door opening
Building exterior surfaces/facades	0.25 W/ft^2 of surface area to be illuminated
Storage and nonmanufacturing work areas	0.20 W/ft^2
Other activity areas for casual use such as picnic grounds, gardens, parks and other landscaped areas.	0.10 W/ft^2
Private driveways/walkways	0.10 W/.ft^2
Public driveways/walkways	0.15 W/ft^2
Private parking lots	0.12 W/ft^2
Public parking lots	0.18 W/ft^2

ILHR 63.44 INTERIOR LIGHTING POWER REQUIREMENT. The interior lighting power of a building calculated in accordance with s. ILHR 63.45 shall be no greater than the interior lighting power allowance calculated in accordance with s. ILHR 63.46.

ILHR 63.45 CALCULATION OF INTERIOR LIGHTING POWER. The calculated interior lighting power of a building is the total watts of all interior luminares including, but not

limited to, track and flexible lighting systems, lighting that is integral with modular furniture, movable displays and cabinets, and internally illuminated case work for task or display purposes, minus any adjustments allowed under subs. (1) through (4).

(1) MULTIPLE INTERLOCKED LIGHTING SYSTEMS SERVING A SPACE. When multiple interlocked lighting systems serve a space, the watts of all systems except the system with the highest wattage may be excluded from the calculated lighting power if:

(a) The lighting systems are interlocked to prevent simultaneous operation; or

(b) The lighting systems are controlled by a preset dimming system or other device that prevents simultaneous operation of more than one lighting system, except under the direct control of authorized personnel.

(2) REDUCTION OF WATTAGE THROUGH CONTROLS. The watts of any luminaire that is controlled may be reduced by the number of watts times the applicable power adjustment factor from Table 63.45 if:

(a) The control complies with s. ILHR 63.51; and

(b) At least 50 percent of the light output of the luminaire is within the applicable space listed in Table 63.45; and

(c) Except as noted in Table 63.45, only one power adjustment factor is used for the luminaire; and

(d) For daylighting control credits, the luminaire is controlled by the daylighting control, and the luminaire is located within the daylit area; and

(e) For automatic time switch control devices, a timed manual override is provided at each switch location required by s. ILHR 63.50. The override device shall control only the lights in the surrounding area enclosed by ceiling-height partitions.

Table 63.45
Lighting Power Adjustment Factors

Type of Control	Type of Space	Factor
Automatic daylighting controls	Daylit areas	
Continuous dimming		0.30
Multiple step dimming		0.20
On/off		0.10
Automatic time switch control device in conjunction with automatic daylighting controls	Daylit areas ≤ 250 square feet	
Continuous dimming		0.35
Multiple step dimming		0.25
On/off		0.15
Automatic time switch control device in conjunction with lumen maintenance and automatic daylighting controls	Daylit areas ≤ 250 square feet	
Continuous dimming		0.40
Multiple step dimming		0.30
On/off		0.20
Lumen maintenance	Any space	0.10
Lumen maintenance in conjunction with an automatic time switch control device	Space ≤ 250 square feet	0.15
Automatic time switch control device	Spaces ≤ 250 square feet	0.15
Occupant-sensing device with a separate sensor for each space	Spaces ≤ to 250 square feet enclosed by opaque floor-to-ceiling partitions; any size classroom, corridor, conference or waiting room	0.30*
Occupant-sensing device with separate sensor for each space	Rooms of any size that are used exclusively for storage	0.60*
Occupant-sensing device with separate sensor for each space	Spaces > 250 square feet	0.10*

Table 63.45 (Continued)
Lighting Power Adjustment Factors

Type of Control	Type of Space	Factor
Occupant-sensing device with a separate sensor for each space used in conjunction with daylighting controls and separate sensor for each space	Spaces ≤ 250 square feet within a daylit area and enclosed by opaque floor-to-ceiling partitions	
Continuous dimming		0.40*
Multiple step dimming		0.35*
On/off		0.35*
Occupant-sensing device with a separate sensor for each space used in conjunction with daylighting controls and separate sensor for each space and lumen maintenance	Spaces ≤ 250 square feet within a daylit area and enclosed by opaque floor-to-ceiling partitions	0.35*
Continuous dimming		0.45*
Multiple step dimming		0.40*
On/off		0.35*
Occupant-sensing device with a separate sensor for each space used with lumen maintenance	Spaces ≤ 250 square feet and enclosed by opaque floor-to-ceiling partitions	0.35*
Occupant-sensing device with a separate sensor for each space used in conjunction with an automatic time switch control device	Spaces ≤ 250 square feet enclosed by opaque floor to ceiling partitions	0.35*
Manual dimming system	Hotels, motels, restaurants, auditoriums, theaters	0.10
Multiscene programmable dimming system	Hotels, motels, restaurants, auditoriums, theaters	0.20
Occupant-sensing device with programmable multiscene dimming system	Hotels, motels, restaurants, auditoriums, theaters	0.35

*Note to Table 63.45: Adjustment factors for occupant-sensing devices are for devices with on-off operation. If devices are used that turn lights down, rather than off, the adjustment factor shall be multiplied by the percent of energy savings that occur while the lights are turned down.

(3) LIGHTING WATTAGE EXCLUDED. The watts of the following lighting applications may be excluded from the calculated interior lighting power of the building.

(a) Lighting for theatrical productions and other live performances, television broadcasting, audio-visual presentations, and those portions of entertainment facilities such as stage areas in hotel ballrooms, night clubs, dance floors, and casinos where lighting is an essential technical element for the function performed, if the lighting is an addition to a general lighting system, and if the lighting is separately controlled and accessible only to authorized operators.

(b) Lighting for television, video and film production.

(c) Lighting for photographic processes.

(d) Lighting for theme parks.

(e) Lighting for exhibits in areas such as exhibit, convention, and hotel function areas, if the lighting is an addition to a general lighting system, and if the lighting is separately controlled and accessible only to authorized operators.

(f) Specialized local lighting installed in nonlighting process equipment by its manufacturer used to illuminate process related tasks only.

(g) In buildings for medical and clinical care, examination and surgical lights, low-level night lights, and lighting integral to medical equipment.

(h) Lighting fixtures that are an integral part of refrigeration equipment.

(i) Nonretail display lighting required for art exhibits or displays in galleries, museums and monuments.

(j) Special lighting needed for research.

(k) Task lighting for plant growth or maintenance, if it is equipped with an automatic 24-hour time switch that has program back-up capabilities that prevent the loss of the switch's program and time setting for at least 10 hours if power is interrupted.

(l) Exit way or egress illumination that is normally off.

(m) Task lighting specifically designed for primary use by visually impaired, for lip reading, and by senior citizens.

(n) Lighting for signs, including exit signs.

Note: See s. ILHR 63.52 for exit sign requirements.

(o) Display window lighting in retail facilities provided the display area is separated from the store sales area by opaque ceiling-height partitions.

(p) Lighting in dwelling units that provide complete independent living facilities for one or more persons including permanent provisions for living, sleeping, eating, cooking, and sanitation.

(q) In restaurant buildings and areas, lighting for food warming or integral to food preparation equipment;

(r) Lighting equipment that is for sale;

(s) Lighting demonstration equipment in lighting education facilities.

(4) LIGHTING FIXTURES THAT ALLOW SUBSTITUTION OF SOURCES. The watts of track and other lighting fixtures that allow the substitution of low efficacy sources for high efficacy sources without altering the wiring of the fixture shall be determined by this subsection or other method approved by the department.

(a) Track lighting. The wattage of track lighting shall be determined by the method described in subd. 1. or 2.

1. The wattage of track lighting shall be the larger of the following two values:

a. 45 watts per foot of track; or

b. The total luminaire wattage proposed to operate on each track.

2. If interlocked switching is provided that limits the circuits that can be operated simultaneously, the wattage shall be the maximum luminaire wattage that can be operated simultaneously.

(b) Incandescent medium base sockets. The wattage for medium base fixtures shall be the listed lighting power capacity, in watts, of the fixture.

Note: See Appendix for default lamp/ballast wattages acceptable to the department.

ILHR 63.46 CALCULATION OF INTERIOR LIGHTING POWER ALLOWANCE. The interior lighting power allowance shall be calculated using one of the methods in s. ILHR 63.47, 63.48, or 63.49 as applicable.

ILHR 63.47 COMPLETE BUILDING METHOD. The Complete Building Method may be used only on projects involving entire buildings where plans and specifications are submitted for the entire building and at least 80 percent of the areas of the building are the same type of use.

Under this approach, the interior lighting power allowance is the lighting power density value in Table 63.47 times the conditioned floor area of the entire building. Hotel, motel and residential buildings shall not use this method. Building uses that are not listed in Table 63.47 shall be assigned the allowed lighting power density given under "All Others."

Table 63.47
Complete Building Method
Lighting Power Density Values (Watts/ft^2)

Type of Use	Allowed Lighting Power Density
Banks and Financial Institutions	1.7
Correctional Housing	1.4
General Commercial and Industrial Work Buildings	1.2
Grocery Store	1.8
Industrial and Commercial Storage Buildings	0.8
Medical Buildings and Clinics	1.5
Office Building	1.5
Religious Worship, Auditorium, and Convention Centers	2.0
Restaurants	1.5
Retail and Wholesale Store	2.0
Schools	1.8
Theaters	1.5
All Others	0.8

ILHR 63.48 AREA CATEGORY METHOD. Under the Area Category Method, the interior lighting power allowance for the building is the sum of all allowed lighting powers for all areas in the building. The allowed lighting power for an area is the lighting power density in Table 63.48 times the area. For purposes of the Area Category Method, an "Area" means all contiguous spaces which accommodate or are associated with a single one of the primary functions listed in Table 63.48. Buildings with primary functions not listed in Table 63.48 shall not use this method. Where areas are bounded or separated by interior partitions, the floor space occupied by those interior partitions shall not be included in any area. The area shall not include enclosed retail display windows with exempted lighting as described in s. ILHR 63.45 (3) (j). When the Area Category Method is used to calculate the interior lighting power allowance for an entire building, main entry lobbies, corridors, rest rooms, and support functions shall be treated as separate areas.

Table 63.48
Area Category Method - Lighting Power Density Values (Watts/ft^2)

Primary Function	Allowed Lighting Power Density
Auditorium	2.0
Bank/Financial Institution	1.8
Classrooms	2.0
Convention, Conference and Meeting Centers	1.6
Corridors, Rest Rooms and Support Areas	0.8
Detention Facilities	1.6
Dining	1.2
Exhibit	2.3
Storage Garage	0.2
General Commercial and Industrial Work	1.3
Grocery	2.0
Hotel Function	2.3*
Industrial and Commercial Storage	0.6
Kitchen	2.2
Laboratory	3.3
Living Unit or Guest Room	1.4
Lobbies:	
Hotel Lobby	2.3*
Main Entry Lobby	1.6*
Malls, Arcades, and Atria	1.2*
Medical and Clinical Care	1.8
Office	1.6
Precision Commercial and/or Industrial Work	2.0
Religious Worship	2.2*
Retail Sales, Wholesale Showrooms	2.2
Theaters	
Motion Picture	1.0
Performance	1.5*

* Note to Table 63.48: The smallest of the following values may be added to the allowed lighting power listed in Table 63.48 for ornamental chandeliers and sconces that are switched or dimmed on circuits different from the circuits for general lighting:

a. 1 watt per square foot times the area of the space in which the chandelier or sconce is used; or

b. The actual design wattage of the chandelier or sconce.

ILHR 63.49 ACTIVITY METHOD. Under the activity method, the interior lighting power allowance for a building is determined by calculating a lighting power budget for each space in accordance with subs. (1) to (4) and summing them in accordance with sub. (5).

(1) The lighting power budget of each interior space shall be determined in accordance with the equation given below:

$$LPB = A \times UPD \times AF$$

Where:

LPB = lighting power budget of the space, W
A = area of the space, ft^2
UPD = unit power density, W/ft^2 [Table 63.49]
AF = area factor of the room [Figure 63.49]

(a) The UPD shall be selected from Table 63.49. For applications to areas or activities other than those given, select values for the most similar areas or activities. The UPD for a multifunctional space shall be based on the lowest UPD of any of the activities of the space.

(b) The area factor (AF) shall be determined from Figure 63.49 based on the room area (A_r) and ceiling height. The room area shall be calculated from the inside dimensions of the room. Rooms of identical ceiling height and activities may be evaluated as a group. The AF of a group of rooms shall be determined from the average area of these rooms.

The equation below gives the formula used in developing Fig. 63.49.

$$AF = 0.2 + 0.8(1/0.9^n)$$

Where:

$$n = \left[\frac{10.21(CH - 2.5)}{\sqrt{A_r}} \right] - 1$$

AF = Area factor
CH = Ceiling height, ft.
A_r = Room area, ft^2

If AF < 1.0, then AF = 1.0
If AF > 1.8, then AF = 1.8

(2) For rooms serving multiple functions such as hotel banquet or meeting rooms and office conference or presentation rooms, an adjustment factor of 1.5 times the UPD may be used if a supplementary system is actually installed and meets the following conditions:

(a) The installed power for the supplementary system shall not be greater than 33 percent of the adjusted lighting power budget calculated for that space, and

(b) Independent controls shall be installed for the supplementary system.

(3) In rooms containing multiple simultaneous activities, such as a large general office having separate accounting and drafting areas within the same room, the lighting power budget for the rooms shall be the weighted average of the activities in proportion to the areas being served.

(4) The activity of indoor sports areas shall be considered as an area 10 feet beyond the playing boundaries of the sport, not to exceed the total floor area of the indoor sports space less the spectator seating area.

(5) The interior lighting power allowance shall be calculated in accordance with the equation given below. The interior lighting power allowance shall include a 0.20 W/ft^2 allowance for unlisted spaces.

$$ILPA = (LPB_1 + LPB_2 + \ldots + LPB_n) + (0.20\ W/ft^2 \times \text{unlisted space area})$$

Where:

ILPA = interior lighting power allowance, W

Unlisted space area = GLA - Σ(LS), ft^2

GLA = gross lighted area, ft^2

LPB = lighting power budget, W

LS = listed space

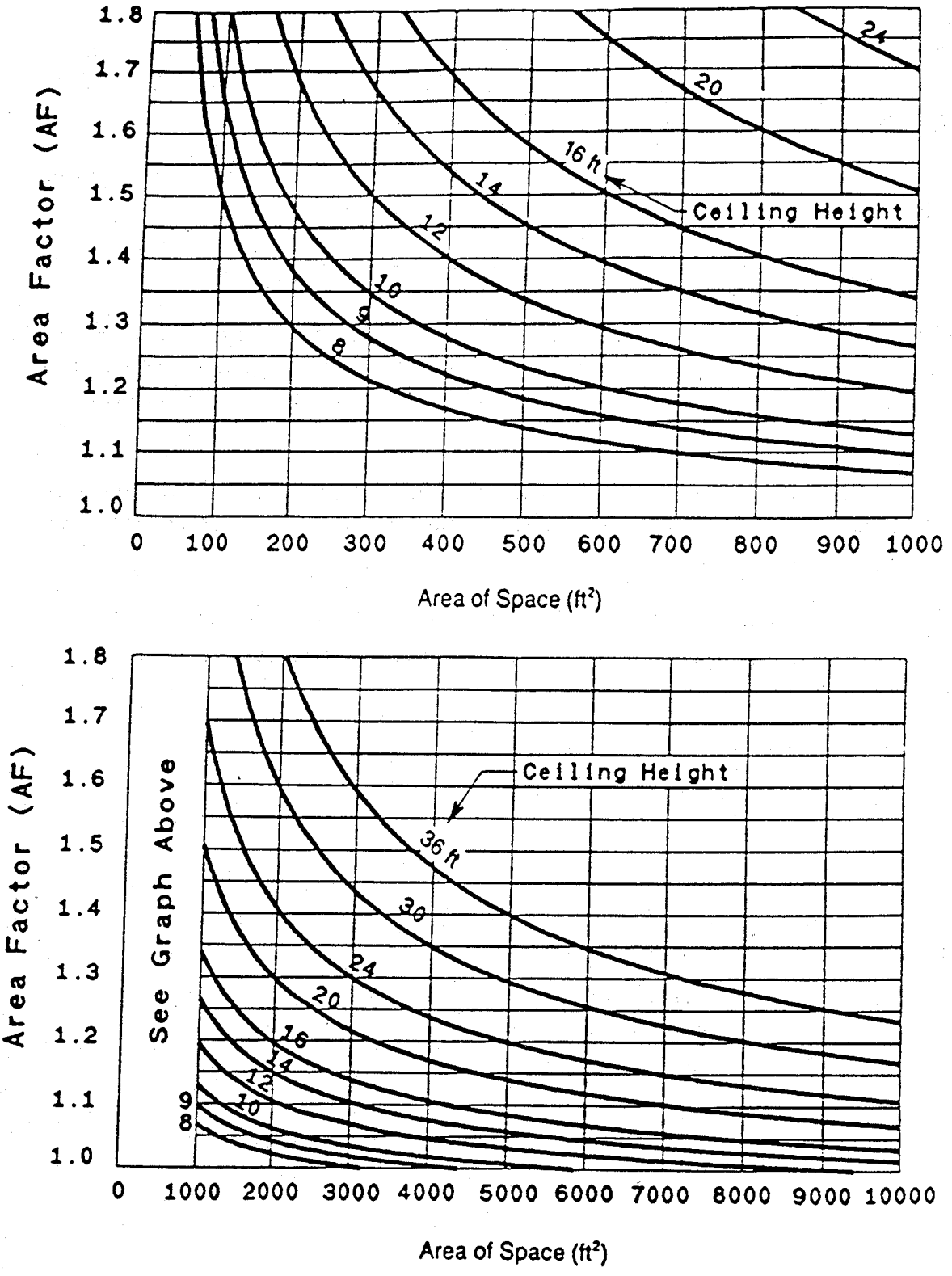


Figure 63.49 Area Factor

Table 63.49
Unit Power Densities
Part a - Common Activity Areas

Activity/Area	UPD W/ft^2	Note
Auditorium	1.6	a
Corridor	0.8	b
Classroom/Lecture Hall	2.0	
Electrical/Mechanical Equipment Room		
General	0.7	b
Control Rooms	1.5	b
Food Service		
Fast Food/Cafeteria	1.3	
Leisure Dining	2.5	c
Bar Lounge	2.5	c
Kitchen	1.4	
Recreation/Lounge	0.7	
Stair		
Active Traffic	0.6	
Emergency Exit	0.4	
Toilet and Washroom	0.8	
Garage		
Auto and Pedestrian Circulation Area	0.3	
Parking Area	0.2	
Laboratory	3.0	
Library		
Audio/Visual	1.1	
Stack Area	1.5	
Card File and Cataloging	1.6	
Reading Area	1.9	
Lobby (General)		
Reception and Waiting	1.0	
Elevator Lobbies	0.8	
Atrium (Multistory)		
First Three Floors	0.7	
Each Additional Floor	0.2	

Table 63.49
Unit Power Densities
Part a - Common Activity Areas (Continued)

Activity/Area	UPD W/ft^2	Note
Locker Room and Shower	0.8	
Office Category 1		
Enclosed offices, all open plan offices without partitions or with partitions* lower than 4.5 feet below the ceiling		
Reading, Typing and Filing	1.8	d
Drafting	2.6	d
Accounting	2.1	d
Office Category 2		
Open plan offices 900 square feet or larger with partitions* 3.5 to 4.5 feet below the ceiling Offices less than 900 square feet shall use Category 1		
Reading, Typing and Filing	1.9	b
Drafting	2.9	b
Accounting	2.4	b
Office Category 3		
Open plan offices 900 square feet or larger with partitions* higher than 3.5 feet below the ceiling Offices less than 900 square feet shall use Category 1		
Reading, Typing and Filing	2.2	b
Drafting	3.4	b
Accounting	2.7	b
Common Activity Areas		
Conference Meeting Room	1.8	a
Computer Office Equipment	2.1	
Filing, Inactive	1.0	
Mail Room	1.8	
Shop (Nonindustrial)		
Machinery	2.5	
Electrical/Electronic	2.5	
Painting	1.6	
Carpentry	2.3	
Welding	1.2	

Table 63.49
Unit Power Densities
Part a - Common Activity Areas (Continued)

Activity/Area	UPD W/ft^2	Note
Storage and Warehouse		
Inactive Storage	0.3	
Active Storage, Bulky	0.3	
Active Storage, Fine	1.0	
Material Handling	1.0	
Unlisted Space	0.2	

* Not less than 90 percent of all work stations shall be individually enclosed with partitions of at least the height described.

Part b - Specific Buildings

Activity/Area	UPD W/ft2	Note
Airport, Bus and Rail Station		
Baggage Area	1.0	
Concourse/Main Thruway	0.9	
Ticket Counter	2.5	
Waiting and Lounge Area	1.2	
Bank		
Customer Area	1.1	
Banking Activity Area	2.8	
Barber and Beauty Parlor	2.0	
Church, Synagogue, Chapel		
Worship/Congregational	2.5	
Preaching and Sermon/	2.7	
Dormitory		
Bedroom	1.1	
Bedroom With Study	1.4	
Study Hall	1.8	
Fire and Police Department		
Fire Engine Room	0.7	
Detention Dayroom	1.5	
Jail Cell	1.2	

Table 63.49
Unit Power Densities
Part b - Specific Buildings (Continued)

Activity/Area	UPD W/ft^2	Note
Hospital/Nursing Home		
Corridor	1.3	b
Dental Suite/Examination/Treatment	1.6	
Emergency	2.3	
Laboratory	3.0	
Lounge/Waiting Room	0.9	
Medical Supplies	2.4	
Nursery	2.0	
Nurse Station	2.1	
Occupational Therapy/Physical Therapy	1.6	
Patient Room	1.4	
Pharmacy	1.7	
Radiology	2.1	
Surgical and O.B. Suites		
General Area	2.1	
Operating Room	7.0	
Recovery	2.3	
Hotel/Conference Center		
Banquet Room/Multipurpose	2.4	a
Bathroom/Powder Room	1.2	
Guest Room	1.4	
Public Area	1.2	
Exhibition Hall	2.6	
Conference/Meeting	1.8	a
Lobby	1.9	
Reception Desk	2.4	
Laundry		
Washing	0.9	
Ironing and Sorting	1.3	
Museum and Gallery		
General Exhibition	1.9	
Inspection/Restoration	3.9	
Storage (Artifacts)		
Inactive	0.6	
Active	0.7	
Post Office		
Lobby	1.1	
Sorting and Mailing	2.1	

Table 63.49
Unit Power Densities
Part b - Specific Buildings (Continued)

Activity/Area	UPD W/ft^2	Note
Service Station/Auto Repair	1.0	
Theater		
Performance Arts	1.5	
Motion Picture	1.0	
Lobby	1.5	
Retail Establishments		
Merchandising and Circulation Area - Applicable to all lighting, including accent and display lighting, installed in merchandising and circulation areas	2.2	
Mall Concourse	1.4	
Retail Support Areas		
Tailoring	2.1	
Dressing/Fitting Rooms	1.4	

Part c - Indoor Athletic Areas[e,f]

Activity/Area	UPD W/ft2
Seating Area, All Sports	0.4
Badminton	
Club	0.5
Tournament.	0.8
Basketball/Volleyball	
Intramural	0.8
College	1.3
Professional	1.9
Bowling	
Approach Area	0.5
Lanes.	1.1

Table 63.49
Unit Power Densities
Part c - Indoor Athletic Areas[e,f] (Continued)

Activity/Area	UPD W/ft2
Boxing or Wrestling (platform)	
Amateur	2.4
Professional	4.8
Gymnasium	
General Exercising and Recreation Only	1.0
Handball/Raquetball/Squash	
Club	1.3
Tournament	2.6
Hockey, Ice	
Amateur	1.3
College or Professional	2.6
Skating Rink	
Recreational	0.9
Exhibition/Professional	2.6
Swimming	
Recreational	0.9
Exhibition	1.5
Under Water	1.0
Tennis	
Recreational (Class III)	1.3
Club/College (Class II	1.9
Professional (Class I)	2.6
Tennis, Table	
Club	1.0
Tournament	1.6

Notes for Table 63.49

a. A 1.5 power adjustment factor is applicable for multifunctional spaces.

b. Area factor of 1.0 shall be used for these spaces.

c. UPD includes lighting power required for clean-up purpose.

d. Area factor shall not exceed 1.55.

e. Area factor of 1.0 shall be used for all indoor athletic spaces.

f. Facilities that are used for more than one level of play shall have appropriate switching between the different levels specified in Table 63.49. Dimming shall not be used to accomplish the reduction in illumination. The illumination at all levels shall be uniform.

ILHR 63.50 LIGHTING CONTROLS THAT MUST BE INSTALLED. (1) AREA CONTROLS. (a) Except as provided in pars. (c) and (d), each interior area enclosed by ceiling-height partitions shall have an independent switching or control device. This switching or control device shall be:

1. Readily accessible; and

2. Located so that a person using the device can see the lights or area controlled by that switch, or so that the area being lit is annunciated; and

3. Manually operated, or automatically controlled by an occupant-sensing device that meets the requirements of s. ILHR 63.51 (4).

(b) Other devices may be installed in conjunction with the switching or control device required by par. (a) provided that they:

1. Permit the required switching or control device to override the action of the other devices; and

2. Reset the mode of any automatic system to normal operation without further action.

(c) Up to one-half watt per square foot of lighting in any area within a building that must be continuously illuminated for reasons of building security or emergency egress are exempt from par. (a) if:

1. The area is designated a security or emergency egress area on the plans and specifications submitted to the department; and

2. The area is controlled by switches accessible only to authorized personnel.

(d) Public areas with switches that are accessible only to authorized personnel are exempt from the area control requirements of par. (a).

(2) CONTROLS TO REDUCE LIGHTING. (a) Except as provided in par. (b), the general lighting of any enclosed interior space 100 square feet or larger in which the connected lighting load exceeds 1.2 watts per square foot for the space as a whole, and that has more than one light source or luminaire, shall be controlled so that the load for the lights may be reduced by at least one-half while maintaining a reasonably uniform level of illuminance throughout the

area. A reasonably uniform reduction of illuminance shall be achieved by one of the following or other method approved by the department:

1. Controlling all lamps or luminaires with dimmers; or

2. Dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps; or

3. Switching the middle lamps of three lamp luminaires independently of the outer lamps; or

4. Switching each luminaire or each lamp.

(b) The requirements of par. (a) do not apply to:

1. Lights in areas that are controlled by an occupant-sensing device that meets the requirements of s. ILHR 63.51 (4);

2. Lights in corridors; or

3. Lights in areas that are controlled by an automatic time switch control device that has a timed manual override available at each switch location required by sub. (1), and that controls only the lights in that area enclosed by ceiling height partitions.

(3) DAYLIT AREAS. (a) Except as provided in (b), daylit areas in any interior enclosed space greater than 250 square feet shall meet the requirements of 1. and 2.

1. Such areas shall have at least one control that:

a. Controls only luminaires in the daylit area; and

b. Controls at least 50% of the lamps or luminaires in the daylit area, in a manner described in sub. (2)(a) 1. to 4., independently of all other lamps or luminaires in the enclosed space. The other luminaires in the enclosed space may be controlled in any manner allowed by sub. (2)(a) 1. to 4.

2. Such areas shall have controls that control the luminaires in each vertically daylit area separately from the luminaires in each horizontally daylit area.

(b) The requirements of this subsection do not apply to:

1. Daylit areas where the effective aperture of glazing is equal or less than 0.1 for vertical glazing and 0.01 for horizontal glazing; or

2. Daylit areas where existing adjacent structures or natural objects obstruct daylight to the extent that effective use of daylighting is not feasible.

(4) SHUT-OFF CONTROLS. (a) Except as provided in (b), for every floor or metered space, all interior lighting systems shall be equipped with at least one separate automatic control to shut off the lighting. This automatic control shall meet the requirements of s. ILHR 63.51 and may be an occupancy sensor, automatic time switch, or other device capable of automatically shutting off the lighting.

(b) The requirements of par. (a) do not apply to the following: 1. Buildings or separately metered spaces of less than 5,000 square feet of conditioned space;

2. Where the system is serving an area that must be continuously lit, or where the use of the space prohibits the use of a preestablished lighting program;

3. Lighting in corridors, guest rooms, and lodging quarters of residential buildings hotels and motels;

4. Up to one-half watt per square foot of lighting in any area within a building that must be continuously illuminated for reasons of building security or emergency egress, if:

a. The area is designated a security or emergency egress area on the plans and specifications submitted to the department; or

b. The area is controlled by switches accessible only to authorized personnel.

(c) If an automatic time switch control device is installed to comply with par. (a), it shall incorporate an override switching device that:

1. Is readily accessible; and

2. Is located so that a person using the device can see the lights or the area controlled by that switch, or so that the area being lit is annunciated; and

3. Is manually operated; and

4. Allows the lighting to remain on for no more than two hours when an override is initiated; and

5. Controls an area not exceeding 5,000 square feet.

6. Two overrides may be provided for a maximum of 10,000 square feet if the lighting is dual level controlled in accordance with subd. (2)(a) 2. or 3.

(5) DISPLAY LIGHTING CONTROLS. Display lighting shall be separately switched on circuits that are 20 amps or less.

(6) EXTERIOR LIGHTING CONTROLS. Except in lighting in parking garages, tunnels, and large covered areas that require illumination during daylight hours, exterior lighting shall be controlled by a directional photocell or astronomical time switch that automatically turns off the exterior lighting when daylight is available. Time switches shall be equipped with back-up provisions to keep time during a power outage of 10 hours or more.

(7) HOTEL AND MOTEL GUEST ROOM CONTROLS. Hotel and motel guest rooms or suites excluding bathrooms shall have one or more master switches at the main entry door or at the entry door of each room that turn off all permanently wired lighting fixtures and switched receptacles in the room or suite.

ILHR 63.51 REQUIREMENTS FOR LIGHTING CONTROL DEVICES. Automatic time switch control devices, occupant-sensing devices, automatic daylighting control devices, lumen maintenance control devices, or interior photocell sensor devices that are used to justify a wattage reduction factor in the calculation of the actual internal lighting power in s. ILHR 63.45 (2) shall be approved for compliance with all of the applicable requirements of subs. (1) to (7) and shall be installed in compliance with sub. (8). Approval of devices shall be obtained via the material approval program in accordance with s. ILHR 50.19 or via manufacturer certification to the California Energy Commission.

Note: Information on California Energy Commission Certification may be obtained from the California Energy Commission, Energy Efficiency and Local Assistance Division, 1516 9th Street, MS-2S, Sacramento, CA 95814-5512.

(1) ALL DEVICES: INSTRUCTIONS FOR INSTALLATION AND CALIBRATION. The manufacturer shall provide step-by-step instructions for installation and start-up calibration of the device.

(2) ALL DEVICES: STATUS SIGNAL. The device shall have an indicator that visibly or audibly informs the device operator that it is operating properly, or that it has failed or malfunctioned, except for photocell sensors or other devices where a status signal is infeasible because of inadequate power.

(3) AUTOMATIC TIME SWITCH CONTROL DEVICES. Automatic time switch control devices shall:

(a) Be capable of programming different schedules for weekdays and weekends; and

(b) Incorporate an automatic "holiday shut-off" feature that turns off all loads for at least 24 hours, then resumes the normally scheduled operation; and

(c) Have program backup capabilities that prevent the loss of the device's program and time setting for at least 10 hours if power is interrupted.

(4) OCCUPANT-SENSING DEVICES. Occupant-sensing devices shall be capable of automatically controlling all the lights in an area no more than 30 minutes after the area has been vacated. In addition, ultrasonic and microwave devices shall have a built-in mechanism that allows calibration of the sensitivity of the device to room movement in order to reduce the false sensing of occupants and shall comply with either par. (a) or (b), as applicable:

(a) If the device emits ultrasonic radiation as a signal for sensing occupants within an area, the device shall:

1. Have had an Initial Report submitted to the Bureau of Radiological Health, Federal Food and Drug Administration, under 21 Code of Federal Regulations, Section 1002.10; and

2. Emit no audible sound; and

3. Not emit ultrasound in excess of the decibel (dB) values given in Table 63.61 measured no more than 5 feet from the source on axis.

Table 63.51
Maximum Ultrasound Emissions

Midfrequency of Sound Pressure Third-Octave Bank (in kHz)	Maximum dB Level within Third-Octave Band (in dB reference 20 micropascals)
less than 20	80
20 or more to less than 25	105
25 or more to less than 31.5	110
31.5 or more	115

(b) If the device emits microwave radiation as a signal for sensing occupants within area, the device shall:

1. Comply with all applicable provisions in 47 Code of Federal Regulations, Part 5, and have an approved Federal Communications Commission identification number that appears on all units of the device and that has been submitted to the department; and

2. Not emit radiation in excess of 1 milliwatt per square centimeter measured at no more than 5 centimeters from the emission surface of the device; and

3. Have permanently affixed to it installation instructions recommending that it be installed at least 12 inches from any area normally used by room occupants.

(5) AUTOMATIC DAYLIGHTING CONTROL DEVICES. Automatic daylighting control devices shall:

(a) Be capable of reducing the light output of the general lighting of the controlled area by at least one-half while maintaining a uniform level of illuminance throughout the area; and

(b) If the device is a dimmer, provide electrical outputs to lamps for reduced flicker operation through the dimming range and without causing premature lamp failure, and

(c) If the device is a stepped dimming system, incorporate time delay circuits to prevent cycling of light level changes of less than three minutes; and

(d) If the device uses step switching with separate "on" and "off" settings for the steps, have sufficient separation or deadband of "on" or "off" points to prevent cycling; and

(e) Have provided by the manufacturer step-by-step instructions for installation and start-up calibration to design foot-candle levels.

(6) LUMEN MAINTENANCE CONTROL DEVICES. Lumen maintenance control devices shall:

(a) Be capable of reducing the light output of the general lighting of the controlled area by at least 30 percent while maintaining a uniform illuminance throughout the area; and

(b) Provide electrical outputs to lamps for reduced flicker operation through the dimming range and without causing premature lamp failure; and

(c) Incorporate an alarm, either audible or visible, to announce when a specified setpoint of lumens or watts has been reached; and

(d) Have provided by the manufacturer step-by-step instructions for installation and start up calibration to design foot-candle levels.

(7) INTERIOR PHOTOCELL SENSOR DEVICES. Interior photocell sensors shall not have a mechanical slide cover or other device that permits easy unauthorized disabling of the control, and shall not be incorporated into a wall-mounted occupant-sensing device.

(8) INSTALLATION IN ACCORDANCE WITH MANUFACTURER'S INSTRUCTIONS. If an automatic time switch control device, occupant-sensing device, automatic daylighting control device, lumen maintenance control device, or interior photocell sensor device is installed, it shall comply with both pars. (a) and (b).

(a) The device shall be installed in accordance with the manufacturer's instructions; and

(b) Automatic daylighting control devices and lumen maintenance control devices shall:

1. Be installed so that automatic daylighting control devices control only luminaries within the daylit area; and

2. Have photocell sensors that are either ceiling mounted or located so that they are accessible only to authorized personnel, and that are located so that they maintain adequate illumination in the area according to the designer's or manufacturer's instructions.

ILHR 63.52 EXIT SIGNS. Exit signs shall have an installed wattage of 20 watts or less.

ILHR 63.53 REDUCTION OF SINGLE LAMP BALLASTS. The following luminaries located within the same room shall be tandem wired or provided with three-lamp ballasts:

(1) One-lamp or three-lamp fluorescent luminaries recess-mounted within 10 feet center-to-center of each other; and

(2) One-lamp or three-lamp fluorescent luminaries pendant- or surface-mounted within one foot edge-to-edge of each other.

Subchapter VI — Nondepletable Energy Source

ILHR 63.60 BUILDINGS UTILIZING SOLAR, GEOTHERMAL, WIND OR OTHER NONDEPLETABLE ENERGY SOURCE. Any building, or portion thereof, utilizing any nondepletable energy source shall meet all the requirements of this chapter. An energy credit will be given to the building envelope in the amount of the net nondepletable energy collected. The nondepletable energy must be derived from a specific collection, storage and distribution system, which may include active and passive systems.

Note: An energy credit to the building envelope in the amount of the net recovered energy will be given to the use of recovery systems which will conserve energy, provided the amount expended is less than the amount recovered when the energy transfer potential and the operating hours are considered.

ILHR 63.61 Documentation. Proposed alternative designs, submitted as variations to the standard design criteria, shall be accompanied by an energy analysis. This department will accept alternative systems designed according to the requirements of nationally recognized agencies.

Subchapter VII — System Analysis Design

ILHR 63.70 ANNUAL ENERGY CONSUMPTION. A building designed in accordance with this part will be deemed as complying with this chapter if the calculated annual energy consumption is not greater than a similar building with enclosure elements and energy consuming systems designed in accordance with subchapters I through V. If the proposed alternative design results in an increase in consumption of one energy source and a decrease in

another energy source, the difference in each energy source shall be converted to equivalent energy units for purposes of comparing the total energy used.

Note: Use of the ASHRAE 90.1 Energy Cost Budget Method will not verify compliance with all portions of subchapters I through V. Compliance with the following sections of ch. ILHR 63 must be shown independently if the Energy Cost Budget Method is used: ss. ILHR 63.11 to 12, 63.20 to 63.29, 63.32 (2) and subchapter V.

ILHR 63.71 SIMULATION. 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 all systems and equipment. The calculation procedure shall be based upon 8,760 hours of operation of the building and its service systems and shall utilize the following input:

(1) CLIMATIC DATA: Coincident hourly data for temperatures, solar radiation, wind and humidity of typical days in the year representing seasonal variation.

(2) BUILDING DATA: Orientation, size, shape, thermal mass, air moisture and heat transfer characteristics.

(3) OPERATIONAL CHARACTERISTICS: Temperature, humidity, ventilation, illumination, control mode for occupied and unoccupied hours.

(4) MECHANICAL EQUIPMENT: Design capacity, partial load profile.

(5) BUILDING LOADS: Internal heat generation, lighting, equipment, number of people during occupied and unoccupied periods.

ILHR 63.72 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 building and system design and on the data used.

SECTION 44. Chapter ILHR 64 is repealed and recreated to read:

Subchapter I -- Scope

ILHR 64.01 SCOPE. (1) GENERAL. All heating, ventilating and air conditioning systems shall be designed, installed, maintained and operated so as to provide the service and results required within the provisions of this chapter. The minimum requirements established in each part of this chapter shall be complied with as they apply to that specific public building or place of employment. The administrative rules pertaining to energy conservation may be applied retroactively to existing buildings.

(2) ADDITIONS. The provisions of this chapter shall apply to additions to existing buildings and structures as specified in s. ILHR 50.03. When an existing HVAC system is extended to serve an addition, existing system components are not required to be replaced if the requirements of this chapter are met within the addition.

(3) ALTERATIONS. (a)The provisions of this chapter shall apply to remodeling or alterations in any building or structure which affect the replacement of major equipment as specified in s. ILHR 50.03.

(b)When an existing HVAC system serves a remodeled or altered space that has not undergone a change in occupancy or use, the existing system components are not required to be replaced if the requirements of this chapter that applied to the original construction of the space are met.

Note: "Occupancy or use" refers to the entries in Table 64.05.

Note: Compliance with this code shall not constitute assurance of proper installation or operation of the heating, ventilating and air conditioning system. This code is not to be used as a design manual, but it is established as a minimum standard for safety, health and general welfare of the public.

ILHR 64.02 APPROVAL OF DRAWINGS AND SPECIFICATIONS. All drawings and specifications shall be submitted to the department in accordance with the provisions of ss. ILHR 50.07 and 50.12.

ILHR 64.025 DEFINITIONS. In this chapter:

(1) "Air Change" means the introduction of new, cleansed, or recirculated air to a space.

(1m)"Air change rate" means airflow in volume units per hour divided by the building space volume in identical volume units.

(2) "Air conditioning" means the process of treating air to control temperature or humidity and distributing to meet the requirements of the conditioned space.

(3) "Exhaust vent" means a vent, including a relief vent, through which air is exhausted from a space to the atmosphere.

(4) "Exhaust ventilating system" means any combination of building construction, machinery, devices or equipment, designed and operated to remove gases, dusts, fumes or vitiated air from the breathing zone of employes and frequenters.

(5) "Gravity exhaust ventilation" means a process of removing air by natural means, the effectiveness depending on atmospheric condition, such as difference in relative density, difference in temperature or wind motion.

(6) "Mechanical ventilation" means the process of supplying a mixture of tempered outside air or simultaneously removing contaminated air to the outside by power-driven fans or blowers or both.

(7) "Outside air" means air that is taken from outside the building and is free from contamination of any kind in proportions detrimental to the health or comfort of the general population exposed to it.

(8) "Recirculated air" means the transfer of air from a space through the air-handling equipment and back to the space.

(9) "Spot heating" means to provide heat to raise the air temperature to the required minimum in the immediate area of the occupants.

(10) "Tempered air" means air transferred from a heated or cooled area of a building.

(11) "Tempered outside air" means outside air heated or cooled before distribution.

(12) "Ventilation" means the process of supplying or removing air by natural or mechanical means, to or from any space.

Subchapter II -- Design and Operation Requirements

ILHR 64.03 DESIGN. (1) BUILDING HEAT LOSS. The total building heat loss shall be equal to the sum of the building transmission losses and infiltration or the building transmission losses and ventilation losses, whichever sum is greater.

(2) HEATING SYSTEM DESIGN. The primary heating system intended to maintain the inside design temperature of s. ILHR 64.05 (1) shall be designed to equalize building transmission losses and infiltration or ventilation losses during occupied periods. Credit will be given for internal heat gains against the total design loss of the heating system, provided the heat gains are demonstrated by the designer.

(3) CAPACITY AND ARRANGEMENT. The calculated capacity and the arrangement of all installations for required heating and ventilating shall be based upon simultaneous service to all parts of the building unless otherwise exempted by this code.

ILHR 64.04 OUTSIDE TEMPERATURE DESIGN CONDITIONS. Outside design temperatures shall be taken from either Figure 63.23 or ASHRAE 90.1.

ILHR 64.05 INSIDE DESIGN TEMPERATURES AND VENTILATION REQUIREMENTS. (1) INSIDE DESIGN TEMPERATURES. (a) Heating system design. The heating system shall be designed to maintain a temperature of not less than that shown in Table 64.05 and must be operated at not less than that temperature during occupied periods.

(b) Spot heating. Spot heating may be used to heat individual fixed work stations in large industrial buildings where it is impractical to provide heat to the entire space as described in par. (a), provided the inside design temperature at the fixed work station is at least 60°F.

(2) VENTILATION REQUIREMENTS. The ventilating system shall be designed, maintained and operated to accomplish the required minimum ventilation indicated in Table 64.05. The required ventilation for areas of each occupancy or use is specified by the ventilation classification assigned to each occupancy or use in Table 64.05. Areas of different ventilation classification shall be provided with a complete solid separation or the most stringent ventilation requirement shall apply to all unseparated areas.

(a) Areas assigned ventilation classification (a) shall be provided with a supply of outside air and an equal amount of exhaust ventilation at a rate of 7.5 cubic feet per minute per person within the area served by the system and with a minimum air change rate as specified in s. ILHR 64.06 (2).

(b) Areas assigned ventilation classification (b) shall be provided with a supply of outside air and an equal amount of exhaust ventilation at a rate of 7.5 cubic feet per minute per person within the area served by the system and with a minimum air change rate as specified in s. ILHR 64.06 (2), or shall be provided with a percentage of openings in accordance with sub. (3).

(c) Areas assigned ventilation classification (c) shall be provided with a supply of outside air and exhaust ventilation determined using the cfm per square foot of net floor area specified in Table 64.05.

(d) Areas assigned ventilation classification (d) shall be provided with an amount of exhaust ventilation determined using the cfm per square foot of net floor area specified in Table 64.05. The area shall be provided with negative pressure relative to adjacent areas. An equal supply of outside air is required when the exhaust exceeds 1/2 air change per hour in the area served by the exhaust unless otherwise exempted under sub. (4).

(e) Areas assigned ventilation classification (e) shall be provided with a percentage of outside openings in accordance with sub. (3).

(f) Corridor areas in shopping malls assigned ventilation classification (f) do not require a separate supply of outside air provided the outside air introduced in the store areas adjacent to the mall is circulated through and exhausted from the shopping mall corridor area.

(3) PERCENT OF OPENINGS. Where the required ventilation is provided with a percent of openings, the net openable area of exterior windows and doors in each room shall be at least equal to the specified percent of the floor area of that room. Separate mechanical ventilation systems shall be provided for rooms with less than the required percent of openings.

(4) EXCEPTIONS. (a) Outside air requirement waived. If a mechanical air supply system is provided and the requirement for outdoor air determined in accordance with Table 64.05 is less than 5% of the minimum required air changes per hour determined in accordance with s. ILHR 64.06 (2), the requirement for outside air may be eliminated.

(b) Outside air requirement and percent of openings waived. The requirement for outside air or percent of openings specified in Table 64.05 may be omitted for (a) or (b) ventilation classifications in large volume spaces containing 5,000 or more cubic feet per occupant.

(5) DETERMINATION OF NUMBER OF PERSONS. The number of persons in a given space shall be calculated using the net square feet per person given in Table 64.05 unless justification acceptable to the department is provided to show that a different number of occupants is reasonable. When the number of persons is not derived from Table 64.05, the number of occupants shall be documented. Where there is no value indicated for the net square feet per person in Table 64.05, the actual number of occupants shall be used to determine the required amount of outside air.

TABLE 64.05
TEMPERATURE AND VENTILATION TABLE

Use or Occupancy[6]	Minimum Inside Temperature (Degrees F)	Ventilation Requirements[1]					Applicable Occupancy Code Section (ILHR Number)
		Ventilation Classification	Basis of Capacity				
			O.A. - Mech. Net Sq. Ft. Per Person	O.A. - Nat. Percent of Openings[2]	Exhaust CFM/Net Square Feet Floor Area	Air Change Rate[9] Minimum Air Change Per Hour With A/C	
Factories, office and mercantile buildings							
Animal kennels	NMR	(d)	---	---	Note 3	---	64.54
Barber and beauty salons	67	(d)	---	---	0.50	---	64.54, 64.18
Canning factories	60	(b)	75	3	---	---	64.54, 64.68
Conference rooms	67	(a)	7	---	---	3	64.54
Court and jury rooms	67	(b)	6	3	---	3	64.54
Factories and machine shops	60	(b)	75	3	---	---	64.54
Flammable liquids storage	NMR	(d)	---	---	---	---	64.18, ILHR 10
Foundries and boiler shops	50	(b)	75	3	---	---	64.13, 64.54
Funeral homes:							
Chapel	67	(b)	6	3	---	---	64.54
Embalming room	67	(d)	---	---	2.00	---	64.54
Offices	67	(a)	75	---	---	1.5	64.54
Places of worship, entertainment and recreation which accommodates less than 100 persons	†	(b)	---	3	†	---	64.54
Printing establishments	60	(a) or (d)	75	---	Note 8	3	64.18, 64.54
Retail establishments	67	(b)	60	3	---	1.0	64.54
Shopping mall corridor areas (except mercantile areas)	NMR	(f)	Aggregate capacity of stores served by mall	---	---	---	64.54
Security vaults (occupied)	67	(a)	300	---	---	---	64.54
Warehouses	NMR	---	---	---	---	---	64.18, 64.54
Dark room	67	(d)	---	---	2.00	---	64.54, 64.18
Smoking lounge	67	(d)	---	---	2.00	---	64.54, 64.18
Dry cleaners	67	(d)	---	---	2.00	---	64.54, 64.18 ch. ILHR 15
Theaters and places of assembly (which accommodate more than 100 persons)							

TABLE 64.05 (CONTINUED)

Use or Occupancy[6]	Minimum Inside Temperature (Degrees F)	Ventilation Requirements[1]					Applicable Occupancy Code Section (ILHR Number)
		Ventilation Classification	Basis of Capacity				
			O.A. - Mech. Net Sq. Ft. Per Person	O.A - Nat. Percent of Openings[2]	Exhaust CFM/Net Square Feet Floor Area	Air Change Rate[9] Minimum Air Change Per Hour With A/C	
Arenas and field houses (use seated area)	60	(a)	6	---	---	2	64.55
Armory drill floors	55	(a)	30	---	---	---	64.55
Assembly halls (other than church)	67	(a)	6	---	---	2	64.55
Bowling alleys	67	(a)	15	---	---	2	Based on occupied areas
Cafeterias, dining areas, restaurants, billiard rooms	67	(a)	15	---	---	2	64.55
Places of worship:							
Chapels	67	(b)	6	3	---	---	64.55 (3)
Dining and social rooms	67	(b)	15	3	---	---	64.55 (3)
Nave or auditorium	67	(b)	6	3	---	---	64.55 (3)
Class rooms	67	(b)	20	3	---	---	64.55 (3)
Dance halls	67	(a)	15	---	---	2	64.55
Ice skating rinks (indoor)	NMR	(a)	15	---	---	---	64.55
Ice resurfacing (indoor)	NMR	(d)	---	---	---	---	64.18, 64.55
Lodge halls, club rooms	67	(a)	15	---	---	2	64.55
Roller skating rinks (indoor)	50	(a)	15	---	---	2	64.55
Bars and cocktail lounges	67	(d)	---	---	0.50	---	64.55
Tennis courts (indoor)	60	(a)	---	---	---	---	64.55
Theaters (seated area)	67	(a)	6	---	---	2	64.55
Lobbies	67	(a)	15	---	---	---	64.55
Lounge rooms	67	(a)	15	---	---	---	64.55
Motion picture booths	60	(a) or (c)	---	---	2.00	---	64.55
Smoking lounge	67	(d)	---	---	2.00	---	64.55, 64.18
Game rooms	67	(a)	15	---	---	2	64.55
Gambling casinos	67	(a)	15	---	---	2	64.55
Health care facilities				See s. ILHR 64.57			
Schools or other places of instruction							
Administrative office space	67	(a)	75	---	---	1.5	64.56
Arts, crafts	67	(a)	30	---	---	2	64.56

TABLE 64.05 (CONTINUED)

Use or Occupancy[6]	Minimum Inside Temperature (Degrees F)	Ventilation Requirements[1]					Applicable Occupancy Code Section (ILHR Number)
		Ventilation Classification	Basis of Capacity				
			O.A. - Mech. Net Sq. Ft. Per Person	O.A. - Nat. Percent of Openings[2]	Exhaust CFM/Net Square Feet Floor Area	Air Change Rate[9] Minimum Air Change Per Hour With A/C	
Classrooms	67	(a)	20	---	---	2	64.56
Gymnasiums, field houses, auditoriums, theaters (fixed seats)	67	(a)	6	---	---	2	64.56
Bleachers	---	(a)	2.75 or 18"/person	---	---	2	64.56
Locker and shower rooms	70	(d)	---	---	2 or 35 cfm per locker	---	64.56
Gymnasiums, field houses, auditoriums, theaters (nonseated areas)	67	(a)	75	---	---	2	64.56
Home economics	67	(a)	30	---	---	2	64.56
(cooking)	67	(d)	---	---	Note 5	---	64.67
Laboratories (science)	67	(a)	30	---	---	2	64.18
Lecture halls	67	(a)	6	---	---	2	64.56
Corridors with lockers	67	(a)	---	---	---	10 cfm/lineal ft. of length	64.56
Library and resource centers	67	(a)	20	---	---	2	64.56
Reading rooms	67	(a)	20	---	---	2	64.56
Stack areas	67	(d)	---	---	0.25	---	64.56
Lunchrooms	67	(a)	10	---	---	1	64.56
Museums and art galleries	67	(a)	40	---	---	2	64.56
Music rooms (instrumental)	67	(a)	20	---	---	2	64.56
(vocal)	67	(a)	10	---	---	2	64.56
Special education	67	(a)	35	---	---	2	64.56
Study halls, common areas with nonfixed seating	67	(a)	10	---	---	2	64.56
Toilet rooms	67	(d)		---	Greatest of 2 or 75 cfm/TF	---	64.54
Vocational shops:							
With vehicle service and repair	60	(d)	---	---	0.75	---	64.18
Without vehicle service and repair	60	(a)	50	---	---	2	64.18
Wardrobes, coat rooms	NMR	(d)	---	---	2.00	---	64.65

TABLE 64.05 (CONTINUED)

Use or Occupancy[6]	Minimum Inside Temperature (Degrees F)	Ventilation Requirements[1]					Applicable Occupancy Code Section (ILHR Number)
		Ventilation Classification	Basis of Capacity				
			O.A. - Mech. Net Sq. Ft. Per Person	O.A. - Nat. Percent of Openings[2]	Exhaust CFM/Net Square Feet Floor Area	Air Change Rate[9] Minimum Air Change Per Hour With A/C	
Detention facilities							
Sleeping rooms (note 7)	67	(b)	35	4	---	---	64.58
Residential occupancies							
Living and sleeping areas	67	(b)	Note 4	4	---	---	64.59
Day care facilities	67	(a)	35	---	---	2	64.60
Garages and service stations							
Automobile showrooms:							
Less than 6 vehicles	60	(b)	75	3	---	---	64.64
6 or more vehicles	60	(d)	---	---	0.50	---	64.64
New vehicles only	60	(a)	75	---	---	1	64.64
Garages: less than 6 vehicles	NMR	(b)	---	3	---	---	64.63
Garages: 6 or more vehicles	NMR	(d)	---	---	0.50	---	64.63
Repair areas	60	(d)	---	---	0.75	---	64.61
Vehicle service buildings	60	(d)	---	---	0.50	---	64.62, 59.17
General sanitation and service areas							
Chlorine storage rooms	NMR	(d)	---	---	2.00	---	64.65
Janitor closets	NMR	(d)	---	---	2 or 50/sink	---	64.65
Locker rooms and shower rooms	70	(d)	---	---	2 or 35/locker	---	64.65
Toilet rooms	67	(d)	---	---	2 or 75/TF	---	64.65
Toilet rooms (with outdoor stadium)	50	(d)	---	---	2 or 75/TF	---	64.65
Coat rooms (walk in)	60	(d)	---	---	2.00	---	64.65
Locker and changing rooms with toxic contamination	70	(c)	---	---	2 or 35/locker	---	64.65, 64.54 & 54.13

TABLE 64.05 (CONTINUED)

Use or Occupancy[6]	Minimum Inside Temperature (Degrees F)	Ventilation Requirements[1]					Applicable Occupancy Code Section (ILHR Number)
		Ventilation Classification	Basis of Capacity				
			O.A. - Mech. Net Sq. Ft. Per Person	O.A. - Nat. Percent of Openings[2]	Exhaust CFM/Net Square Feet Floor Area	Air Change Rate[9] Minimum Air Change Per Hour With A/C	
Changing rooms without toxic contamination	70	(b)	15	3	0.50	1	64.65
Laundries :(commercial)	60	(d)	---	---	2.00	---	64.65
Natatoriums	76	(d)	---	---	2/pool sf	---	64.66
Kitchens	60	(d)	---	---	2.00	---	64.67
Seasonal occupancies							
Camps and lodges:							
Dining and recreational areas	NMR	(b)	15	3	---	---	64.68
Living and sleeping areas	NMR	(e)	---	4	---	---	64.68
Club houses	NMR	(b)	15	3	---	---	64.68
Drive-ins	NMR	(b)	15	3	---	---	64.68
Kitchens	NMR	(c) or (d)	---	---	2.00	---	64.67
Outdoor toilets	NMR	(d)	---	---	2.00	---	52.53 & 64.65

CFM = Cubic feet per minute
LF = Lineal foot
NMR = No minimum requirement
TF = Toilet fixtures (water closets and urinals)
A/C = Air conditioning

† See theaters and places of assembly for inside design temperature and cfm per net square feet floor area.

1 See ss. ILHR 64.06, 64.07 and 64.08 for mechanical, natural and exhaust ventilation systems; and ss. ILHR 64.11 to 64.18 for ventilation air standards.

2 See s. ILHR 64.07 for special considerations on natural ventilation.

3 Temperature, humidity and air flow for animal kennels will depend on animal type.

4 30 cfm of outside air shall be provided for each room. All other requirements for the (b) ventilation classification remain the same.

5 200 cfm of exhaust ventilation per cooking appliance shall be provided. All other requirements for the (d) ventilation classification remain the same.

6 This Table is intended as a reference guide with generic Use types listed under those Occupancy types most often associated with the Use. When Use types are mixed between Occupancy types and the Use type is unlisted within the specific Occupancy Type, the use shall be ventilated as required by the same Use type listed in the other Occupancy type. Unlisted occupancies or uses shall be ventilated as required for the most similar listed occupancy or use acceptable to the department. Rooms that are used for different purposes at different times shall be designed for the greatest amount of ventilation required for any of the uses.

7 See ss. ILHR 58.45(2) & 58.46(2) for more stringent requirements which may exist. When unseparated toilet fixtures are included in sleeping areas (such as cells), the room shall be ventilated as required for Toilet rooms.

8 In instances where the printing process involve inks or solvents which are volatile or otherwise toxic to humans, the (d) ventilation classification shall be used the exhaust rate shall not be less than 2 cfm/square foot of floor area.

9 See s. ILHR 64.06 for specific requirements and exceptions which may exist. The minimum air change rate is 6 air changes per hour. The air change rates shown in the table are the rates permitted when air conditioning is provided in accordance with s. ILHR 63.23 and the heat gain requirement for the space has been satisfied.

ILHR 64.06 MECHANICAL VENTILATION SYSTEMS. (1) OUTSIDE AIR. Mechanical ventilation systems shall be operated to provide a continuous source of outside air to all areas while people are present. The minimum amount of outside air supplied to the system shall be determined in accordance with s. ILHR 64.05. Exhaust ventilation in equal volume shall be maintained simultaneously.

Note: When less than one occupant per 5000 cubic feet is present, operation of the ventilation system may be modified as specified in s. ILHR 64.05 (4).

(2) AIR CHANGE. Air change shall be provided while people are present. The air-change rate may be based on actual room height or up to 10 feet from the floor level of the room in question. The volume above 10 feet, in rooms which are more than 10 feet in height, need not be considered in the air change requirement if the required air change is designed to occur in the lower 10 feet of the occupied space. Where more than one room is served by a common supply system, the required minimum air change volume shall be transferred through the air handling equipment where it is diluted or replaced with outside air, and supplied back to the space. Where a supply system serves only one room, the required minimum air change may be achieved by circulation within the room at the required rate.

(a) Six air changes per hour. When required for (a) and (b) ventilation classifications, as specified in s. ILHR 64.05, the total air change rate shall be at least 6 air changes per hour.

(b) Less than 6 air changes per hour. An air change rate of less than 6 air changes per hour will be permitted where mechanical cooling (air conditioning) is provided in accordance with s. ILHR 63.23 (2), and the heat gain requirement for the space has been satisfied. The air change rate may not be less than the minimum air changes per hour if specified in Table 64.05.

Note: The amount of outside air required by s. ILHR 64.05 must be maintained even if the air change rate is reduced.

(c) Air change requirement waived. The air change requirement for 6 air changes per hour may be omitted in the following applications:

1. Spot heating.

2. Buildings where the requirement for outside air is waived in accordance with s. ILHR 64.05 (4)(b).

3. Buildings utilizing percentage of openings as specified in s. ILHR 64.05.

(3) AIR DISTRIBUTION. An adequate number of air supply, return and exhaust outlets or grilles shall be provided to insure a uniform distribution of air.

(4) RECIRCULATION AND TRANSFER OF AIR. (a) Recirculation. No air contaminated by any source other than human occupancy shall be recirculated, except within the same ventilation classification as assigned in s. ILHR 64.05.

(b) Transfer. Air in a volume equal to the outside air required for a room may be transferred through a corridor and exhausted through a locker room, toilet room, kitchen, janitor closet or a similar area. Air shall not be transferred through elevator shafts and stairwells where doors are required at any floor level.

(5) DIVERSIFIED MECHANICAL SYSTEMS. If the mechanical ventilation system is able to deliver required quantities of outside air to each area when required, the department will recognize diversity and the system may be designed on the actual capacity.

Note #1: The outdoor air amounts specified in this section assume that the dominant source of indoor air contamination is human occupancy. Where other indoor contaminants or sources are present, source control or other control or removal strategies may be needed.

Note #2: See ch. ILHR 32, Safety & Health Standards for Public Employes, for requirements for dust, fumes, vapors and gases.

ILHR 64.07 NATURAL VENTILATION SYSTEM. (1) OUTDOOR OPENINGS. Outdoor openings used for natural ventilation shall be within 100 feet, or 5 times the least dimensional width of the occupied area, whichever is the least.

(a) Outdoor openings located below grade. Outdoor openings below grade will not be accepted unless there is a clear space outside of the opening having a width not less than 1 1/2 times the distance below grade at the bottom of the opening.

Note: Width of clear space is the horizontal distance measured at right angles to the plane of the opening.

(b) Outdoor openings located from a property line. Outdoor openings shall be at least 5 feet from a property line or lot line or both or an adjacent building on the same property. This distance restriction does not apply to property lines along streets.

Note: For further restrictions, see Table 51.03-B and s. ILHR 64.19.

(2) VESTIBULE OPENINGS. Vestibule type openings may be used to satisfy the requirements specified in sub. (1) only for the areas of the building into which the vestibule opens and which are not separated from the vestibule by an additional door.

ILHR 64.08 EXHAUST VENTILATION SYSTEM.(1) DEFINITIONS. (a) Exhaust ventilating system. Any combination of building construction, machinery, devices or equipment, designed and operated to remove harmful gases, dusts, fumes or vitiated air from the breathing zone of employes and frequenters.

(b) Gravity exhaust ventilation. A process of removing air by natural means, the effectiveness depending on atmospheric condition, such as difference in relative density, difference in temperature or wind motion.

(2) DESIGN. (a) Exhaust ventilating systems shall be designed to reasonably prevent contaminated air from reentering the building.

(b) Mechanical exhaust ventilation shall be used when exhaust ventilation is required for toilet rooms, repair areas and garages except that gravity exhaust ventilation may be used for unoccupied, detached garages for long-term storage only.

(3) OPERATION. The required building exhaust ventilating systems shall operate continuously when people are in the building to provide the amount of exhaust specified in Table 64.05.

Note: Continuous operation of some exhaust systems, such as purging systems, chloride storage exhaust, or industrial exhaust, may be necessary. See ch. ILHR 32, Safety & Health Standards for Public Employes.

(4) EXHAUST VENTS. All exhaust vents shall be ducted to the exterior of the building.

(5) GRAVITY SIPHON-TYPE ROOF VENTILATORS. (a) Except as provided in par. (b), gravity siphon-type roof ventilators shall be sized to provide a free area so that the velocity of the air does not exceed 300 feet per minute.

(b) The allowable velocity specified in par. (a) may be increased to 600 feet per minute provided the outside air is supplied by mechanical means.

Note: Heat reclaim equipment for exhaust systems having more than 10,000 CFM capacity should be considered for energy savings.

ILHR 64.09 COMBUSTION AIR INTAKES. Any room in which fuel-burning equipment, including water heaters, fireplaces and process equipment, is located shall be supplied with combustion air for safe operation. When new heating equipment is installed in existing buildings, combustion air shall be provided in accordance with this section unless another method is shown to be adequate.

(1) COMBUSTION AIR. Combustion air shall be provided by one of the following methods:

(a) Combustion air by gravitational means. Where combustion air is introduced by gravitational means, the minimum free area for combustion air intakes shall be calculated in square inches as indicated in Table 64.09. The values for gas- and oil-fired equipment are based on the fuel input of the equipment. The value for solid-fuel equipment and fireplaces is based on

the fuel input of the equipment, the area of the chimney connector or the listing for the specific piece of equipment. (See Table 64.09)

TABLE 64.09
Combustion Air Intake Areas

Atmospheric Combustion	Combustion Air Intakes Ducted from the Outside to an Interior Room or Fireplace	Combustion Air Intakes Located at the Outside Wall of an Exterior Room
Gas-fired, all occupancies except industrial	1 sq. in./1000 Btu/hr.	1 sq. in./2000 Btu/hr.
Gas-fired, industrial occupancies	1 sq. in./1000 Btu/hr.	1 sq. in./5000 Btu/hr.
Oil-fired, all occupancies	1 sq. in./1000 Btu/hr.	1 sq. in./2000 Btu/hr.
Solid-fuel fired equipment and fireplaces, all occupancies	1 sq. in./1000 Btu/hr. for furnace type units. 1/2 of the chimney connector area for free-standing and fireplace type units. In accordance with equipment listing, if listing includes combustion air provisions.	

(b) Combustion air for power burners. The free area for combustion air intakes for power burners, including forced draft and induced draft systems, shall be at least 0.5 square feet per 1,000,000 Btu per hour fuel input, with a minimum free area of 10 square inches.

(c) Combustion air by mechanical means. Combustion air furnished by mechanical systems, such as makeup air units, may be used when complete design data is submitted and approved by the department.

(d) Combustion air by infiltration. If the heating equipment is not required to be located in a fire-resistive room, combustion air may be provided by means of infiltration where the total area of outdoor openings is greater than 3% of the floor area in which the equipment is located, and where 150% of the air required for theoretical complete combustion is no greater than 1/4 air change per hour.

Note: See s. ILHR 64.22 for special conditions.

(2) DAMPERS. (a) Manually operated dampers are prohibited in combustion air intakes, except for manually fired solid-fuel fired equipment, where the combustion air is connected directly to the equipment.

(b) A motorized damper or fire damper shall be permitted in combustion air intake if a means is provided to ensure that the damper is open before the burner is in operation.

(3) DUCTWORK. Where ductwork is required to bring combustion air into the building, the duct shall have the same cross-sectional area as the free area of the combustion air openings.

(4) SEGREGATION OF COMBUSTION AIR. The combustion air path shall be completely segregated from the outside air ventilation ductwork.

(5) NEGATIVE PRESSURE LOCATIONS. Atmospheric combustion shall be prohibited in a space under negative pressure.

(6) MOUNTING HEIGHT. Mounting height of the combustion air intakes shall be as required in s. ILHR 64.19 (1) (c).

(7) AIR-HANDLING EQUIPMENT LOCATED IN A BOILER OR FURNACE ROOM. If the fuel input rating of the fuel burning equipment exceeds 400,000 Btu per hour, the air-handling equipment and the fuel-burning equipment shall be interlocked to shut off the fuel-burning equipment and the air-handling equipment when any service door of the air-handling equipment is opened, unless an air barrier separation is provided between the fuel-burning equipment and the air-handling equipment.

ILHR 64.10 REFRIGERANTS. The rules covering the use of refrigerants for air conditioning systems shall conform with ch. ILHR 45, Mechanical Refrigeration.

Subchapter III -- Ventilation and Air Standards

ILHR 64.11 VENTILATION AND AIR STANDARDS. The quantity of air used to ventilate a given space during periods of occupancy shall always be sufficient to maintain the standards of air distribution, air movement, recirculation, ss. ILHR 64.13 to 64.19.

ILHR 64.13 TEMPERED AIR REQUIREMENTS. (1) SUPPLY AIR. The design conditions of the supply air temperature to the occupied space shall be between 50°F. and 140°F.

(2) TEMPERED AIR SUPPLY DEPENDING ON NEGATIVE PRESSURE. A supply of tempered air, depending on a negative pressure within the space, will be permitted in foundries, steel fabricating shops and similar areas.

ILHR 64.14 TEMPERED OUTSIDE AIR REQUIREMENTS. (1) MAKE-UP AIR. A supply of tempered outside air shall be provided when the total volume of exhaust exceeds 1/2 air change per hour in the area served by the exhaust.

Note: See ch. ILHR 32, Safety and Health Standards for Public Employes, for further requirements for makeup air for industrial exhaust systems.

(2) PROCESS HEAT. Process heat may be used to temper required outside air.

ILHR 64.15 Air movement and distribution. The air delivery capacity of all equipment supplying air for heating, ventilating and air conditioning purposes shall be based on standard air ratings.

Note: Standard air is substantially equivalent to dry air at 70°F. and 29.92 inches (Hg) barometric pressure.

ILHR 64.16 AIR-CLEANSING DEVICES. (1) AIR-CLEANSING ACCESS. Air-cleansing devices shall be designed and installed to permit access to the equipment for maintenance and to insure proper operation of the heating and ventilating system.

(2) AIR-CLEANSING FILTERS. Approved air-cleansing filters shall be designed and installed in a manner to filter the outside air and recirculated air used with mechanical heating and ventilating systems except as follows:

(a) Filters are not required in garages, factories, foundries and similar occupancies;

(b) Filters are not required for use with unit heaters designed for heating and recirculation; or

(c) Where jet systems or blend-air systems are approved, air filters are not required in the ducts that are installed for the recirculation of air within the same occupied space.

Note: The department recognizes as approved, filters listed in the Building Materials List published by Underwriters Laboratories, Inc., and test data of any other recognized testing agency for the purpose for which it is used.

(3) AIR-CLEANSING MATERIALS. Contaminated water shall not be used or recirculated through sprays affecting air used for ventilating purposes.

ILHR 64.17 CONTROLS. (1) GENERAL. Except as provided in sub. (2), automatic controls shall be provided to maintain design temperature, control ventilation to provide a continuous air movement of not less than the minimum required by this chapter, and to provide a continuous supply of outside air, make-up air and exhaust determined by the provisions of s. ILHR 64.05, when occupied.

(2) EXCEPTION. Manual control of solid-fuel fired equipment to maintain inside design temperature is permitted.

ILHR 64.18 CONTAMINATION OF AIR. (1) CONTAMINATION. Air contaminated from odors, fumes, noxious gases, smoke, steam, dust, spray, or other contamination shall be diluted with uncontaminated air or exhausted to prevent the contaminated air from spreading to other parts of the building occupied by people.

Note: For requirements pertaining to all places of employment or occupancy where smoke, gas, dust, fumes, steam, vapor, industrial poisons, or other detrimental materials are used, stored, handled, or are present in the air in sufficient quantities to obstruct the vision, or to be injurious to the health, safety or welfare of the employes or frequenters, see ch. ILHR 32, Safety and Health Standards for Public Employes.

(a) Chlorinated hydrocarbons. Areas where chlorinated hydrocarbons are introduced shall be arranged to satisfy the following conditions:

Note: Some of the chlorinated hydrocarbons commonly used are: trichloroethylene, perchloroethylene, carbon tetrochloride, methylene chloride, methyl chloroform, Freon F-11, Freon F-12, Freon F-21 and Freon F-114. For example, these materials are used in dry cleaning establishments, in degreasing operations, and where pressure can propellants are used. Pressure cans are used for such products as enamels, lacquers, paint removers, stencil inks, lubricants, pesticides, hair sprays, shaving lathers, shampoos and colognes.

1. The area shall have an exhaust system capable of maintaining a negative pressure within the enclosed area.

2. The volume and distribution of air movement within the area shall be such that the average threshold limit values of specific airborne contaminants are not exceeded.

Note: See ch. ILHR 32, Safety and Health Standards for Public Employes.

3. No fuel-fired heating unit, with or without a heat exchanger, shall be located within this area, nor shall it recirculate air from this area.

4. The surface temperatures of any type of heating equipment used in these areas shall be below the temperature at which toxic materials may be released.

Note: Toxic materials are those covered in ch. ILHR 32, Safety and Health Standards for Public Employes.

(b) Transfer of contaminated air. Air shall not be transferred from an area of greater contamination.

Note: The department will accept air transferred from: corridor to toilet room; corridor to cloak room or janitor closet; dining room to kitchen; locker room to toilet room; gymnasium to locker room; showroom to garage; and corridor to school vocational shops.

(c) Transfer of air between dwelling units. Air shall not be transferred from one dwelling unit to another, except in buildings where tobacco smoking is controlled and restricted to designated areas and not allowed in dwelling units, and air is not transferred from designated smoking areas to dwelling units.

(2) BATTERY CHARGING AREAS. Battery charging areas shall be provided with 3/4 cfm per square foot of outside air and equivalent exhaust unless calculations are submitted to verify that the concentration of hydrogen generated during battery charging will be maintained below 1.5% by volume by other means. Exhaust air shall be drawn from the battery charging area at ceiling height.

ILHR 64.19 LOCATION OF OUTSIDE VENTILATING AIR INTAKES OR EXHAUSTS FOR MECHANICAL VENTILATION SYSTEMS. (1) LOCATION AND DISTANCE. (a) Location to prevent contamination. Outside air intake openings for ventilation, doors, and openable windows shall be located to minimize contamination of outdoor air and shall be at least 10 feet, measured in any direction, from outlets that emit products of combustion and exhaust vents. Exceptions to this paragraph are given in subds. 1. to 4.

1. Exhaust vents of 100 cfm or less shall be located at least 12 inches, measured in any direction, from doors or openable windows.

2. Paragraph (a) does not apply to intakes for combustion air or short-cycle hoods.

3. The 10-foot minimum separation of par. (a) does not apply to the intake and exhaust of a factory-packaged rooftop unit provided nothing restricts air flow around the unit. The exhaust and intake of the unit shall be located to minimize contamination of outside air.

4. Product of combustion outlets of direct vent sealed combustion chamber appliance vents shall be located at least 12 inches, measured in any direction, from doors or openable windows.

Note 1: See s. ILHR 82.31(16) for plumbing vent setbacks. That rule requires plumbing vents to be 10 feet from air intakes and 10 feet horizontally from or 2 feet above roof scuttles, doors or openable windows.

Note 2: See NFPA 45, Standard on Fire Protection for Laboratories using Chemicals, adopted under Ch. ILHR 10, for chemical fume hood exhaust location. Health care facilities may have additional requirements, see s. ILHR 64.57.

(b) Distance to adjacent properties. Air intakes and exhausts shall be at least 10 feet from a property line or lot line or both or an adjacent building on the same property. This distance restriction does not apply to property lines along streets or alleys.

(c) Mounting height. The lowest side of outside air intake openings shall be located at least 12 inches above outside grade, above adjoining roof surfaces, or above the bottom of an areaway.

Note: The department will accept outside air intakes in areaways provided the minimum horizontal cross section of the areaway is equal to the free area of the opening, a grating is provided over the areaway with a free area equal to the required air intake, and the grating is designed for a minimum of 100 PSF live load. A guardrail, as defined in s. ILHR 51.162, will be accepted in lieu of the grating.

(2) SCREENS. All outside air intake openings shall be provided with a device to prevent intake of foreign material of 1/2 inch size or larger.

(3) WEATHER PROTECTION. All outside air intake openings shall be protected against weather and water with a weatherproof hood or louvers.

(4) ACCESSIBILITY AND CLEANLINESS. All outside air intakes shall be easily accessible for cleaning and shall be kept clean and sanitary.

(5) DAMPERS. (a) Intake. All required outside air intakes serving tempered or heated spaces shall be equipped with a damper with automatic controls which will close the damper and prevent the intake of outside air into the building when the ventilating unit is not in operation. Barometric controls shall not be used for the damper.

(b) Exhaust. Exhaust openings serving tempered or heated spaces shall be provided with automatic or self-activating back-draft dampers to prevent the intake of outside air into the building when the exhaust units are not in operation. Commercial kitchen hood systems are exempt from this paragraph.

Note: See s. ILHR 64.57 for additional requirements for the location of intakes and exhausts for hospitals and nursing homes. See the Administrative Plumbing Code, chs. ILHR 81-86 for additional clearance requirements for plumbing vents.

Subchapter IV -- Heating Equipment Requirements

ILHR 64.20 EQUIPMENT RATINGS AND SAFETY CONTROLS. (1) TEST AND INSTALLATION STANDARDS. All oil- and gas-fired heating equipment, electric heating equipment, solid-fuel heating equipment and accessory equipment or devices shall be tested and installed in accordance with standards recognized by the department. Department review and approval of input or output ratings or both are required when ratings are needed to satisfy s. ILHR 64.03 or 64.09.

Note: The table on the following page is a tabular summary of UL 296 and UL 795.

(2) SAFETY CONTROLS. (a) General. The complete safety control package for the heating and ventilating equipment shall comply with standards accepted by the department.

(b) Limits and controls. Oil and gas-fired heating equipment and electric heating equipment shall be equipped with primary (flame safeguard) safety controls, safety limit

switches, and burners or electric elements that comply with standards accepted by the department.

Note: The department recognizes UL 296/Oil Burners, and UL 795/Commercial-Industrial Gas-Heating Equipment, as acceptable standards that satisfy the requirements of subs. (1) and (2).

(3) LISTED EQUIPMENT. Complete factory assembled heating units shall be labeled by listing agencies approved by the department.

Note: The department accepts heating equipment listed by the American Gas Association (AGA), Underwriters Laboratories (UL), ETL Testing Laboratories, Warnock Hersey International, Inc., Braun Intertec Corp. (Formerly Northwest Testing Laboratories, Inc.) and PFS corporation.

(4) UNLISTED EQUIPMENT. If the heating equipment is unlisted, the following provisions shall be taken:

(a) Manufacturer's statement. A statement from the equipment manufacturer shall be provided indicating the national standard with which the equipment complies.

(b) Tests. A test by a Wisconsin registered engineer shall be conducted on the output and safety controls, in accordance with the national standard used by the manufacturer. A statement regarding the test of the rating and safety controls shall be furnished for each installation unless an approval for the equipment is obtained from the department in accordance with sub. (5).

(5) EQUIPMENT APPROVAL. Equipment approval may be obtained from the department upon submission of a technical report, based on the test required in sub. (4) (b), together with the fee as specified in ch. ILHR 2 for equipment approval.

Note: The purpose of the technical report is to show that the equipment is in complete compliance with the national standard by which the equipment is designed, constructed and tested.

ILHR 64.21 LOCATION OF EQUIPMENT. The various types of heating equipment for the corresponding types of occupancies in which the equipment may be located shall be installed as specified in Table 64.21.

Note #1: The footnotes below the table designate special requirements for the listed equipment.

Note #2: The department will accept net ratings as listed by Mechanical Contractors Association of America, Inc., Institute of Boiler and Radiator Manufacturers, and equipment tested according to commercial standard 140-47.

(1) CENTRAL FURNACES. For the purpose of this section, a central furnace shall be considered as a direct vent sealed combustion chamber appliance, if the furnace conforms to ANSI Z21.64 and has been issued a material approval under s. ILHR 50.19.

(2) BOILERS AND WATER HEATERS. For the purpose of this section, a low pressure boiler or a water heater shall be considered as a direct vent sealed combustion chamber appliance, if:

(a) The boiler or water heater conforms to those parts of ANSI Z21.13, Z21.10.1, or Z21.10.3, whichever is applicable, relating to direct vent appliances.

(b) All parts of the direct vent system for the boiler or water heater conform to s. 1.1.7 of ANSI Z21.64; and

(c) The boiler or water heater has been issued a material approval under s. ILHR 50.19.

LOCATION OF EQUIPMENT

Location and Type of Occupancy	Vented Units									Unvented Units		Electric	Water or Steam
	Gas or Oil or Solid Fuel Boilers	Gas or Oil or Solid Fuel Furnaces and Water Heaters		Gas or Oil Unit Heaters	Gas or Oil Infrared		Gas or Oil Space Heater	Solid Fuel Space Heater[1,2]	Gas Direct Vent Sealed Combustion Appliance[18]	Gas Direct Fired Make-up Air[3,4]	Gas Infrared	Furnaces, Unit Heaters, Heat Pumps, Baseboard Heaters, etc.	Unit Ventilators, Heaters, Make-Up Air Units, Baseboard Heaters, etc.
	Rated[19] Enclosure	Rated[19] Enclosure	Suspended[5]	Suspended[5]	Closed Combustion Infrared Equipment with Surface Temperatures not Exceeding 1500°F Suspended[5]	Open Flame Infrared Equipment with Surface Temperatures Exceeding 1500°F Suspended[5]			Rated Enclosure Not Required	Suspended[5]	Suspended[5]		
Type of Occupancy													
Factories	Yes[5]	Yes[5]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes		
Mercantile Buildings	Yes[5]	Yes	Yes	Yes	Yes	Yes	N.P.[5,6]	N.P.[6]	Yes	N.P.	N.P.		
Office Buildings	Yes[5]	Yes	Yes	Yes	Yes	N.P.	N.P.[5,6]	N.P.[6]	Yes	N.P.	N.P.		
Places of assembly, entertainment, recreation, worship or dining (100 persons or less)	Yes[5]	Yes[20]	Yes	Yes	Yes	Yes	N.P.[5,6]	N.P.[6]	Yes	N.P.[7]	N.P.		
Tennis Facilities (court areas only)	Yes[5]	Yes	Yes	Yes	Yes	Yes	N.P.[5,6]	N.P.[6]	Yes	N.P.	N.P.		
Tennis Facilities (all other areas)	Yes[5]	Yes	Yes	Yes	Yes	N.P.	N.P.[5,6]	N.P.[6]	Yes	N.P.	N.P.		
Theaters and places of assembly, entertainment, recreation, worship or dining (more than 100 persons)	Yes	Yes	Yes	Yes	Yes	N.P.	N.P.	N.P.	Yes	N.P.	N.P.	Permitted in all Occupancies	Permitted in all Occupancies
Restaurants	Yes	Yes[20]	Yes	Yes	Yes	N.P.	N.P.	N.P.	Yes	N.P.[7]	N.P.		
Tennis Facilities (court areas only)	Yes	Yes	Yes	Yes	Yes	Yes	N.P.	N.P.	Yes	N.P.	N.P.		
Tennis Facilities (all other areas)	Yes	Yes	Yes	Yes	Yes	N.P.	N.P.	N.P.	Yes	N.P.	N.P.		
Schools and other places of Instruction	Yes	Yes[20]	Yes	Yes	Yes	N.P.[10]	N.P.	N.P.	Yes	N.P.[9]	N.P.		
Hospitals, Nursing Homes and Penal Institutions	Yes	Yes[20]	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.	N.P.[22]	N.P.	N.P.		
Residential Occupancies	Yes	Yes	N.P.	N.P.	N.P.	N.P.	N.P.[11]	N.P.[14]	Yes	N.P.	N.P.		
Hazardous Occupancies													
Garages	Yes	Yes	Yes[12]	Yes[12]	Yes	Yes	N.P.[15]	N.P.	Yes	Yes[12]	Yes[12]		
Aircraft Hangers	Yes	Yes	Yes[13]	Yes[13]	Yes[13]	Yes[13]	N.P.	N.P.	Yes	Yes[13]	Yes[13]		
Day Care Centers	Yes	Yes	Yes	Yes	Yes	N.P.	N.P.[6]	N.P.[6]	Yes	N.P.	N.P.		
Community-Based Residential Facilities[17]	Yes	Yes	N.P.	N.P.	N.P.	N.P.	N.P.[6]	N.P.[6]	Yes	N.P.	N.P.		

N.P. = Not Permitted

Unlisted Occupancies - Use the listed occupancy in the table that is most similar to the subject occupancy.

Clearance to combustibles and combustible construction 1. Heating equipment shall be installed in accordance with the manufacturer's recommendations to provide minimum clearance. In the absence of manufacturer's recommendations, a minimum clearance of 36 inches shall be provided. 2. Combustible construction, such as partitions, shelving or storage lockers, shall not encroach upon the required clearance.

[1] See s. ILHR 64.22 (7) (d) for fireplace requirements.

[2] All solid-fuel fired space heaters shall be located in occupied space or in a space provided with approved smoke detectors and located or guarded to maintain clearances to combustibles and prevent accidental damage or contact with hot surfaces. Solid-fuel burning stoves are limited to 150,000 Btu/hr output.

[3] Except as provided in Footnote 4, direct-fired make-up air units shall be mechanically exhausted in the range of 90% to 110% of the air supplied.

[4] See s. ILHR 64.22 (4) for other permitted uses of direct-fired unvented natural gas heaters.

[5] Boiler and water heaters up to 200,000 Btu input, gas and liquid fuel-fired space heaters, suspended furnaces, vented and unvented unit heaters may be used without an enclosure where approved by the department. Exception: Suspended units in factories shall have no size limitation. All such units shall be located in an occupied space and suspended at least 7 feet above the floor. The blow-off pipe for suspended boilers and water heaters shall be extended down to within 6 inches of the floor. Infrared equipment shall be located at least 8 feet above the floor. Suspension of solid-fuel fired equipment is not permitted. See ss. ILHR 54.14 (3) and 64.22 (3) for additional requirements.

[6] Permitted with combustion air ducted to unit in occupancies less than 3,000 square feet gross area and with occupant load less than 100 persons.

[7] Permitted in kitchens to provide make-up air for kitchen exhaust systems if located outside building or in a rated enclosure.

[9] Permitted only in shops with a 3-hour separation from other areas of the school building.

[10] Permitted only in shops with a 3-hour separation from other areas of the school building.

[11] Gas-fired, direct-vent wall furnaces are permitted in apartments and motels. Space heaters fired with liquid fuel may be used without an enclosure in motels and apartment buildings not more than one story in height.

[12] Suspended heating units are allowed in garages if located at least 8 feet off the floor. Suspension of solid-fuel fired equipment is not permitted.

[13] Suspended heating units are allowed if located at least 10 feet above the upper surface of the wings or engine enclosure of the aircraft. Suspension of solid-fuel fired equipment is not permitted.

[14] Solid-fuel fired space heaters are permitted in rowhouse units only.

[15] Waste oil burners are permitted provided they are installed on mezzanines or service platforms located at least 8'-0" above the main floor, are visible from the main floor and are guarded as specified in this section.

[17] See s. ILHR 61.24 for requirements.

[18] See ss. ILHR 51.01 (29a), 54.14 (1) (b), 55.29 (1) (b), 56.15 (1) (c), 57.14 (1) (c) 5., 59.21, 60.37 (2), 63.32 (1) (b) and 62.78 (1) (b) for additional requirements. Suspended units must be installed in accordance with this table, Note 5 and s. ILHR 64.22 (3). Note: Electrical Code clearances specified in ch. ILHR 16 apply. Electrical components and burners may be required to be at least 18 inches from the floor in "Class I" areas including garages.

[19] See s. ILHR 51.08 for hazard enclosure requirements.

[20] Gas-fired booster water heaters used exclusively for sanitizing dishes and cooking utensils need not be installed in fire-resistive enclosures.

[21] Includes water heaters used for space heating and for plumbing system supply.

[22] Direct vent sealed combustion chamber appliances may be used if placed within a rated enclosure described in Note 19.

ILHR 64.22 SPECIAL REQUIREMENTS. (1) BOILERS AND PRESSURE VESSELS. (a) Construction standards. Boilers and pressure vessels shall be constructed and installed in compliance with the standards of the American Society of Mechanical Engineers, as adopted under chs. ILHR 41-42.

(b) Installation notification. The installing contractor shall notify the department of boiler installation, in accordance with the requirements of s. ILHR 41.41 (1), before the boiler or pressure vessel is put into operation.

(2) FURNACES. Forced-air heating systems shall be designed to prevent a negative pressure on the heat exchanger.

(3) SUSPENDED EQUIPMENT. (a) Equipment suspended as specified in s. ILHR 64.21 shall be installed in an occupied space. Suspended equipment may be used in multiple tenant buildings providing the equipment is located in tenant spaces of an occupancy use where suspended equipment is permitted. The equipment shall be visible to persons within the room.

(b) Suspended units shall be designed and listed for such use. Furnaces designed for floor mounting only may be mounted on platforms that serve only to hold the unit.

(c) Where the clearance to the floor specified in s. ILHR 64.21 cannot be provided for suspended units, provisions shall be made for maintaining clearances to combustibles and collision protection. The collision protection shall be capable of withstanding a horizontal impact load of 1,000 pounds per lineal foot. The unit shall be visible to the occupants of the room. The unit shall be suspended to provide a minimum clearance of 18 inches from the floor. The minimum clearances specified by the manufacturer shall also be provided.

(d) In factories, where the clearance to the floor specified in s. ILHR 64.21 cannot be provided, a floor mounted unit may be used in accordance with this paragraph. Provisions shall be made for maintaining clearances to combustibles and collision protection. The collision protection shall be capable of withstanding a horizontal impact load of 1000 pounds per lineal foot. The unit shall be visible to the occupants of the room. The unit shall be installed to provide a minimum clearance of 18 inches from the floor to the burner. The minimum clearances specified by the manufacturer shall also be provided.

Note: See Electrical Code, Ch. ILHR 16, for clearance requirements for electrical components in hazardous locations.

(e) Duct furnaces and unit heaters required to be suspended under s. ILHR 64.21 may be installed in an unoccupied or concealed space without a rated enclosure providing the following conditions are met:

1. The appliance has been issued a material approval under s. ILHR 50.19 recognizing conformance to the requirements for separated combustion appliances as specified in ANSI Z83.8 or Z83.9, whichever is applicable, and conformance of all parts of the direct vent system for the duct furnace or unit heaters to s. 1.1.7 of ANSI Z21.64; and

2. The unit is properly suspended and clearances to combustibles are maintained as specified in the manufacturer's listing.

(4) GAS OR OIL-FIRED RADIANT HEATERS AND DIRECT FIRED UNVENTED NATURAL GAS HEATERS. Gas- or oil-fired radiant heaters and direct fired unvented natural gas heaters are subject to the following provisions:

(a) The heaters shall be equipped with an automatic pilot of the complete shutoff type or with a 100% shutoff electric ignition;

(b) If unvented radiant heaters or direct fired unvented natural gas heaters are used, mechanical means shall be provided to supply at least 4 cfm of outside air per 1000 Btu per hour input of installed heaters;

(c) The amount of air supplied which exceeds the building's designed infiltration rate shall be relieved through relief openings or interlocked power exhaust. Relief openings may be louvers, gravity siphon-type roof ventilators, counterbalanced gravity dampers or motorized dampers provided the motorized damper is interlocked with the supply fan so as not to permit blower operation until the damper is proved in the open position.

(d) Oil-fired radiant heaters shall be equipped with mechanical pressure-atomizing burners; and

(e) Direct fired unvented natural gas heaters shall comply with ANSI Z83.18.

(5) SPACE HEATERS. Space heaters shall comply with the following provisions:

(a) The burner of the appliance shall be enclosed with a metal housing so constructed that there will be no open flame and the burner housing shall be effectively guarded against personal contact. The arrangement shall be such that the shield will prevent any combustible material in the vicinity of the appliance from coming in contact with the flame or with the housing that encloses the burner. Oil-fired space heaters shall be equipped with a mechanical pressure atomizing burner; and

(b) Space heaters shall not be equipped with duct extensions beyond the vertical and horizontal limits of the metal enclosure.

(c) The use of unvented fuel-fired space heating equipment shall be prohibited except for the equipment types and occupancies specified in Table 64.21.

(6) EQUIPMENT IN HAZARDOUS LOCATIONS. The types of heating and ventilating equipment that may be installed in hazardous locations (as defined in Article 500 of the National Electrical Code as adopted by reference in ch. ILHR 16) are as follows:

(a) Listed low-pressure steam or hot water unit heaters and makeup air units; and

(b) Listed electric units.

(7) FIREPLACES AND FIREPLACE STOVES. Masonry fireplaces, factory-built fireplaces and factory-built fireplace stoves shall be constructed and installed in accordance with the NFPA standard No. 211--Standard for Chimneys, Fireplaces and Vents.

(a) Masonry fireplaces. 1. Masonry fireplaces shall be constructed of solid masonry units, stone or reinforced portland or refractory cement concrete.

a. Where a lining of low-duty firebrick complying with the provisions of ASTM C64, or the equivalent, at least 2 inches thick laid-in fire-clay mortar complying with the provisions of ASTM C105, or the equivalent, or other approved lining is provided, the total thickness of back and sides, including the lining, shall be not less than 8 inches.

b. Where the lining described in subpar. a. is not provided, the thickness of back and sides shall be not less than 12 inches.

2. Steel fireplace units incorporating a firebox liner of not less than 1/4 inch thick steel and an air chamber shall be installed with masonry to provide a total thickness at the back and sides of not less than 8 inches, not less than 4 inches of which shall be solid masonry.

3. Warm air ducts employed with steel fireplace units of the circulating air type shall be constructed of metal or masonry.

4. Fireplace hearth extensions of approved noncombustible material for all fireplaces shall be provided.

a. Where the fireplace opening is less than 6 square feet, the hearth extension shall extend at least 16 inches in front of, and at least 8 inches beyond each side of the fireplace opening.

b. Where the fireplace opening is 6 square feet or larger, the hearth extension shall extend at least 20 inches in front of, and at least 12 inches beyond each side of the fireplace opening.

c. Where a fireplace is elevated above or overhangs a floor, the hearth extension shall also extend over the area under the fireplace.

d. Fireplaces constructed of masonry or reinforced portland or refractory cement concrete shall have hearth extensions of brick, concrete, stone, tile or other approved noncombustible material properly supported and with no combustible material against the underside thereof.

Wooden forms or centers used during the construction of hearth and hearth extension shall be removed when the construction is completed.

5. All wood beams, joists and studs shall be trimmed away from fireplaces. Headers supporting trimmer arches at fireplaces shall be not less than 20 inches from the face of the chimney breast.

Note: Trimmers shall be not less than 6 inches from the inside face of the nearest flue lining.

6. Woodwork shall not be placed within 4 inches of the back face of a fireplace.

7. Woodwork shall not be placed within 6 inches of a fireplace opening. Woodwork above and projecting more than 1 1/2 inches from a fireplace opening shall not be placed less than 12 inches from the top of a fireplace opening.

(b) Factory-built fireplaces and fireplace stoves. Factory-built fireplaces and fireplace stoves shall be installed according to the requirements of the approval as specified in s. ILHR 64.20.

(c) Hearth opening protection. Fireplaces and fireplace stoves shall be equipped with safety screens or glass doors to prevent the escape of sparks and embers.

(d) Permitted installations. Fireplaces are permitted in the following applications.

1. In all occupancies within the scope of chs. ILHR 54 and 55;

2. In health care facilities as specified in s. ILHR 58.24 (3);

3. In common use areas of residential occupancies; and

4. In individual living units of residential occupancies except that fireplaces in individual living units of hotels and motels shall comply with the following:

a. The appliance shall be gas-fired and shall be tested and installed in accordance with standards recognized by the department.

Note: ANSI Z21.50 and ANSI Z32.60 are recognized by the department. See s. ILHR 64.20 (3) for listing requirements.

b. The appliance shall be designed to be ignited by an intermittent ignition device.

c. The fire box shall be provided with a permanently installed glass partition to prevent access to the fire box and appliance. The partition shall be designed to be compatible with the appliance listing.

Note: Operation of the appliance via a control located outside the fire box will be necessary.

d. Outside air shall be provided for combustion in accordance with s. ILHR 64.09. Combustion air shall not be provided via infiltration.

(8) FLOOR-STANDING VENTED OR UNVENTED EQUIPMENT. Floor-standing, vented or unvented unit heaters, furnaces and boilers in metal fabricating plants, foundries and machine shops are exempt from the requirements of s. ILHR 54.14.

(9) HEAT EXCHANGER CORROSION PROTECTION. If the entering air to the heat exchanger of all gas-fired equipment is 30°F or lower, the heat exchanger and burners shall be constructed of corrosion-resistive materials.

(10) WATER HEATERS USED FOR SIMULTANEOUS SPACE HEAT AND HOT WATER SUPPLY FOR PLUMBING SYSTEM. (a) Water heater construction standards. Water heaters that provide simultaneous space heat and hot water supply for a plumbing system shall be listed for compliance with ANSI Z21.10.1 or ANSI Z21.10.3 and be specifically designed for such use. The water heater shall have an input rating of 100,000 Btu/h or less.

(b) Heat exchanger unit. Heat exchanger units that are part of the plumbing system shall meet the requirements of Chs. ILHR 81-84.

(c) Sizing. The water heater shall be sized with a sufficient capacity to simultaneously offset the heat loss at design temperatures and meet the other system demands it serves. The design recovery rate of the water heater shall be less than one hour for the hot water load for plumbing at design temperatures.

Note: See ch. ILHR 84 for additional requirements for water heating equipment and s. ILHR 63.20 for energy conservation requirements.

(11) PROCESS EQUIPMENT. Section ILHR 64.21 does not apply to process equipment unless the equipment provides water supply for a plumbing system or provides space heating, exclusive of waste heat.

ILHR 64.23 PIPING. (1) PIPE SIZES AND ARRANGEMENT. All supply and return piping carrying steam, hot water or other fluids, air-line piping and auxiliary equipment shall be of appropriate sizes, elevations and arrangements to accomplish the calculated services in practical operation, without undue noise, stress or other detriment.

(2) EXPANSION AND CONTRACTION. The piping for the heating system shall be equipped with anchors, expansion swings or joints, supports and similar devices to relieve stress and strains caused by temperature change of the pipe material.

(3) PIPE INSULATION. All supply and return piping carrying steam, hot water or other fluids shall be covered with insulating material where the pipes pass through occupied areas and the surface temperature exceeds 180°F., unless guarded.

(4) PIPE PROTECTION. No pipe carrying hot water, steam, or other fluid at a surface temperature exceeding 250°F. shall be placed within one inch of any woodwork, pass through a combustible floor, ceiling or partition, unless the pipe is protected by a metal tube one inch larger in diameter than the pipe or with approved pipe covering.

(5) GAS OR OIL INSTALLATIONS. (a) Piping installations. All gas piping and all oil piping shall comply with the following standards:

1. National Fuel Gas Code, NFPA No. 54; or

2. Installation of Oil-Burning Equipment, NFPA No. 31.

(b) Oil tank installation. Oil tanks serving oil-burning equipment shall be installed in accordance with ch. ILHR 10.

Subchapter V -- Air Delivery Systems

ILHR 64.31 DUCT DESIGN. All ducts shall be designed to promote the unrestricted flow of air.

Note: The department will accept air duct velocities designed in accordance with the standards of the ASHRAE Handbook of Fundamentals, published by the American Society of Heating, Refrigerating and Air Conditioning Engineers.

ILHR 64.32 DUCT USE. No duct designed for the transmission of air shall be used for any other purpose.

ILHR 64.33 UNDERGROUND DUCT CONSTRUCTION AND INSTALLATION. (1) MATERIALS. (a) Tile ducts. All underground duct systems using cement tile, glazed clay tile and other tile having a composition of cement and mineral shall be waterproof and shall have sufficient strength to prevent failure of duct at the time of installation and while in service. All fittings shall be designed with bell and spigot or slip-joint connections. All joints shall be waterproof.

(b) Plastic and metal ducts. Metal, plastic-coated metal ducts, and other approved materials may be used for underground systems if encased in not less than 2 inches of concrete. The ducts shall be waterproof, noncombustible, smooth and of sufficient strength to prevent collapse. The sealing material for fittings and joints shall be approved by the department.

1. Exception. Solid polyvinyl ducts and fittings and polyvinyl chloride (pvc)-clad metallic ducts and fittings need not be encased in concrete provided the space around the ducts and fittings is backfilled with sand or similar fill material.

(2) DUCT INSULATION. All underground ducts shall be insulated as specified in s. ILHR 63.29.

(3) DUCT DRAINAGE. Underground ducts shall be provided with drainage to a lower room of the building or to a sump. No duct shall be connected to a sewer.

(4) DUCT INLETS AND OUTLETS. A water-tight connection shall be provided where the inlet and outlet risers are connected to underground ducts.

(5) PIPING. Nonhazardous piping may be installed in underground ducts if it does not restrict the air flow.

ILHR 64.34 DUCT CONSTRUCTION. (1) METAL DUCTS. All sheet metal ducts, duct liners and fittings shall be constructed in compliance with standards approved by the department.

Note: The department will accept the standards for ducts in the ASHRAE Handbook of Equipment Volume, published by the American Society of Heating, Refrigerating and Air Conditioning Engineers, or as illustrated in the HVAC Duct Construction Standards, Metal and Flexible and HVAC Air Duct Leakage Text Manual as published by the Sheet Metal and Air Conditioning Contractors National Association, Inc.

(2) COMBUSTIBLE DUCTS. All ducts or airways of wood or other combustible building elements shall be lined with sheet metal or other approved noncombustible material unless specifically exempted by this code.

(3) NONMETALLIC DUCTS. Coated metal ducts or ducts constructed of other than metal shall conform to the following:

(a) The method for fabricating, installing and supporting ducts shall be approved by the department;

Note: The department accepts Class 1 air ducts tested (Standards for Safety, UL 181) and listed by Underwriters' Laboratories, Inc., and constructed in accordance with fibrous glass duct construction standards published by the Sheet Metal and Air Conditioning Contractors National Association, Inc.

(b) The ducts shall resist puncture, deformation or collapse;

(c) The ducts shall not be used where the air temperature exceeds 250°F in fume hood exhaust ducts or for kitchen hood supply or exhaust ducts. Nonmetalic or coated metal ducts may be used to convey solids or corrosive gasses if information is provided to show the duct is suitable for the specific use and approval is granted by the department.

(d) The ducts shall not pass through required fire-resistive construction.

(4) ADDITIONAL DUCT SEALING. In addition to requirements of standards specified in sub. (1), where supply ductwork and plenums that are designed to operate at static pressures from 0.25 inches to 2 inches water column inclusive are located outside of the conditioned space or in return plenums, joints shall be sealed in accordance with Seal class C as defined in the SMACNA HVAC Duct Leakage Test Manual. Pressure sensitive tape shall not be used as the primary sealant where such ducts are designed to operate at static pressures of 1 inch water column or greater.

ILHR 64.35 DUCT CONNECTORS. (1) FLEXIBLE DUCT CONNECTORS. Flexible duct connectors between duct systems and air outlets or air outlet units shall conform to the following:

(a) The duct material shall be approved for such use;

Note: Flame-retarded fabric or metal or mineral listed in the Building Materials List, published by Underwriters' Laboratories, Inc., are acceptable

(b) The construction shall be approved by the department;

(c) The connector shall not be subject to deterioration from mildew or moisture; and

(d) The connector shall not pass through required fire-resistive construction.

(2) VIBRATION CONTROL. Vibration isolation connectors at the joint between the duct and fan or heat-producing equipment shall conform to the following:

(a) Connectors shall be a type approved for such use;

Note: Flame-retarded fabric or metal or mineral listed in the Building Materials List, published by Underwriters' Laboratories, Inc., are acceptable.

(b) Connectors shall be not more than 10 inches wide; and

(c) Connectors shall not be used where the air temperature is in excess of 250°F.

ILHR 64.36 VERTICAL SHAFTS. Every vertical shaft shall be enclosed with noncombustible material which is fire-resistive rated in accordance with Table 51.03-A.

ILHR 64.37 INSULATION. Heating supply ducts and pipes shall be covered with insulation unless an allowance is made for temperature drop in the system.

Note: Also see s. ILHR 63.29 for additional requirements.

ILHR 64.38 GRAVITY VENTILATION DUCTS. (1) DESIGN. Horizontal runs in gravity ventilation ducts connected to siphon-type roof ventilators shall be avoided wherever possible and the maximum practicable inclination shall be provided in all cases. In no case shall the horizontal run exceed 30% of the vertical run unless the room has a mechanical supply of air or the ventilation duct is connected to an exhaust fan.

(2) SEPARATE DUCTS. Separate gravity ventilation ducts, from each area of similar occupancy, shall extend to a plenum at the base of a siphon ventilator.

(3) PLENUMS. Gravity ventilation ducts, used with mechanical ventilation supply systems, shall not terminate in an attic plenum unless the plenum is airtight, of noncombustible construction, and the attic floor is smooth. All collecting plenums shall be connected to an approved siphon-type roof ventilator or to an exhaust fan discharging outside the building.

(4) DAMPERS. Dampers are prohibited in gravity ventilation ducts, except atmospheric back-draft dampers are permitted.

ILHR 64.39 VENTILATION DISCHARGE. All gravity and mechanical ventilation ducts shall be protected from the weather and shall be located and constructed to prevent contamination of an outside air supply. Gravity ventilation ducts shall extend not less than 2 feet above the highest portion of the building within a 10-foot radius of the duct and shall be provided with an approved type of siphon roof ventilator.

ILHR 64.40 RELIEF VENTS. (1) BAROMETRIC RELIEF VENTS PERMITTED. The use of barometric relief vents is permitted for type (a) and (b) ventilation classifications designated in s. ILHR 64.05. Where barometric relief vents are installed on the roof, the discharge openings shall be not less than 2 feet above the roof surface where the vent pierces the roof.

(2) BAROMETRIC RELIEF VENTS PROHIBITED. The use of barometric relief vents is prohibited for type (c), (d) and (e) ventilation classifications designated in s. ILHR 64.05.

ILHR 64.41 PLENUMS. (1) GENERAL. Plenums used for the supply, return or transfer of air shall be of noncombustible construction.

(a) Exception. Combustible ceiling materials may be used provided they comply with the following:

1. The ceiling material is made from a base material of metal or mineral;

2. All surfaces of ceiling material possess a flame-spread rating of not over 25 without evidence of continued progressive combustion and with a smoke-developed rating of not higher than 50;

3. The ceiling material is supported by noncombustible material having a melting point above 1400°F. (760°C); and

4. The ceiling material is not subject to deterioration or deformation on long exposure to temperatures of 250°F. (121°C) or under conditions of high humidity, excessive moisture, or mildew.

(b) Ceiling systems with fire-resistive ratings. Return air plenums shall not be placed in rated ceiling systems unless specifically allowed by the listing.

Note #1: This section permits the use of steel, painted steel bar joists and metal decking, concrete, plaster, and other noncombustible materials and restricts the use of certain combustible materials within air-handling plenums.

Note #2: The requirements for ceiling materials are based upon the National Fire Protection Association (NFPA) standard 90A, section 2-2.1.3.

(2) DUCTWORK WITHIN THE PLENUM. Ducts within the plenum shall be constructed of metal in accordance with s. ILHR 64.34 (1) or approved nonmetallic materials in accordance with s. ILHR 64.34 (3).

(3) DUCT CONNECTORS. Duct connectors shall comply with the requirements of s. ILHR 64.35.

Note: Flame-retardant fabric or metal or mineral listed in the Building Materials List, published by Underwriters' Laboratories, Inc., are acceptable.

(4) INSULATING MATERIALS WITHIN THE PLENUM. (a) Duct and pipe insulation. Duct and pipe insulation, including coverings, linings, tapes and core materials, shall have a flame-spread rating of not over 25 without evidence of continued progressive combustion, and a smoke-developed rating no higher than 50 when tested according to ASTM E-84 standard tests.

Note: If coverings and linings are to be applied with adhesives, they shall be tested as applied with such adhesives, or the adhesives used shall have a flame-spread rating not over 25 and a smoke-developed rating no higher than 50 when in the final dry state.

(b) Building envelope insulation. Building envelope insulation within the plenum space shall have a flame-spread rating of 25 or less and a smoke-developed rating of 50 or less when tested according to ASTM E-84 test standards. The use of foam plastics, satisfying the

requirements of s. ILHR 51.06, for envelope insulation is permitted provided the foam plastic is protected by a thermal barrier as specified in s. ILHR 51.06 (3).

(5) HAZARDOUS PIPING. The installation of hazardous piping as defined in s. ILHR 51.01 (102) is prohibited in the plenum space, except as permitted under NFPA 54.

(6) OPENINGS. Openings into the plenum that would affect the fire-resistive rating of the structural component or system are prohibited.

(7) WIRING AND CABLES. Electric wiring, including low-voltage wiring, and telephone cables within the plenum space shall be installed according to the Wisconsin State Electrical Code, Vol. 2, ch. ILHR 16.

(8) PLUMBING. Plumbing within the plenum shall be of noncombustible material.

(a) Exception. Plastic plumbing pipe and fittings may be used provided the plastic material is of the self-extinguishing type with an average extent of burn not greater than 10 mm and an average time of burn not greater than 20 seconds when tested according to ASTM D-635. The plastic material shall be wrapped with at least one inch of noncombustible insulation or enclosed with 1/2 inch type X gypsum wallboard.

(9) CONTROL TUBING. Plastic control tubing shall have an average extent of burn not greater than 10 mm and an average time of burn not greater than 20 seconds when tested according to ASTM D-635.

(10) SMOKE DETECTION. (a) New construction. Air-handling plenums which contain ductwork, duct connectors, insulation, plumbing or control tubing which do not meet the requirements of subs. (2) to (4), (8) and (9), respectively, shall be provided with an approved smoke detection system capable of stopping the air flow in and from the plenum and giving an audible alarm in the occupied area when activated.

(b) Existing construction. When existing plenum construction contains combustible insulation, wiring, plumbing or control tubing, and is altered or added to according to s. ILHR 50.03 (1) or (2), the entire plenum space, new and existing, shall be provided with a smoke detection system according to sub. (10)(a).

1. Exception. Building additions separated from existing construction by one-hour noncombustible construction need not be provided with a smoke detection system provided the plenum is constructed according to subs. (1) to (8).

ILHR 64.42 FIRE DAMPERS AND CEILING DAMPERS. (1) REQUIRED FIRE DAMPERS AND CEILING DAMPERS. All heating and ventilating ducts, except underground ducts used with counterflow or downflow heating equipment, which terminate at or pierce code-

required, hourly rated wall, floor, floor ceiling assemblies, roof ceiling assemblies, and membrane finishes used as a substitution for rated assemblies shall be protected as follows:

(a) Penetrations to assemblies having fire resistance ratings of less than 3-hours shall be protected by fire dampers having at least a 1 1/2 hour rating.

(b) Penetration to assemblies having fire resistance ratings of 3-hours or more shall be protected by fire dampers having at least a 3 hour rating.

(c) Penetrations to membranes whose finish ratings are used as a substitution for hourly rated assemblies shall be protected in the same manner specified in (a) and (b). The exception found in (2)(c) cannot be used in this situation.

(2) EXCEPTIONS. Exceptions to sub. (1) are:

(a) Penetrations in 1-hour rated wall assemblies, other than required shaft enclosures, which are provided with continuous horizontal steel ductwork extending, unpierced, at least 6-feet horizontally on at least one side of the wall and the ductwork leads to an air handling device.

Note: See ss. ILHR 51.02(11), 54.08, 55.09, 55.20, 56.10, 57.08, 58.06, 58.23, 58.50, 58.61, 59.17, 60.34, 61.12, and 62.27 for information on when fire resistive rated shafts are required.

(b) Interior bearing walls and partitions if other unprotected openings are permitted by other sections of ILHR 50 through 62.

(c) Air supply, exhaust or return outlet, grille and diffuser penetrations to the ceiling membranes of fire resistance rated floor ceiling assemblies or roof ceiling assemblies which meet one of the following:

1. Any assembly which has been tested by an approved nationally recognized testing laboratory and has all penetrations protected as required by the assembly as tested.

Note: See s. ILHR 51.04 to 51.044 and Appendix A for information on fire-resistive assemblies and approved testing laboratories.

2. Diffuser and grille penetrations to the ceiling membranes of fire-resistive floor ceiling assemblies or roof ceiling assemblies meeting the requirements of s. ILHR 51.045 provided the openings are limited to 100 square inches for each 100 square feet of ceiling area, the individual openings do not exceed an area of 100 square inches, and the openings are protected by one of the following:

a. Listed ceiling dampers.

Note : Ceiling dampers are classified for use in air handling openings penetrating fire resistive membrane ceilings. Ceiling dampers listed by U.L. use standard UL 555C, "Ceiling Dampers" for investigation of products.

b. Duct outlet protection systems which have been tested and listed by an approved nationally recognized testing laboratory.

Note: The General Information Section of the U.L. Fire Resistance Directory includes descriptions and details for duct outlet protection systems A and B which are both examples of acceptable protection.

(d) Kitchen exhaust ducts meeting all requirements of s. ILHR 64.57(5).

(3) SERVICING FIRE DAMPERS. Access panels shall be provided next to fire dampers to permit viewing and servicing.

Note #1: The department will accept fire dampers listed by Underwriters Laboratories Inc. or an approved nationally recognized testing laboratory. Fire dampers listed by U.L. use standard UL 555, "Fire Dampers" for investigation of products. The dampers must be installed in the vertical or horizontal position that the dampers were designed and tested for. The department will accept fire damper installations as recommended in publications of the Sheet Metal, Air Conditioning Contractors National Association, Inc., and the National Fire protection Association.

Note #2: Fire dampers are classified as 1 1 2 hour rated or 3 hour rated.

Note #3: Health care facilities may have additional requirements, see s. ILHR 64.57

ILHR 64.43 DAMPERS AND DAMPER CONTROLS. (1) VOLUME DAMPERS AND DEFLECTORS. Volume dampers, splitters and deflectors shall be provided in all ducts to permit accurate balancing of the system. The dampers, splitters and deflectors shall be adjusted to satisfy the heating and ventilating requirements of the conditioned space and locked in place.

(2) AIR GRILLES. All air supply outlets and returns shall be equipped with grilles or devices which will provide a uniform distribution of air.

ILHR 64.44 FANS AND BLOWERS. Fans and blowers shall be of a type and size that will satisfy the design conditions of the heating and ventilating system. Fans and blowers shall be rated in accordance with an approved test procedure.

Note: The department accepts certified ratings listed by the Air Moving and Conditioning Association, Inc.

Subchapter VI -- Chimneys, Gas Vents, Mechanical Draft and Venting Devices

ILHR 64.45 CHIMNEYS, SMOKE STACKS, GAS VENTS, MECHANICAL DRAFT AND VENTING DEVICES. (1) GENERAL REQUIREMENTS. Heating equipment using

solid, liquid or gas fuels shall be vented to the outside, except as permitted in s. ILHR 64.21. A natural draft chimney or other venting device shall have the height and area to remove the products of combustion.

Note: Chimneys, smoke stacks, gas vents, mechanical draft and venting devices shall comply with the requirements of NFPA No. 211.

(2) NONCOMBUSTIBLE SUPPORTS. All chimneys or gas vents shall be supported from noncombustible construction unless otherwise approved.

(3) TERMINATION. (a) Gravity type. 1. All chimneys or smokestacks depending on a gravity principle for the removal of the products of combustion shall extend at least 3 feet above the highest point of the roof where the chimneys or smokestacks pass through the roof of the building, and at least 2 feet higher than any portion of the building measured 10 feet horizontally from the chimney or smokestack.

2. Type "B", "BW" and "L" vents and single wall vent pipes depending on a gravity principle for the removal of the products of combustion shall extend at least 2 feet above the highest point of the roof where the vents or pipes pass through the roof of the building, and at least 2 feet higher than any portion of the building measured 10 feet horizontally from the vent or pipe.

(b) Mechanical type. The height and cross-sectional area may be reduced for chimneys employing a mechanical draft system of either forced or induced draft when approved by the department.

ILHR 64.46 MASONRY CHIMNEYS. The design and construction of the chimney shall conform to the provisions of this section.

(1) MATERIALS. The walls shall be built of brick or other approved fire-resistive material. No chimney shall rest upon a flooring of wood nor shall any wood be built into or in contact with any chimney. Combustible headers, beams, joists and studs shall be located at least 2 inches from the outside face of a chimney. The foundation shall be designed and built in conformity with the requirements for foundations for buildings. In no case shall a chimney be corbeled out more than 6 inches from the wall and in every case the corbeling shall consist of at least 5 courses of brick.

(2) FLUE SIZE. Every masonry chimney shall have walls at least 8 inches in solid thickness, except that in a chimney with a flue not larger than 260 square inches where a fire clay or other suitable refractory clay flue lining is used for the full height of the chimney the walls shall not be less than 4 inches in solid thickness. No smoke flue shall have a cross-sectional area less than 64 square inches. Flue linings 7 inches by 7 inches inside, or 8 inches in diameter inside, may be used.

(3) FLUE LININGS. All flue linings shall be capable of withstanding reasonably high temperatures and flue gases and shall have a softening point not lower than 1800°F. Flue linings shall be not less than 5/8 inch in thickness and shall be built in as outer walls of the chimney are constructed. Flue linings shall start from a point not less than 8 inches below the bottom of the smoke pipe intake and shall be continuous to a point not less than 4 inches above the enclosing walls.

(4) SMOKE PIPE CONNECTION. If there is more than one smoke pipe connected to a flue, the connections shall be at different levels. Two or more heating units, or appliances, may be connected to a common smoke pipe, or breeching, if joined by Y fittings as close as practicable to the flue. In all such cases, the size of the breeching and the flue shall be sufficient to accommodate the total volume of flue gases.

(5) CLEAN-OUT OPENING. Every chimney shall be provided with a clean-out opening at the base. Such openings shall be equipped with metal doors and frames arranged to remain closed when not in use.

(6) WIND PRESSURE. Every chimney shall be designed to withstand wind pressures in accordance with the requirements of s. ILHR 53.12.

ILHR 64.47 METAL SMOKESTACKS. (1) SMOKESTACKS IN EXCESS OF 30 FEET. The thickness of the metal walls shall be at least 3/16 inch for smokestack heights up to 40 feet and 1/4 inch for greater heights. Stacks used for manufacturing, high-pressure boilers, furnaces or other similar heating or manufacturing appliances shall be lined with firebrick, or equivalent, for a distance of not less than 25 feet from the place where the smoke pipe enters and shall be protected on the outside up to and through the roof of the building with 8 inches of masonry, or a metal shield which provides an 8-inch ventilated air space between such shield and the stack. All stacks shall be properly guyed if the height of the stack exceeds 15 times its least diameter.

(a) Exception. Public utility or industrial power plants are exempted from the protection requirements of this paragraph if they are of type 1 or 2 construction.

(2) SMOKESTACKS LESS THAN 30 FEET. Smokestacks less than 30 feet high may be constructed of not less than No. 10 U.S. gauge steel, with either welded or riveted joints, and may be mounted directly upon masonry chimneys or foundations or upon industrial heating or power boilers provided all of which are designed to support the stack load. A clearance of not less than 6 inches shall be maintained at all times around such smokestacks and any combustible material within 12 inches of such smokestacks shall be protected by noncombustible insulation covered by sheet metal.

ILHR 64.48 FACTORY-BUILT CHIMNEYS AND GAS VENTS. (1) GENERAL. Factory-built chimneys and gas vents shall be of an approved type.

(2) TYPES OF APPROVED CHIMNEYS AND GAS VENTS. (a) Residential type and building heating appliance. An approved "residential type and building heating appliance" chimney or "building heating appliance" chimney may be used with solid-, liquid- or gas-fired heating appliances where the flue gas temperature does not exceed 1000° F. continuously, and does not exceed 1400°F. for infrequent brief periods of forced firing.

Note: Residential type and building heating appliance chimneys were formerly referred to as Class A chimneys.

(b) Type "B". An approved type "B" gas vent may be used with gas-fired appliances where the flue gas temperature does not exceed 550°F. at the outlet of the draft hood.

(c) Type "BW". An approved type "BW" gas vent may be used with a vented recessed wall heater.

(d) Single wall vent pipe. An approved single wall vent pipe may be used with gas-fired, low-heat appliances (low-pressure boilers, furnaces and space heaters). The vent shall be not less than No. 20 standard gauge galvanized iron, No. 24 Brown and Sharpe gauge sheet copper, or other approved corrosion-resistant material. The installation shall conform to the requirements of s. ILHR 64.50.

(e) Type "L". An approved type "L" vent may be used with oil-fired appliances listed as suitable by a recognized agency and with gas-fired appliances approved for type "B" vents.

(f) Equipment listed with venting system. Venting systems included with the listing of the heating appliance may be used subject to the requirements and limitations of the listing.

Note: The department recognizes, as approved, chimneys designated as "residential type", "building heating appliance", "B", "BW" and "L" types listed by Underwriters' Laboratories, Inc.

ILHR 64.49 GAS VENTS. All gas ranges (except those designed as unvented), water heaters and other gas-fired equipment shall be provided with vent pipes conforming to the requirements for gas vents as specified in s. ILHR 64.48 and for connectors as specified in s. ILHR 64.50. Commercial kitchen appliances including but not limited to ranges, ovens, booster heaters and similar equipment may be vented into the kitchen hood exhaust system.

ILHR 64.50 CHIMNEY AND VENT CONNECTORS. (1) CONSTRUCTION AND INSTALLATION. The construction and installation of chimney connectors shall conform with the following requirements:

(a) Concealed space. No chimney connector shall pass through any outside window, door or combustible outside wall, nor be concealed in any closet, attic or similar space;

(b) Combustible partitions and walls. Connectors for appliances shall not pass through interior walls or partitions constructed of combustible material unless they are guarded at the point of passage by:

1. Metal ventilated thimbles not less than 12 inches larger in diameter than the connector, or

2. Metal or burned fireclay thimbles built in brickwork or other approved fireproofing materials extending not less than 8 inches beyond all sides of the thimble;

(c) Distance from materials. Connectors shall be installed with clearance to combustibles specified in par. (b) or NFPA Standard 211;

(d) Multiple appliance venting.

1. Two or more appliances using the same type of fuel may be connected to a common gravity-type chimney or vent, provided the appliances are equipped with primary safety controls and listed shutoff devices and comply with the following requirements:

a. The appliances shall be located in the same story, except for engineered venting systems;

b. The appliances shall be joined at a manifold or Y-type fitting as close to the chimney or vent as possible, unless the connector from each appliance enters a separate chimney or vent inlet and the inlets are offset at least 12 inches vertically or are at right angles to each other;

c. The connector and chimney or vent shall be sized to accommodate the total volume of flue gases. For gas-burning appliances, the venting area shall be at least equal to the size of the largest vent connector plus at least 50% of the area of the other vent connectors; or

d. A chimney serving a fireplace or other piece of solid-fuel equipment shall not be used to vent any other appliance;

Note: Engineered venting systems designed in accordance with NFPA 54, "National Fuel Gas Code" are acceptable to the department.

2. Gas utilization appliances and appliances burning liquid fuel may be connected to one chimney flue in accordance with NFPA 211.

(e) Pitch and length. Chimney or vent connectors shall have no more than two 45° offsets with the vertical. The horizontal length shall not exceed 75% of the total vertical height of the total venting system measured from the appliance outlet. Chimney or vent connectors shall be pitched up at least 1/4 inch per foot from the appliance outlet collar to the chimney or vent inlet;

(f) Dampers. A manual cast iron or equivalent damper to control the draft shall be provided in the chimney connector next to solid-fuel fired equipment. Manually operated dampers shall be prohibited in chimney or vent connectors of all other appliances. When used, listed automatically operated dampers interlocked with the heating appliance shall be installed in accordance with the approved listing; and

(g) Materials and thickness. 1. Except as specified in subd. 2., chimney or vent connectors shall be listed or conform to the type of material and thickness indicated in Table 64.50 or equivalent.

2. Exception. Connectors serving listed residential-type gas appliances shall be not less than .016 inch galvanized steel.

TABLE 64.50
MINIMUM CHIMNEY CONNECTOR METAL THICKNESS

Galvanized Steel		
Diameter of Connector	Minimum Thickness (inch)	Gauge
Less than 6 inches	.019	26
6 inches to less than 10 inches	.024	24
10 inches to 13 inches	.030	22
14 inches to 16 inches	.036	20
Greater than 16 inches	.058	16

Subchapter VII -- Equipment Location, Protection, Maintenance and Operation

ILHR 64.51 GUARDING AND FIRE PROTECTION. (1) GUARDING OF EQUIPMENT. Heating and ventilating equipment in gymnasiums, playrooms and similarly occupied areas shall be fully recessed and protected, or located not less than 7 feet above the floor. Heating and ventilating equipment shall not block any part of the required aisles, passageways and corridors.

(2) GUARDING OF SURFACES. (a) Equipment located in occupied areas and installed less than 7 feet above the floor shall be guarded to prevent contact with surfaces that are likely to cause lacerations.

(b) Surfaces that are located less than 7 feet above the floor that exceed 180°F in temperature shall be covered with insulating material or be guarded.

(3) GUARDING OF MECHANICAL APPARATUS. All mechanical apparatus shall be guarded to comply with the requirements of chs. Ind 1000-2000--Safety and Health Code.

(4) FIRE PROTECTION. (a) 1. Heat-producing appliances and their chimney or vent connectors shall be installed with clearances to combustible material as specified in NFPA Manual No. 211 unless listed for installation at other clearances.

2. Clearance to combustible materials shall be as specified in NFPA Standard No. 211 or as specified by a nationally recommended testing laboratory, whichever is greater.

(b) Clearances shall be measured from the outer surface of the appliance or connector to the combustible material, disregarding any intervening protection applied to the combustible material.

(c) Appliances shall not be installed in alcoves or closets unless approved for such installations.

ILHR 64.52 MAINTENANCE AND OPERATION. (1) MAINTENANCE. All heating, ventilating, exhaust and air conditioning systems shall be maintained in good working order and shall be kept clean and sanitary. Clearances and accessibility shall be provided for equipment maintenance. Chimneys or vents and connectors serving solid-fuel burning appliances shall be cleaned and inspected for damage annually. Chimneys and vents, which have been subjected to a chimney fire, shall not be reused until inspected and approved by the department or authorized deputy.

(2) OPERATION. All heating, ventilating and exhaust systems shall be operated to satisfy the requirements of this chapter during periods the building is occupied.

(3) INSTRUCTIONS. The designer or installer shall provide the owner with written instructions for the operation and maintenance of the system and equipment.

ILHR 64.53 FINAL TEST REQUIRED. (1) The designer, installer or recognized balancing agency shall be responsible for the testing and balancing of every heating, ventilating and air conditioning system. The person or agency responsible for balancing of the ventilating system shall document in writing the amount of outdoor air being provided and distributed for the building occupants and any other specialty ventilation. The document shall be retained at the site and shall be made available to the department upon request.

(2) (a) Air systems shall be balanced in a manner to minimize losses from damper throttling by first adjusting fan speed then adjusting dampers to meet design flow conditions. Balancing procedures shall be acceptable to the department. Damper throttling alone may be used for air system balancing with fan motors of 1 hp or less, or if throttling results in no greater than 1/3 hp fan horsepower draw above that required if the fan speed were adjusted.

(b) 1. Except as provided in subd. 2., hydronic systems shall be balanced in a manner to minimize valve throttling losses by first trimming the pump impeller or adjusting the pump speed then adjusting the valves to meet design flow conditions.

2. As an exception to subd. 1., valve throttling alone may be used for hydronic system balancing under any of the following conditions:

a. Pumps with pump motors of 10 hp or less;

b. If throttling results in no greater than 3 hp pump horsepower draw for pumps of 60 hp or less, or no greater than 5 percent of pump horse power draw for pumps greater than 60 hp, above that required if the impeller were trimmed;

c. To reserve additional pump pressure capability in open circuit piping systems subject to fouling. Valve throttling pressure drop shall not exceed that expected for future fouling; or

d. Where it can be shown that throttling will not increase overall building energy costs.

(3) An operating and maintenance manual shall be provided to the building owner or operator. The manual shall include basic data relating to the operation and maintenance of HVAC systems and equipment. Required routine maintenance actions shall be clearly identified. Where applicable, HVAC controls information such as diagrams, schematics, control sequence descriptions, and maintenance and calibration information shall be included.

Note: National Environmental Balancing Bureau (NEBB) Procedural Standards, the Associated Air Balance Council (AABC) National Standards or equivalent balancing procedures are acceptable to the department.

(4) HVAC control systems shall be tested to assure that control elements are calibrated, adjusted, and in proper working condition.

Note: Submittal of the compliance statement is accepted as verification of compliance with this section.

Subchapter VIII -- Occupancy Requirements

ILHR 64.54 FACTORIES, OFFICE AND MERCANTILE BUILDINGS. (1) SCOPE. This section applies to all places of employment, mercantile buildings, retail establishments where goods and commodities are bought and sold, and places where not more than 100 persons assemble for worship, recreation, entertainment or dining purposes.

Note: For mall corridors of enclosed mall shopping centers, see s. ILHR 64.05, Table 1.

(2) VENTILATION. The air change, supply and distribution for all occupancies in this class shall conform to the requirements of s. ILHR 64.05, except that natural ventilation or mechanical ventilation need not be provided in warehouses and cold storage buildings.

(3) INDUSTRIAL EXHAUST SYSTEM. (a) Contaminants. Industrial exhaust systems shall be installed and operated to remove harmful contaminants in conformance with ch. ILHR 32, Safety and Health Standards for Public Employes.

(b) Make-up air. Make-up air shall be provided as required by s. ILHR 64.14. The quantity of make-up air shall equal at least 90% of the air exhausted.

Note: The quantity of makeup air shall equal at least 90% of the air exhausted.

(c) Connections. Connections between industrial exhaust systems that convey different materials, the combination of which may produce explosive, heat-generating, corrosive, toxic, or otherwise dangerous mixtures, shall be prohibited.

ILHR 64.54 (4) LOCKER ROOMS AND CHANGE ROOMS. Locker rooms and change rooms provided in accordance with s. ILHR 54.13 (1) for employes exposed to toxic materials or industrial poisons shall be provided with a direct supply of outside air or air that is transferred from uncontaminated areas. All other locker rooms shall be provided with outside air as specified in Table 64.05.

Note: Exhaust air from locker rooms other than those provided in accordance with s. ILHR 54.13 may be directed through the adjoining toilet room or shower room.

ILHR 64.55 THEATERS AND PLACES OF ASSEMBLY. (1) SCOPE. This section applies to all auditoriums, arenas, armories, assembly halls, banquet halls, billiard rooms, bowling alleys, cafeterias, club rooms, dance halls, dining rooms, gymnasiums, lecture halls, lodge halls, playrooms, restaurants, school auditoriums, Sunday schools and places of worship, funeral home chapels, parochial schools, convents, indoor skating rinks, and theaters which accommodate more than 100 persons for entertainment, recreation, worship, or dining purposes.

Note: For areas that will accommodate less than 100 persons, see s. ILHR 64.54.

(2) VENTILATION. The air change, supply and distribution for all occupancies under this classification shall conform to the requirements of s. ILHR 64.05.

(3) ALTERNATE SERVICE AND CAPACITY. Heating and ventilating systems installed in places of worship, Sunday schools, and lodge halls may be arranged for selective delivery of the entire service to either the first floor area or to the basement floor area provided these areas are not used simultaneously.

(4) STAGES. The stage in any theater or assembly hall, for which a fire curtain is required, shall be supplied with sufficient air or other means to equalize the pressure to avoid deflecting the curtain.

Note: See ss. ILHR 55.21 through 55.23 concerning proscenium walls and curtains.

ILHR 64.56 SCHOOLS AND OTHER PLACES OF INSTRUCTION. (1) SCOPE. This section applies to all public and private schools, colleges, universities, academies, seminaries, libraries, museums, art galleries, all places used for vocational instruction and research such as laboratories, shops, science rooms, and all parts of buildings used for instructional purposes.

(2) VENTILATION. (a) The air change, supply and distribution shall conform to the requirements of s. ILHR 64.05.

(b) For corridors provided with lockers, the air supply shall be accomplished by means of air inlets admitting air from adjacent classrooms or by a direct tempered air supply. Air from corridors with lockers may be recirculated.

(3) EXHAUST SYSTEMS AND HEAT RECOVERY. (a) An exhaust system, as specified in s. ILHR 64.54 (3), shall be provided for all equipment and processes that create dust, fumes, vapors and gases injurious to health.

(b) Exhaust systems whose operation is more than 3600 hours per year shall be equipped with heat recovery devices to reduce the energy consumption in the building.

1. Exception. a. Systems exhausting explosive materials, such as perchloric acid need not be so equipped.

b. Fan systems exhausting 250 CFM or less need not be so equipped.

ILHR 64.57 HEALTH CARE FACILITIES. (1) SCOPE. The rules of this section apply to hospitals, nursing homes and outpatient surgical facilities where medical services are provided.

(2) GENERAL. (a) The heating ventilating and air conditioning systems of all occupancies within the scope of this sections shall be designed, operated and maintained as specified in AIA, "Guidelines for Construction and Equipment of Hospital and Medical Facilities."

Note #1: Newer versions of the Guidelines may be used in their entirety when approved by the Department.

Note #2: The 1992-93 edition of the Guidelines has been deemed as acceptable and although other portions of the Guidelines may be used for determining the needs of the HVAC system, the majority of the requirements pertaining to the HVAC system will be found in sections 2, 7.31.A. to D., 8.11.A. to D., 9.2.L., 9.4.I., 9.5.L., and 9.6.J of that standard.

Note #3: The newest version of the Guidelines which has been deemed acceptabledard is the 1996-97 edition titled "Guidelines for Design and Construction of Hospital and Health Care Facilities" Although other portions of the Guidelines may be used for determining the needs of the HVAC system, the majority of the requirements pertaining to the HVAC system will be found in sections 2, 7.31.A. to D., 8.31.A. to D., 9.31.L., 9.4.I., 9.5.L., and 9.6.J of the newest standard.

(b) The heating, ventilating and air conditioning system shall also be designed, operated and maintained as specified in the applicable sections of the following standards as referenced in AIA, "Guidelines for Construction and Equipment of Hospital and Medical Facilities."

1. NFPA No. 90A;

2. ASHRAE Handbook of Fundamentals; and

3. ASHRAE Standard No. 52.

(3) APPLICATION OF RULES. Where other provisions of ch. ILHR 64 specify different requirements than those contained in this section, the requirements in sub.(2) shall govern.

ILHR 64.58 PENAL INSTITUTIONS AND PLACES OF DETENTION. (1) SCOPE. This section applies to all corridors and areas of compulsory occupancy in penal institutions, mental hospitals and other places of detention.

(2) VENTILATION. The air change, supply and distribution for all areas of this class shall conform to the requirements of s. ILHR 64.05.

(3) OVERNIGHT LOCK-UPS. Where cells are provided for not more than 6 occupants for the purpose of overnight detention only, exhaust ventilation shall be provided on the basis of 6 air changes per hour for the occupied area.

ILHR 64.59 RESIDENTIAL OCCUPANCIES. (1) SCOPE. This section applies to all apartments, row houses, rooming houses, hotels, motels, dormitories, and all other places of abode.

Note: See s. ILHR 51.01 (102a) for definition of "place of abode."

(2) VENTILATION. The air change, supply and distribution for all areas of this class shall conform to the requirements of s. ILHR 64.05.

(3) RETURN AIR DUCTS. Unlined wood joists and stud spaces will be permitted to be used as return air ducts in individual living units provided with individual heating and ventilating systems.

ILHR 64.60 DAY CARE FACILITIES. (1) SCOPE. This section applies to all public and private day care centers accommodating more than 4 children, including all buildings or parts of buildings used as child day care facilities.

(2) VENTILATION. The air change, supply and distribution for all areas of this class shall conform to the requirements of s. ILHR 64.05.

ILHR 64.61 REPAIR AREAS. (1) SCOPE. This section applies to all areas where motor-driven vehicles are repaired involving the fuel system components or requiring the operation of the internal combustion engine.

(2) VENTILATION. The air change, supply and distribution shall be provided in accordance with the requirements of s. ILHR 64.05. The exhaust air shall be drawn from not more than 18 inches above the floor.

(3) TAIL PIPE EXHAUST. (a) Mechanical exhaust system. A mechanical exhaust system shall be provided in the repair area to remove the exhaust fumes from internal combustion engines. The duct system shall be designed with sufficient outlets to accommodate the total number of vehicles in the repair area. A flexible hose, equipped with a device for connecting it to the exhaust pipe of the vehicle and to the exhaust system, shall be provided. Each outlet shall be provided with a shut-off valve that can be closed when not in use. The blower capacity shall be sufficient to exhaust a volume of air not less than 100 cubic feet per minute for each opening.

(b) Nonmechanical exhaust. A noncombustible flexible tube or hose not more than 10 feet long, connected to the engine exhaust (tail pipe) and terminating outside the building, may be used in lieu of the requirements stated in par. (a).

Note: The requirements stated in sub. (2) need not be increased when satisfying the requirements of either sub. (3) (a) or (b). Also see ch. 32, Safety and Health Standards for Public Employes.

(4) MISCELLANEOUS REPAIR AREAS. Areas involved in the servicing of small internal combustion engines such as lawn mowers, snowmobiles, chainsaws, cycles, boat engines, and similar types of engines, and battery charging areas, shall be ventilated as required for repair areas under s. ILHR 64.05.

(5) CONTAMINANTS. If the provisions of this section do not provide sufficient ventilation to meet the standards for threshold limit values covered in ch. ILHR 32, Safety and Health Standards for Public Employes, the additional exhaust requirements with an equivalent volume of outside air shall be provided to satisfy the requirements found in ch. ILHR 32.

ILHR 64.62 VEHICLE SERVICE BUILDINGS. (1) APPLICATION. (a) This section applies to liquid fuel dispensing stations and facilities where vehicles can be driven into the building for washing, greasing, oil change, tire replacement, body repair, and similar operations.

(b) The exhaust air shall be drawn from not more than 18 inches above the floor.

(2) VENTILATION. (a) Air change, supply, distribution and exhaust shall be provided as specified in s. ILHR 64.05.

(b) Buildings or portions of buildings having a capacity of and used exclusively for washing 2 or more vehicles simultaneously shall be exhausted at not less than 1/2 cubic foot per minute per square foot of floor area based on that portion of the floor located between the termination of the conveyor system and the vehicle exit door. A supply of makeup air is not required for this exhaust.

(c) If the provisions of this section do not provide sufficient ventilation to meet the standards for threshold limit values covered in ch. ILHR 32, Safety and Health Standards for Public Employes, the additional exhaust requirements with an equivalent volume of outside air shall be provided to satisfy the requirements found in ch. ILHR 32.

ILHR 64.63 GARAGES. (1) SCOPE. This section applies to all buildings, or parts of buildings, into which motor vehicles are driven for loading or unloading or are stored.

(2) VENTILATION. (a) Except as permitted in pars. (b), (c) and (d), the air change, supply and distribution for garages shall be provided in accordance with s. ILHR 64.05. Exhaust air shall be drawn not more than 18 inches above the floor.

(b) The air change, supply and distribution for a storage garage accommodating 6 or more vehicles may be provided by permanent open-wall areas, if:

1. The open-wall areas equal at least 30% of the total wall area enclosing the garage;

2. The open-wall areas are distributed to permit air circulation throughout the garage; and

3. The entire floor of the garage is located at or above grade.

(c) The air movement, supply and distribution for a storage garage accommodating 6 or more vehicles may be provided by 3% openings that comply with s. ILHR 64.05(4) if:

1. The building is unoccupied.

2. The storage garage building does not contain and is not attached to any other occupancy or use.

3. The entire floor of the garage is located at or above grade.

(d) An intermittent mechanical exhaust ventilation system may be used in lieu of continuous exhaust if the conditions given in subds. 1. and 2. are met.

1. The system shall be activated to provide exhaust ventilation rates specified in s. ILHR 64.05 by a continuous monitoring and detection system which can maintain carbon monoxide levels below 35 ppm and nitrogen dioxide levels below one ppm.

2. The system shall be provided with automatic controls to provide exhaust ventilation at a rate of 1/2 cfm per square foot for a total of at least five hours in each 24-hour period.

3. A means shall be provided to maintain negative pressure relative to adjacent areas.

(3) CONTAMINANTS. If the provisions of this section do not provide sufficient ventilation to meet the standards for threshold limit values covered in ch. ILHR 32, Safety and Health Standard for Public Employes, the additional exhaust requirements with an equivalent volume of outside air shall be provided to satisfy the requirements found in ch. ILHR 32.

ILHR 64.64 VEHICLE SHOWROOMS. (1) SCOPE. This section applies to all vehicle showrooms with offices and occupancies unless designed as part of the vehicle garage adjacent to repair or vehicle storage areas where all vehicles displayed in the showroom are without batteries and fuel tanks are empty and free of fumes.

Note: A live storage area is any area used for storage of fire trucks, tractors, automobiles, trucks, and similar self-propelled vehicles which are driven in and out of the storage area under their own power; it does not include areas where vehicles and equipment are stored for seasonal periods, or areas where vehicles are displayed without batteries and where the gasoline tanks of the vehicles are empty and free of fumes

(2) VENTILATION. The air change, supply and distribution shall be provided in accordance with the requirements of s. ILHR 64.05.

(a) Separate ventilating system. A separate ventilating system shall be provided for showrooms or offices where such occupancies are adjacent to repair or live storage areas.

Note: Ventilation is not required if an openable area is provided to conform with the requirements of s. ILHR 64.07.

(b) Recirculation. Air shall not be recirculated from any repair, live storage or service area unless the total volume of air in circulation is in excess of the ventilation required. Excess air may be recirculated.

(c) Contaminants. If the provisions of this section do not provide sufficient ventilation to meet the standards for threshold limit values covered in ch. ILHR 32, Safety and Health Standards for Public Employes, the additional exhaust requirements with an equivalent volume of outside air shall be provided to satisfy the requirements found in ch. ILHR 32.

ILHR 64.65 GENERAL SANITATION AND SERVICE AREAS. (1) SCOPE. This section applies to toilet rooms, diaper changing rooms, locker rooms, shower rooms, and janitor

closets. Separate diaper changing rooms shall be ventilated in the same manner as required for toilet rooms at 2 cfm per square foot.

(2) EXHAUST VENTILATING SYSTEMS. Exhaust ventilating systems serving this class of occupancy may be combined with other exhaust services provided the combined system:

(a) Does not allow recirculation; and

(b) Does not include grease hood exhaust, radioactive exhaust, fume hood exhaust, exhaust required by ch. ILHR 32, exhaust that requires electrical grounding, or exhaust that requires spark resistant fan construction.

(3) VENTILATING SYSTEM APPLICATION. Ventilation shall be provided for all areas of this class in accordance with this subsection. Areas of this class that are not ventilated in accordance with applicable pars. (a) through (e) shall be provided with mechanical exhaust ventilation as specified in s. ILHR 64.05. The effectiveness of the exhaust shall be greater than the supply.

(a) Toilet rooms that have only one water closet or urinal shall be provided with either natural ventilation via a window with at least 2 square feet of area openable directly to the outside, or mechanical exhaust ventilation as specified in s. ILHR 64.05. Toilet rooms that have only one water closet or urinal that are not located in restaurants or taverns may use an approved ductless air circulating and treatment device in place of natural or exhaust ventilation.

(b) Janitor closets that have only one service sink or receptor shall be provided with either natural ventilation via a window with at least 2 square feet of area openable directly to the outside, or an approved ductless air circulating and treatment device, or mechanical exhaust ventilation as specified in s. ILHR 64.05.

(c) Bathrooms with one bathtub or shower, or one combined tub and shower, and one water closet or urinal shall be provided with mechanical exhaust ventilation capable of exhausting 50 cubic feet per minute.

(d) Adjoining locker, shower and toilet rooms shall be exhausted at the rate specified in s. ILHR 64.05, based on the largest amount of exhaust required for any of the three rooms. The rooms shall be provided with tempered make-up air supplied directly from the outside or transferred from other areas of the building in accordance with s. ILHR 64.18. A negative pressure relationship shall be maintained in the shower and toilet rooms with respect to the locker room.

(e) Rooms for the changing of clothing only with provisions for short-term storage of clothes, other than areas for industrial employes as specified in s. ILHR 64.54 or areas for employes exposed to toxic materials as specified in s. ILHR 54.13, shall be ventilated as changing rooms as specified in s. ILHR 64.05, Table 64.05. This paragraph does not apply to shower or toilet rooms.

(f) Chemical or septic toilets shall not be placed in rooms provided with mechanical ventilation. Toilet rooms with chemical or septic toilets shall be provided with natural ventilation via a window with at least 2 square feet of area openable directly to the outside. The window shall be provided with a screen to limit the passage of insects and vermin.

(4) MAINTENANCE OF NEGATIVE PRESSURE. Toilet rooms and janitor closets shall be provided with negative pressure relative to adjacent areas. If supply air is provided to toilet rooms or janitor closets, the exhaust must also be provided simultaneously.

ILHR 64.66 NATATORIUMS. (1) POOL VENTILATION. In natatoriums, a volume of tempered outside air supply and exhaust shall be provided at the rate specified in s. ILHR 64.05. The tempered outside air may be supplied directly from the outside or transferred from other areas of the building in accordance with s. ILHR 64.18. The volume of tempered air and exhaust may be reduced to a minimum of one cubic foot per minute per square foot of pool surface provided automatic humidity controls are used to limit the relative humidity to 60%.

(2) AIR MOVEMENT. The air change rate in a natatorium shall be not less than 6 air changes per hour unless mechanical cooling is provided to satisfy the heat gain requirement for the space.

ILHR 64.67 KITCHENS. (1) SCOPE. This section applies to all areas where food is prepared, except in domestic science educational facilities from grades kindergarten through 12, and single unit apartments in hotels, motels and apartment buildings.

(2) EXHAUST VENTILATION SYSTEMS. Exhaust ventilation systems serving this occupancy shall not be used for any other service.

(a) Required exhaust ventilation. When cooking equipment is being operated, mechanical exhaust ventilation shall be provided at a rate specified in s. ILHR 64.05 for every occupied area within the scope of this section. When cooking equipment is not being operated, a minimum supply of outside air and exhaust at 7.5 cfm per person or natural ventilation with openings equal in area to 3% of the floor area as specified in s. ILHR 64.07 shall be provided during periods of occupancy.

(b) Kitchen exhaust hoods. Cooking equipment which produces grease laden vapors, including but not limited to fryers, grills, griddles and broilers, shall be provided with a kitchen exhaust hood, except an exhaust hood does not have to be provided for a single piece of equipment if:

1. The piece of equipment has a frying/cooking surface area of 4 square feet or less; and

2. The piece of equipment is the only piece of grease-producing equipment for the entire food preparation operation.

(3) REPLACEMENT AIR. Adequate replacement air shall be provided to equal the air being exhausted by all exhaust systems.

(4) EXHAUST HOOD REQUIREMENTS. (a) Size of hood. The horizontal inside dimensions for canopy hoods shall be sized to effectively capture grease vapors, but in no case shall these dimensions be less than the overall horizontal dimensions of the grease-producing equipment. The horizontal inside dimensions for noncanopy, prefabricated backshelf hoods may be less than the overall horizontal dimensions of the grease-producing equipment.

(b) Exhaust rates. The kitchen exhaust hood shall be provided with a capture velocity to effectively capture the grease vapors and may be designed through engineering analysis or the empirical design formulas stated below:

1. Canopy hood. Hood open on all 4 sides: Q = 125 cfm A (area).

2. Wall hood. Hood open on 3 sides or less: Q = 80 cfm A (area).

3. Slotted-type hood. V = 350 feet per minute through the slot opening. The slot shall be at least 3 inches in width and shall extend around the open sides of the hood; and

4. Noncanopy hood. The minimum volume of exhaust air for noncanopy type hoods (prefabricated backshelf) may be not less than Q = 200 cfm L (length).

Note: Q equals the exhaust air in cubic feet per minute; A equals the area of the hood over the grease-producing equipment in square feet; V equals the velocity in feet per minute; and L equals the total length in feet of the cooking appliance being ventilated, and measured parallel to the front edge of the appliance.

(c) Materials. Hoods shall be constructed and supported by steel not less than .0478 inch U.S. standard gage (No. 18 manufacturers standard gage) or stainless steel not less than .0359 inch U.S. standard gage (No. 20 manufacturers standard gage) or other materials of equivalent strength, fire and corrosion resistance.

Note: The Department of Health and Social Services (DHSS) may have additional requirements for materials in commercial food preparation areas. For more information, contact the DHSS Environmental Sanitation Unit.

(d) Seams. All seams and joints shall be liquid-tight.

(e) Grease-removal devices. Approved grease extractors, grease filters or other grease-removal devices shall be provided.

(f) Exposed hood surfaces. Hood surfaces and exposed exhaust ducts within 18 inches of combustible material shall be protected as specified in sub. (5) (f).

(g) Concealed hood surfaces. Hood surfaces that are concealed by or recessed into adjoining construction shall be protected as specified in sub. (5) (f).

(h) Double-wall hoods utilizing outdoor air. When hoods are connected to ducts supplying outside air, performance data shall be submitted.

Note: Double-wall hoods provided with a supply of outdoor air conserve energy.

(5) EXHAUST DUCTS FROM HOODS. (a) Design. All ducts shall lead, as directly as possible, to the exterior of the building without forming dips or traps which collect residues. Ducts exposed to the exterior shall be protected with a suitable weatherproof coating.

Note: Temperatures in excess of 2000°F. may be experienced within ducts in the event of fire. A means of expansion of long ducts should be considered.

(b) Materials. Ducts shall be constructed of and supported by steel not lighter than .0598 inch U.S. standard gage (No. 16 manufacturers standard gage) or stainless steel not lighter than .0478 inch U.S. standard gage (No. 18 manufacturers standard gage) or other materials of equivalent strength, fire and corrosion resistance.

(c) Seams and joints. All seams and joints shall be liquid-tight.

(d) Clean-out openings. Accessible clean-out openings at the sides of ducts shall be provided at each change of direction of the duct for inspection and servicing.

(e) Interior ducts. Ducts shall not pass through required fire walls or partitions.

(f) Concealed exhaust ducts. 1. ' Horizontal ducts.' Horizontal concealed ducts connected to hoods that pass through any other area of the building, including suspended ceilings, shall be protected with insulating material to withstand a flue temperature of not less than 1000°F. The temperature of the exposed surface of the insulating material shall not exceed 250°F. above the normal ambient temperature of 68°F.

Note: The department will accept the use of masonry chimneys or manufactured chimneys which are tested and approved for use at a flue gas temperature of not less than 1000°F., or insulating materials for fire endurance systems listed in the Fire Resistance Index published by Underwriters' Laboratories, Inc.

2. 'Vertical ducts.' Vertical concealed ducts that pass through any other area of the building, including suspended ceilings, in one- and 2-story buildings, shall be protected with insulating material as specified in subd. 1., or shall be located in 2-hour noncombustible fire-resistive enclosures.

Note: In buildings of 3 or more stories, vertical ducts shall be located in 2-hour noncombustible fire-resistive enclosures.

(g) Exposed exhaust ducts. Exposed exhaust ducts connected to hoods or canopies shall be located not less than 18 inches from combustible material unless the duct is protected in accordance with the requirements of par. (f).

(h) Air discharge. The air discharge shall be directed away from the roof or combustible materials.

(i) Dampers. 1. Fire dampers shall not be installed in kitchen exhaust duct systems unless the assembly includes an approved extinguishing system designed to operate with a fire damper in the closed position.

2. Dampers shall be accessible for cleaning and maintenance.

(6) AUTOMATIC SUPPRESSION SYSTEMS. Exhaust hoods and ducts in kitchens used for commercial purposes shall be protected by an approved automatic fire suppression system. The suppression system shall comply with the following:

(a) When the fire suppression system is activated, all gas and electrical sources serving cooking appliances, grease consuming appliances or fume incinerators and equipment associated with the hoods shall be automatically deactivated. Such gas and electrical sources shall not be capable of reactivation except by manual means after the fire suppression system has been serviced and is again ready for action;

(b) 1. Except as provided in subd. 2., hood and duct suppression systems shall provide for both automatic and manual actuation of the system;

2. Automatic fire sprinkler systems using water need not be provided with means for manual actuation.

(c) A manual station for actuation of the suppression system shall be located at or near one of the means of egress from the area but not nearer than 10 feet to the range hood and shall be securely mounted not less than 4 1/2 feet nor more than 5 feet above the floor, unless otherwise specifically approved by the chief of the fire department having jurisdiction;

(d) The system shall be maintained at full operating capacity by the owner and shall be serviced every 6 months; and

(e) All nozzles shall be accessible for cleaning and replacement.

(7) SUPPLY DUCTS TO HOODS. Kitchen hood supply ducts shall meet SMACNA gauge steel thicknesses. Exhaust hood assemblies with integrated air supply plenums shall be designed and provided with a fire-actuated damper as specified in NFPA 96.

ILHR 64.68 Seasonal occupancies. When approved in writing by the department, heating requirements may be waived but not ventilation required by s. ILHR 64.05, Table 1 during the period of May 15 through September 15 for the following or similar occupancies: drive-in eating places, club houses, outdoor toilets, camp lodge buildings, canning factories and migrant labor camps.

Note: Rules on migrant labor can be found in ch. Ind 201.

SECTION 45. ILHR A64.06(1) of the appendix is repealed.

SECTION 46. ILHR 66.14 (3)(c) is repealed and recreated to read:

ILHR 66.14 (3)(c) Energy Conservation Data. Calculations and specifications that contain the details and data required by s. ILHR 63.01 shall be submitted for the types of projects outlined in s. ILHR 63.001. The submittal shall be on forms provided by the department or other forms approved by the department.

Note: See A50.12 of the appendix of chs. ILHR 50 to 64 for sample copies of forms.

SECTION 47. ILHR 66.14 (3)(d) is repealed and recreated to read:

ILHR 66.14 (3)(d) Heating and ventilating data. A description of the construction for the walls, floors, ceilings, and roof and the transmission coefficients of the construction materials shall be furnished. The calculations shall include heat losses for the individual rooms, including transmission, infiltration or ventilation losses, whichever are greater; a summary of the total building heat loss expressed in Btu/hour or watts; heat gain calculations for air conditioning systems; ventilation calculations, including outside air requirements for each space and ventilation system expressed in cubic feet per minute or liters per second; and percent of outside air at maximum and minimum flow rates when the building is occupied.

Note: If the code does not specify a required calculation method, the department will accept as the basis for calculations and design data the methods and standards recommended by the Mechanical Contractors' Association of America; the American Society of Heating, Refrigerating and Air-Conditioning Engineers; and the Institute of Boiler and Radiator Manufacturers.

SECTION 48. ILHR 66.46 is repealed and recreated to read:

ILHR 66.46 Natural light and ventilation. (1) Every habitable room shall be provided with natural light by means of glazed openings.

(2) Glazed openings shall consist of windows, skylights, or glazed doors, or a combination of the three, except that no more than 25% of the minimum required light for a dwelling unit may be provided with skylights.

(3) The area of glazed openings shall equal at least 8% of the floor area of the room served.

(4) Glazed openings serving habitable rooms shall view onto the outside.

SECTION 49. ILHR 66.47 is repealed and recreated to read:

ILHR 66.47 ISOLATION OF HAZARDS. (1) TWO-HOUR ENCLOSURES. Except as provided in sub. (3), a 2-hour fire-resistive rated enclosure shall be provided for all rooms in a 3- to 6-story building that are used for storage of flammable or combustible liquids, trash collection, or other similar hazards. Isolation of heating equipment shall comply with ss. ILHR 64.21 and 64.22. Flammable and combustible liquid isolations shall also comply with ch. ILHR 10. If the building is protected with an automatic fire sprinkler system in accordance with s. ILHR 66.33 (1), the isolation may be reduced to a 1-hour fire-resistive rated enclosure.

(2) ONE-HOUR ENCLOSURES. Except as provided in sub. (3), a 1-hour fire-resistive rated enclosure shall be provided for all rooms in a 2-story or shorter building that are used for storage of flammable or combustible liquids, trash collection, or other similar hazards. Isolation of heating equipment shall comply with ss. ILHR 64.21 and 64.22. Flammable and combustible liquid isolations shall also comply with ch. ILHR 10.

(3) EXCEPTIONS. (a) 1. A residential clothes dryer having a rated capacity of 37,000 Btu/hour or less may be used within a dwelling unit without providing a fire-resistive rated enclosure.

2. A laundry of not more than 100 square feet that is in a nondwelling unit portion may be either protected with a sprinkler system complying with s. ILHR 66.33 (1), or isolated with a 1-hour fire-resistive rated enclosure.

(b) A furnace and water heater serving a single dwelling unit, when located within that unit, may be used without a fire-resistive rated enclosure.

SECTION 50. Chapter ILHR 72 is repealed.

SECTION 51. ILHR 82.40 (5)(b) is repealed and recreated to read:

ILHR 82.40 (5)(b) Temperature maintenance. If the developed length of hot water distribution piping from the source of the hot water supply to a plumbing fixture or appliance exceeds 100 feet, a circulation system or self-regulating electric heating cable shall be provided to maintain the temperature of the hot water within the distribution piping.

1. If a circulation system is used to maintain the temperature, no uncirculated hot water distribution piping may exceed 25 feet in developed length.

2. If a self-regulating electric heating cable is used to maintain the temperature, the cable shall extend to within 25 feet of each fixture or the appliance.

3. Water distribution piping conveying circulated water or served by a self-regulating electric heating cable shall be insulated to limit the heat loss at the external surface of the pipe insulation to a maximum of 25 BTUs per hour per square foot for aboveground piping and 35 BTUs per hour per square foot for underground piping. The maximum heat loss shall be determined at a temperature differential, T, equal to the maximum water temperature minus a design ambient temperature no higher than 65°F.

4. Water distribution piping served by self-regulating electric heating cable shall be identified as being electrically traced in accordance with ch. ILHR 16.

5. The installation of self-regulating electric heating cable may be subcontracted by a plumber to another trade.

Note: See s. ILHR 63.29 for pipe insulation requirements.

(END)

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EFFECTIVE DATE

Pursuant to s. 227 (2)(b), Stats., these rules shall take effect on April 1, 1997.

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Wisconsin
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Tommy G. Thompson, Governor
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December 5,1996

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Douglas LaFollette
Secretary of State
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Madison, Wisconsin 53703

Dear Messrs. Poulson and LaFollette:

TRANSMITTAL OF RULE ADOPTION

CLEARINGHOUSE RULE NO.: 96-144

RULE NO.: Ch. ILHR 63 & 64

RELATING TO: Energy Conservation and Ventilation

Pursuant to section 227.20, Stats., agencies are required to file a certified copy of every rule adopted by the agency with the offices of the Secretary of State and the Revisor of Statutes.

At this time, the following material is being submitted to you:

1. Order of Adoption.
2. Rules Certificate Form.
3. Rules in Final Draft Form.

Pursuant to section 227.114, Stats., a summary of the final regulatory flexibility analysis is included for permanent rules. A fiscal estimate and fiscal estimate worksheet is included with an emergency rule.

Respectfully submitted,

for William J. McCoshen
Secretary