94-116

RULES CERTIFICATE

STATE OF WISCONSIN)
) SS
DEPT. OF INDUSTRY,)
LABOR & HUMAN RELATIONS)

TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETINGS:

I, Carol Skornicka, Secretary of the Department of Industry, Labor and Human Relations, and custodian of the official records of said department, do hereby certify that the annexed rule(s) relating to Energy Conservation and HVAC (Subject) were duly approved and adopted by this department on 8/8/95 (Date).

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 and affixed the official seal of the department at 4:00 pm in the city of Madison, this 8th day of August A.D. 19 95.

Secretary

4/1/96 ... 95

ORDER OF ADOPTION

Pursuant to authority vested in the Department of Industry, Labor and Human Relations by section(s) 101.02(1) and (15),

Stats., the Department of Industry, Labor and Human Relations [X] creates; [X] amends; [X] repeals and recreates; [X] repeals and adopts rules of Wisconsin Administrative Code chapter(s):

ILHR 50-64 and 72 (Number) Energy Conservation and HVAC (Title)

The attached rules shall take effect on The first day of the fourth month following publication pursuant to section 227.22, Stats.

Adopted at Madison, Wisconsin this

date: August 8, 1995

DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS

Secretary

ADM-6055(R.01/95)

State of Wisconsin \ Department of Industry, Labor and Human Relations

RULES in FINAL DRAFT FORM

Rule No.: Chs ILHR 50-64 and 72

Relating to: Energy Conservation and Heating Ventilating and Air Conditioning

Clearinghouse Rule No.: 94-116

ADM-6053 (R 06/92)

The Wisconsin Department of Industry, Labor and Human Relations proposes an order to repeal ss. ILHR 52.54, 54.14, 55.29, 56.15, 57.14, 58.24 (1), Table 58.24-A, 58.62, 59.21, 60.37, 62.32, 62.78, 62.965, 62.995 (6), 63.02 to 63.42, 64.12, 64.42 (2)(b), 64.54 (5), 64.59 (2)(a), 66.46 (2), Ch. 72, 82.40 (5)(b) 3.; to renumber ss. ILHR Table 58.24-B, 58.24 (3), Subchapter VII, 63.50 to 63.51, Subchapter VIII, 63.61 to 63.62, 64.08 (2), 64.22 (3), 64.42 (2)(c), 64.51 (2), 64.53, 82.40 (3)(b) 4. and 5.; to renumber and amend ss. ILHR Table 51.08, 58.24 (2), 63.60; to amend ss. ILHR 50.12 (4)(b), 50.23 (2), 50.12 (4)(c), 50.01 (7), Table 51.03-B, 51.08 (title), Table 51.25-9, Table 51.25-17, 57.13 (2)(b), 58.25 (1)(a) and (b), 58.44 (title), 58.44 (1), 60.19 Note, 63.001 (3)(b), 63.001 (2), 63.001 (3)(c), 63.01, Subchapter II (title), 64.07 (2), 64.08 (3), 64.09 (intro.), 64.09 (1)(d), 64.09 (2)(b), 64.17 (1), 64.19 (5), 64.20 (3) (Note), 64.21 (2)(a), 64.33 (2), 64.34 (1), 64.34 (2), 64.42 (1) (intro.) 64.54 (2), 64.55 (2), 64.58 (2), 64.59 (2), 64.60 (2), 64.61 (2), 64.61 (4), 64.62 (2)(a), 64.63 (1), 64.63 (2)(a), 64.64 (2), 64.65 (1), 64.66 (1), 64.67 (2)(a), 64.67 (5)(I), 66.47; to repeal and recreate ss. ILHR 51.01 (102), Table 51.25-7, Table 51.25-10, 52.53, 54.145, 55.05, 56.145, 57.145, 58.02, 58.44 (3), 59.22, 60.10, 62.23, 62.93, 64.05 and 64.06, 64.14 (1), 64.19 (1)(a), Table 64.21, 64.22 (5)(c), 64.34 (3)(c), 64.39, 64.42 (1)(a) and (b), 64.52 (1), 64.54 (3)(b), 64.54 (4), 64.56 (2), 64.63 (2)(c), 64.65 (3), 66.14 (3)(c), 66.14 (3)(d); and to create ss. ILHR Table 51.08-2, Table 51.25-13M, Tables 51.25-17M and 51.25-18M, 63.001 (3)(d), 63.05 to 63.53, 64.025. 64.08 (2)(b), 64.18 (1)(c), 64.18 (2), 64.22 (3)(b) to (d), 64.22 (3)(e), 64.22 (10), 64.22 (11), 64.34 (5), 64.41 (1)(b), 64.42 (2)(a) (Note), 64.42 (2)(c), 64.42 (Notes), 64.50 (1)(d) (Note), 64.51 (2)(b), 64.53 (2) to (4), 64.63 (2)(d), 64.64 (4)(c) (Note), 64.65 (4), 64.67 (7), 82.40 (5)(b) (Note), relating to energy conservation and heating, ventilating and air conditioning systems.

* *

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 proposed rule changes are primarily a revision of ch. ILHR 63, Energy Conservation, and ch. ILHR 64, Heating Ventilating and Air Conditioning (HVAC).

The current chs. ILHR 63 and 64 are based on standards published by the American Society of Heating and Refrigerating Engineers (ASHRAE). Newer editions of those standards have been issued and the code needs to be updated to be consistent with current technology and building practices. The last comprehensive revisions of chapters ILHR 63 and 64 were made in 1986.

With the revision of ch. ILHR 63, the department also hopes to fulfill a requirement of the federal Energy Policy Act of 1992 (EPACT). That act requires all states to certify to the federal Department of Energy that their energy code for commercial buildings meets or exceeds ASHRAE/EIS standard 90.1-1989.

A synopsis of the major revisions to ch. ILHR 63 follows.

The revised ch. ILHR 63 consists 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 current code contains a subchapter on water heating, those requirements will be 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 ACP tables offer some flexibility in the design of fenestration.

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

Subchapter IV - Equipment and Systems, contains efficiency standards only for HVAC equipment that is <u>not</u> 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 are 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 zonal 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 proposed rules expand 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 proposal allows exemptions for types of lighting considered to be essential and credits are given for the use of automatic controls.

In the proposal, no substantive changes are 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 are 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 current code are 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 specifies 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 designed to maintain an acceptable level of indoor air quality where the major source of contamination is human occupancy. The amount of carbon dioxide is used as an indicator of indoor air quality, and the amounts of outside air are intended to keep the carbon dioxide level below 1000 parts per million (ppm) as directed by the ASHRAE standard.

One difficulty with specifying the outdoor air requirement in cfm per person is the accurate estimation of the number of occupants for each room of a building at the time the HVAC system is being designed. To address this difficulty, the design outdoor air requirements of table 64.05 have been revised so that they are on a square foot basis. The proposal was developed by multiplying the occupant densities of the current Table 64.05 by 7.5 cfm.

The proposal requires that HVAC systems be designed and sized to provide the specified cfm per square foot of outside air to each room. The proposal allows three options for providing outside air in system operation:

Option 1: The system may be operated to provide each room with the amount of outside air based on the cfm per square foot specified in Table 64.05; or

Option 2: The system may be operated to provide each room with 15 cfm of outside air for each person in that room; or

Option 3: the system may be operated to provide outside air calculated for the entire system using a methodology from the ASHRAE 62 standard which allows outdoor air amounts for areas with different ventilation requirements to be somewhat "averaged" over the entire building which reduces the amount of outside air that would otherwise be required.

Of the options, the first is the most simple, but may result in overventilation of spaces that are sparsely occupied. Options 2 and 3 are more complex, but allow the outside air to be reduced to achieve the minimum level of outside air adequate for indoor air quality without excessive energy costs.

A synopsis of other major changes to ch. ILHR 64 follows.

ILHR 64.06 will specify 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 will require 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) will restrict 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 is 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 have been amended as well.

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

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

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

ILHR 64.63(2)(d) requirements for intermittent ventilation of garages are 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 have been revised and include a requirement for mechanical exhaust ventilation for bathrooms with tub or shower facilities to be consistent with the Uniform Dwelling Code.

The proposed rules were developed after consultation with its 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
Harry Hackler, Department of Administration
William Jankovich, Building Owners & Managers Assoc. of Milwaukee, Inc.
Russ Lerum, Department of Health and Social Services
James Mapp, Division of Energy and Intergovernmental Relations
Harold Olsen, Self - Private Consultant
Dave Osborne, Wisconsin Builders Association
John Paulson, Self - Private Consultant
Joseph Powelka, Wisconsin Society of Architects/AIA
Randy Sikkema, Wisconsin Chapter ASHRAE
Richard Newman, Mechanical Contractors Association of Wisconsin
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

ENERGY/HVAC LIGHTING SUBCOMMITTEE

Thom Flickenger, Durrant Engineers
Marty Martin, Arnold and O'Sheridan, Inc.
John Carvin, Affiliated Engineers, Inc.
Ross DePaola, Intergrated Energy Services
Jim Mapp, Department of Administration
Carol Stemrich, Public Service Commission
Stan White, Department of Administration
James Reiner, Luma Tech
Bill Raymond, Electrical Contractors Association

Chapter ILHR 72, Intermittent Ignition Devices for New residential Gas Appliances, is being repealed because it was preempted by the National Appliance Energy Conservation Act of 1987. Requirements for energy conserving features in new residential gas appliances are in CFR part 430, Energy Conservation Program for Consumer Products.

SECTION 1. ILHR 50.03 (2) is amended 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 2. ILHR 50.12 (4)(b) is amended 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. ~~Thermal performance information shall be provided as specified in s. ILHR 63.12.~~

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

SECTION 3. ILHR 50.12 (4)(c) is amended to read:

ILHR 50.12 (4)(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: ~~The~~ 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 4. ILHR 51.01 (7) is amended 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 5. 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 6. Table 51.03-B is amended to read:

(Partial Table)

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.

SECTION 7. ILHR 51.08 (title), (1) and (2) are amended 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 ~~51.08~~ Table 51.08-1.

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

~~(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.

SECTION 8. Table 51.08 is renumbered Table 51.08-1 and is amended to read:
(Partial table)

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			
		Occupants ≤750	Occupants >750			Health Care	Detention[o]	≤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
Ch 55											
≤750 occupants	3[n]	3[e]	4[e]	3[f,g]	3	3[a]	3[b]	3	4	3	4
>750 occupants	4[n]	4[e]	4[e]	4[f,g]	4	4[a]	4[b]	~~3~~4	4	~~3~~4	4
Ch 56	0	3[f,g]	4[f,g]	0	i	2[a]	2[b]	2	3	2	3
Ch 57	i	3	4	i	i	2[a]	2[b]	1[c]	2	2[c,i]	3
Ch 58											
Health Care	2[a]	3[a]	4[a]	2[a]	2[a]	0	2[b]	3	4	3	4
Detention[o]	2[b]	3[b]	4[b]	2[b]	2[b]	2[b]	0	3	4	3	4
Ch 59											
Storage ≤500 sq ft	1[c,d]	3	3	2	1[c]	3	3	0	1[k]	1[k]	1[k]
Repair ≤500 sq ft	2	4	4	3	2	4	4	1[k]	0	1[k]	1[k]
Storage >500 sq ft	2[c,d]	3	3	2	2[c,j]	3	3	1[k]	1[k]	0	1[k]
Repair >500 sq ft	3	4	4	3	3	4	4	1[k]	1[k]	1[k]	0

FOOTNOTES TO TABLE ~~51.08~~ 51.08-1: (Partial table)

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.

SECTION 9. Table 51.08-2 is created to read:

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 s. ILHR 64.21 for fuel-fired heating equipment See also ILHR 10 for flammable/combustible liquid requirements See exceptions in footnotes 1, 2, 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	See Footnote 3
Ch 58 Health care Detention	2	3	N/A
Ch 59 Storage ≤ 500 sq ft Repair ≤ 500 sq ft Storage > 500 sq ft Repair > 500 sq ft	2	2	N/A
Ch 60	1	2	N/A
Ch 61	N/A	N/A	N/A
Ch 62 Open parking structures	2	2	N/A
Ch 62 Assembly seating facilities	2	2	N/A
Greenhouses	1	N/A	

Footnotes

(1) Fuel-Fired Heating Equipment. All fuel-fired boilers, furnaces and water heaters shall be isolated in accordance with Table 64.21.

(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 except as follows:

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 ILHR 52.20) shall be located separately in a 2-hour 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 ILHR 51.02 (22).

SECTION 10. Table 51.25-7 is repealed and recreated to read:

Table 51.25-7

ANSI	American National Standards Institute, Incorporated 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).

Table 51.25-7
(Continued)

ANSI	American National Standards Institute, Incorporated 1430 Broadway New York, New York 10018
Standard Reference Number	Title
4. Z21.64-1990	Direct Vent Central Furnaces.
5. Z83.4-1991, with Z83.4a-1992 Addenda	Direct Gas-Fired Make-up Air Heaters.
6. Z83.8-1989, with Z83.8a-1990 and Z83.8b-1992 Addendum	Gas Unit Heaters.
7. Z83.9-1990, with 83.9a-1992 Addenda	Gas-Fired Duct Furnaces.
8. Z83.18-1990, with Z83.18a-1991 and Z83.18b-1992 Addenda	Direct Gas-Fired Industrial Air Heaters.
9. Z97.1-1994	Safety Glazing Materials Used in Buildings.
10. 101-93	ANSI/AAMA Aluminum Prime Windows and Sliding Glass Doors.
11. I.S.2-87	ANSI/NWWDA Wood Window Units.
12. I.S.3-88	ANSI/NWWDA Wood Sliding Patio Doors.

SECTION 11. Table 51.25-9 is amended to read:

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, ~~1985~~ 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.

SECTION 12. Table 51.25-10 is repealed and recreated to read:

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.

Table 51.25-10
(Continued)

ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, Pennsylvania 19103
Standard Reference Number	Title
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.
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.
	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.

Table 51.25-10
(Continued)

ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, Pennsylvania 19103
Standard Reference Number	Title
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.
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.

Table 51.25-10
(Continued)

ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, Pennsylvania 19103
Standard Reference Number	Title
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.
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.

Table 51.25-10
(Continued)

ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, Pennsylvania 19103
Standard Reference Number	Title
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.

SECTION 13. Table 51.25-13M is created to read:

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

SECTION 14. Table 51.25-17 is amended to read:

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-~~1988~~ 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.
15. 90A-1985	Standard for the installation of air conditioning and ventilating systems.

Table 51.25-17
(Continued)

NFiPA	National Fire Protection Association One Batterymarch Park Quincy, Massachusetts 02169
Standard Reference Number	Title
16. 96-1991	Standard for the installation of equipment for the removal of smoke and grease-laden vapors from commercial cooking equipment.
~~16~~ 17. 211-1988	Standard for chimneys, fireplaces, vents and solid fuel burning appliances.
~~17~~ 18. 231-1990	Standard for general storage.
~~18~~ 19. 231C-1990	Rack storage of materials.

SECTION 15. Tables 51.25-17M and 51.25-18M are created to read:

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 51.25-18M

SMACNA	Sheet Metal and Air Conditioning Contractors National Association Vienna, Virginia 22180
Standard Reference Number	Title
	HVAC Duct Leakage Test Manual, 1st Ed, 1985.

SECTION 16. 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 17. ILHR 52.54 is repealed.

SECTION 18. ILHR 54.14 is repealed.

SECTION 19. 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 20. 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 21. ILHR 55.29 is repealed.

SECTION 22. 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 23. ILHR 56.15 is repealed.

SECTION 24. ILHR 57.13 (2)(b) is amended 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 25. ILHR 57.14 is repealed.

SECTION 26. 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 27. 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 28. ILHR 58.18 (1) is amended 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 29. ILHR 58.24 (1) is repealed.

SECTION 30. ILHR 58.24 (2) is renumbered 58.24 (1) and is amended to read:

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

SECTION 31. Table 58.24-A is repealed.

SECTION 32. Table 58.24-B is renumbered Table 58.24.

SECTION 33. ILHR 58.24 (3) is renumbered 58.24 (2).

SECTION 34. ILHR 58.25 (1)(a) and (b) are amended 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-B~~ 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 ~~58.24-A and 58.24-B~~ 51.08-2 and 58.24.

SECTION 35. ILHR 58.44 (title) is amended to read:

ILHR 58.44 (title) SEPARATION FROM OTHER OCCUPANCIES AND HAZARD ENCLOSURES.

SECTION 36. ILHR 58.44 (1) and (3)(title) are amended to read:

ILHR 58.44 (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 ~~by at least 2 hour fire resistive rated construction as specified in s. ILHR 51.04~~ 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).

(3)(title) HAZARD ENCLOSURES. ~~All openings in occupancy separations shall be protected by fire resistive door assemblies as specified in s. ILHR 58.60.~~ Hazards shall be enclosed in accordance with s. ILHR 51.08.

SECTION 37. ILHR 58.62 is repealed.

SECTION 38. ILHR 59.21 is repealed.

SECTION 39. 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 40. 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 41. ILHR 60.18 (2) is amended to read:

ILHR 60.18 (2) Fresh air at the rate of ~~5~~ 15 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 42. ILHR 60.19 Note is amended to read:

Note: NFPA Standard No. 30 is ~~not~~ a mandatory standard for the storage of flammable and combustible liquids within the scope of ch. ILHR 10.

SECTION 43. ILHR 60.37 is repealed.

SECTION 44. 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 45. ILHR 62.32 is repealed.

SECTION 46. ILHR 62.78 is repealed.

SECTION 47. 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 48. ILHR 62.965 is repealed.

SECTION 49. ILHR 62.995 (6) is repealed.

SECTION 50. ILHR 63.001 (2) is amended to read:

ILHR 63.001 (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.

SECTION 51. ILHR 63.001 (3)(b) and (c) are amended to read:

ILHR 63.001 (3)(b) Any alteration, including change of occupancy or use of any existing building or structure within the scope of this chapter, which would increase the energy consumption shall not be permitted unless such building or structure is made to comply with the requirements of this chapter.

(c) 1. heating and cooling equipment replacement ~~and complete lighting system 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.

SECTION 52. ILHR 63.001 (3)(d) is created to read:

ILHR 63.001 (3)(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.

SECTION 53. ILHR 63.01 is amended to read:

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~~, and the thermal performance value of the building envelope~~. 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.

SECTION 54. ILHR 63.02 to 63.42 are repealed.

SECTION 55. ILHR 63.05 to 63.53 are created to read:

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" 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:

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

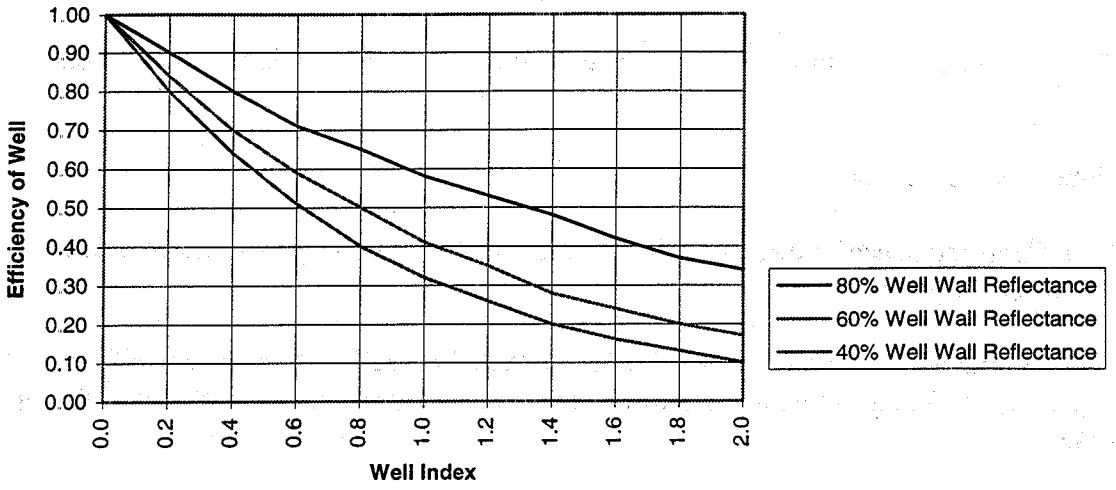
; or

(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 Sliding Glass Doors.

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

3. ANSI/NWWDA I.S.2 Wood Window Units (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 Sliding 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. 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.

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 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.

(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 occupancy and 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) Based on the occupancy type for the proposed design, select the point of entry to the tables.

(b) Select the Shading Coefficient of 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).

(c) 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) MAXIMUM OVERALL THERMAL TRANSMITTANCE FOR THE OPAQUE ABOVE-GRADE WALL ASSEMBLY. The overall thermal transmittance for the opaque above-grade wall assembly or U_{ow} shall be less than the maximum U_{ow} listed in the appropriate ACP table.

(a) For a wall assembly of heat capacity less than 5 Btu/ft^2 °F, use the maximum U_{ow} value indicated for a lightweight wall assembly.

(b) To use the mass wall adjustment for wall assemblies of heat capacity greater than or equal to 5 Btu/ft^2 °F, determine the mass wall heat capacity and insulation position. If the wall insulation is positioned internal to or integral with the wall mass, use the column headed "Interior." If the wall insulation is positioned external to the wall mass, use the column headed "Exterior" to determine the maximum U_{ow}.

Note: Heat capacities of typical masonry wall assemblies are given in the appendix. See s. ILHR 63.05 for a definition of "mass wall insulation position."

(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 63.15-2.

(b) Skylights for which daylight credit cannot be taken in accordance with s. ILHR 63.13 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.

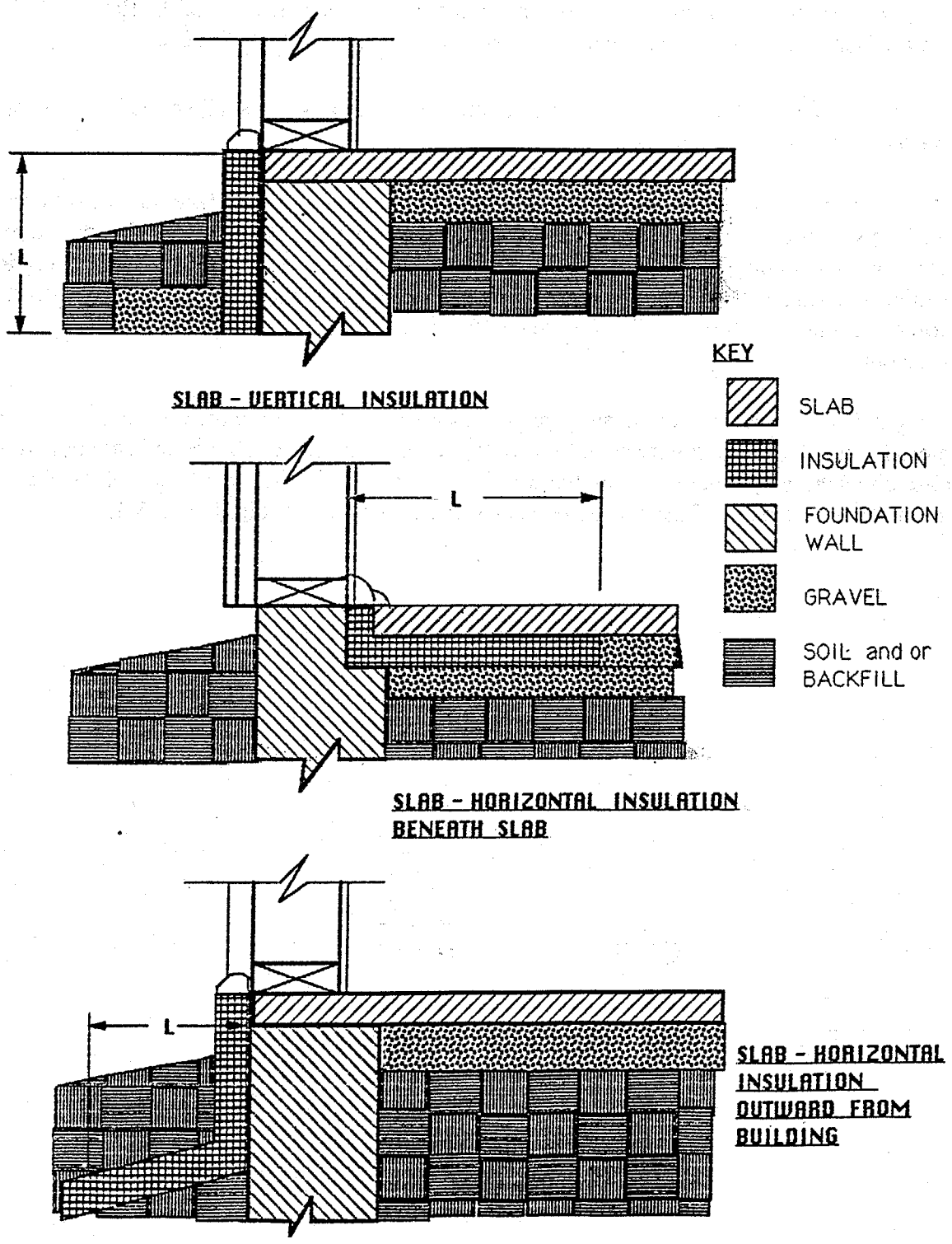
(5) THERMAL RESISTANCE VALUE FOR SLAB-ON-GRADE FLOORS. (a) Unheated slab-on-grade floors shall have insulation around the perimeter of the floor with the thermal resistance (R_u) of the insulation as listed in the appropriate ACP table.

(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. See Figure 63.15-1 for examples of acceptable insulation placement.

(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 as illustrated in Figure 63.15-1.

Figure 63.15-1 Illustration of slab-on-grade insulation placement.



L = The minimum horizontal distance specified in Figure 63.15-2 ACP Tables, part A4, B4, or C4.

(6) THERMAL RESISTANCE OF BELOW-GRADE WALL ASSEMBLY. (a) The thermal resistance of the below-grade wall assembly of the building shall be greater than or equal to that listed in the appropriate ACP table.

(b) The R-value required for below grade walls refers to the overall R-value of the wall assembly excluding air film coefficients and the adjacent ground.

(c) No insulation is required for those portions of walls more than one story below grade.

Figure 63.15-2
Degree Day Regions

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

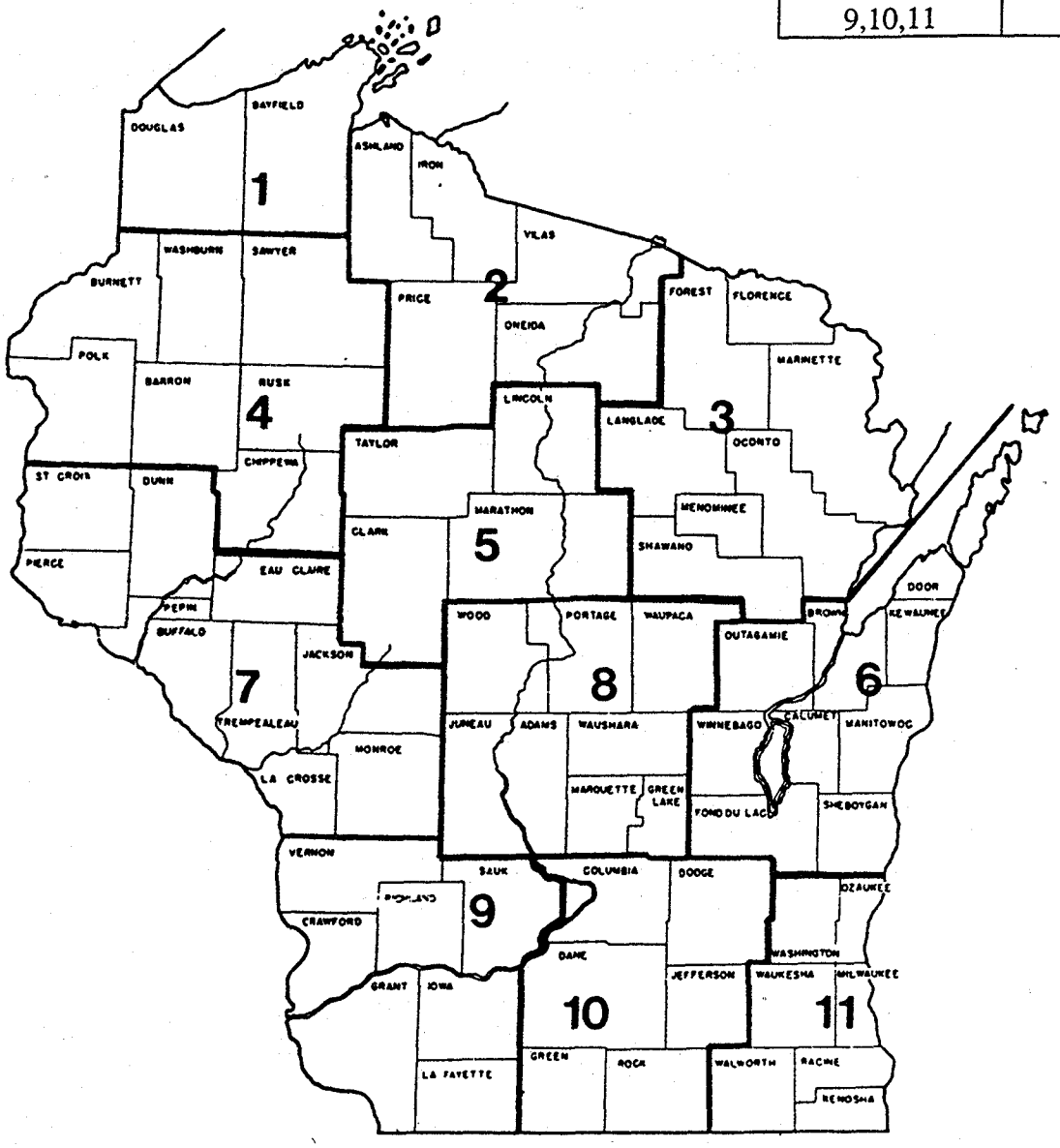


Figure 63.15-2 (Continued)
Alternate Component Package
ACP Table A

Part A1: Windows				
Occupancy Type	Shading Coefficient Range (SC_x)	Maximum Window Wall Ratio For U_{of} Range		
		0.52 to 0.40	0.39 to 0.31	0.30 to 0.00
Residential and Warehouse	1.00 - 0.72	26	30	33
	0.71 - 0.61	29	35	39
	0.60 - 0.51	30	38	44
	0.50 - 0.39	31	41	49
	0.38 - 0.26	30	43	56
	0.25 - 0.00	29	42	59
Other Than Residential or Warehouse	1.00 - 0.72	23	25	27
	0.71 - 0.61	25	29	32
	0.60 - 0.51	28	33	36
	0.50 - 0.39	30	36	42
	0.38 - 0.26	31	41	49
	0.25 - 0.00	32	44	59

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: Opaque Wall Max U_{ow}		
Heat Capacity	Insulation Position	
	Interior	Exterior
HC<5 Light Weight	0.058	0.058
HC≥5 Mass Wall	0.059	0.071
HC≥10 Mass Wall	0.062	0.078
HC≤15 Mass Wall	0.064	0.080

Part A4: 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

* See Figure 63.15-1

Figure 63.15-2 (Continued)
Alternate Component Package
ACP Table B

Part B1: Windows				
Occupancy Type	Shading Coefficient Range (SC_x)	Maximum Window Wall Ratio For U_{of} Range		
		0.52 to 0.40	0.39 to 0.31	0.30 to 0.00
Residential and Warehouse	1.00 - 0.72	23	25	26
	0.71 - 0.61	26	29	31
	0.60 - 0.51	28	33	36
	0.50 - 0.39	31	37	42
	0.38 - 0.26	30	43	51
	0.25 - 0.00	29	42	60
Other Than Residential or Warehouse	1.00 - 0.72	19	20	21
	0.71 - 0.61	22	24	25
	0.60 - 0.51	25	28	30
	0.50 - 0.39	28	32	35
	0.38 - 0.26	32	38	43
	0.25 - 0.00	33	45	57

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: Opaque Wall Max U_{ow}		
Heat Capacity	Insulation Position	
	Interior	Exterior
HC<5 Light Weight	0.065	0.065
HC≥5 Mass Wall	0.067	0.086
HC≥10 Mass Wall	0.072	0.098
HC≤15 Mass Wall	0.076	0.100

Part B4: 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

* See Figure 63.15-1

Figure 63.15-2 (Continued)
Alternate Component Package
ACP Table C

Part C1: Windows				
Occupancy Type	Shading Coefficient Range (SC_x)	Maximum Window Wall Ratio For U_{of} Range		
		0.52 to 0.40	0.39 to 0.31	0.30 to 0.00
Residential and Warehouse	1.00 - 0.72	26	29	30
	0.71 - 0.61	29	33	36
	0.60 - 0.51	31	37	42
	0.50 - 0.39	33	41	47
	0.38 - 0.26	34	46	56
	0.25 - 0.00	34	49	66
Other Than Residential or Warehouse	1.00 - 0.72	22	24	25
	0.71 - 0.61	26	28	30
	0.60 - 0.51	28	32	35
	0.50 - 0.39	31	36	40
	0.38 - 0.26	34	43	50
	0.25 - 0.00	38	50	63

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: Opaque Wall Max U_{ow}		
Heat Capacity	Insulation Position	
	Interior	Exterior
HC<5 Light Weight	0.072	0.072
HC≥5 Mass Wall	0.075	0.100
HC≥10 Mass Wall	0.082	0.110
HC≤15 Mass Wall	0.087	0.120

Part C4: 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

* See Figure 63.15-1

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.

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.

$$U_o = SU_iA_i/A_o$$
$$= (U_1A_1 + U_2A_2 + \bullet\bullet\bullet\bullet + U_nA_n)/A_o$$

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.

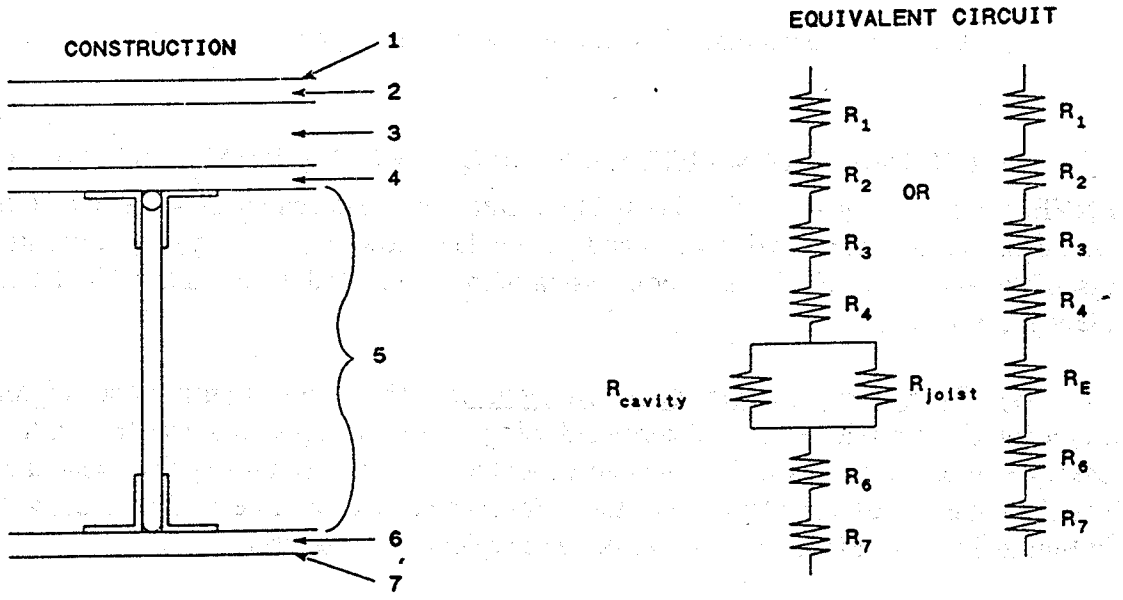
(2) THERMAL TRANSMITTANCE (U_i) OF AN INDIVIDUAL PATH THROUGH AN ENVELOPE ASSEMBLY. The thermal transmittance of each envelope shall be determined with consideration of all major series and parallel heat flow paths through the elements of the assembly and film coefficients. Compression of insulation 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 $1/R_e = \frac{(1 - \%\ \text{joist})}{R\ \text{cavity}} + \frac{\%\ \text{Joist}}{R\ \text{joist}}$ or $R_e = R\ \text{cavity} \times F_C$

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-- no thermal break*	Aluminum Frame-- thermal break*	Wood or Vinyl Frame
Single glazing			
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 sapce	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-- no thermal break*	Aluminum Frame-- thermal break*	Wood or Vinyl Frame
Single glazing			
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 sapce	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-- no thermal break*	Aluminum Frame-- thermal break*	Wood or Vinyl Frame
Single glazing			
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 sapce	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 plenums 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

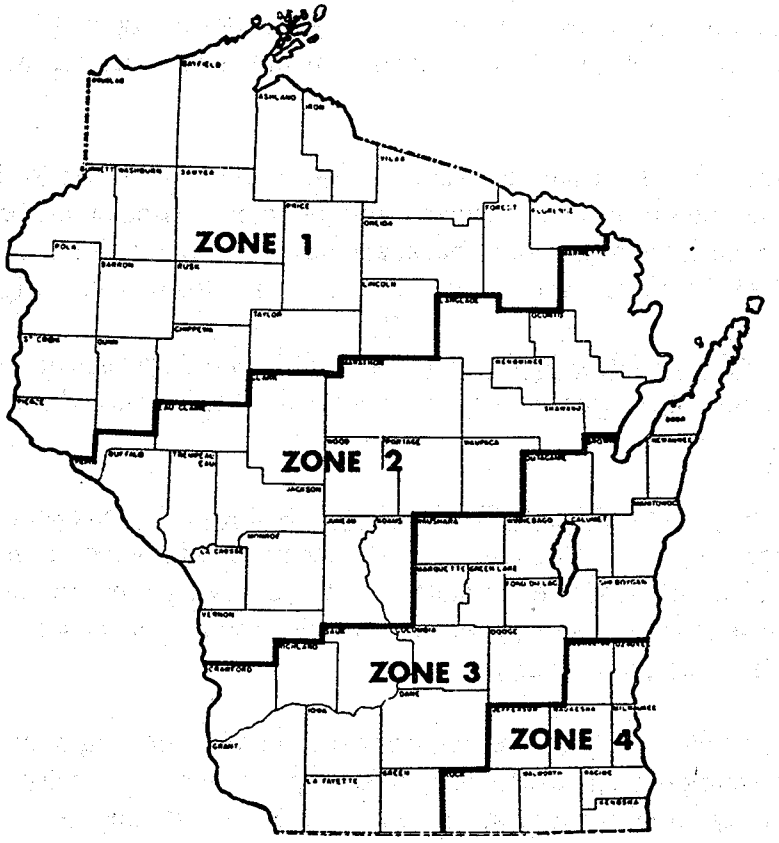
ILHR 63.23 LOAD CALCULATIONS FOR SIZING. (1) CALCULATION PROCEDURES. Heating and cooling system design loads for the purpose of sizing systems and equipment shall be determined in accordance with the procedures described in the ASHRAE Handbook, Fundamentals Volume, or a similar computation procedure 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 may be taken from either Figure 63.23 or ASHRAE 90.1.

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 sytems, 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^2•°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

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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 specified in subs. (1) to (6).

(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; and

(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.

(6) Lighting that has a minimum efficacy of 30 lumens per watt for lamps under 30 watts, and 60 lumens per watt for sources 30 watts and greater.

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 feeet	
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 feeet	0.15
Automatic time switch control device	Spaces ≤ 250 square feeet	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*

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
Storge 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.

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

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

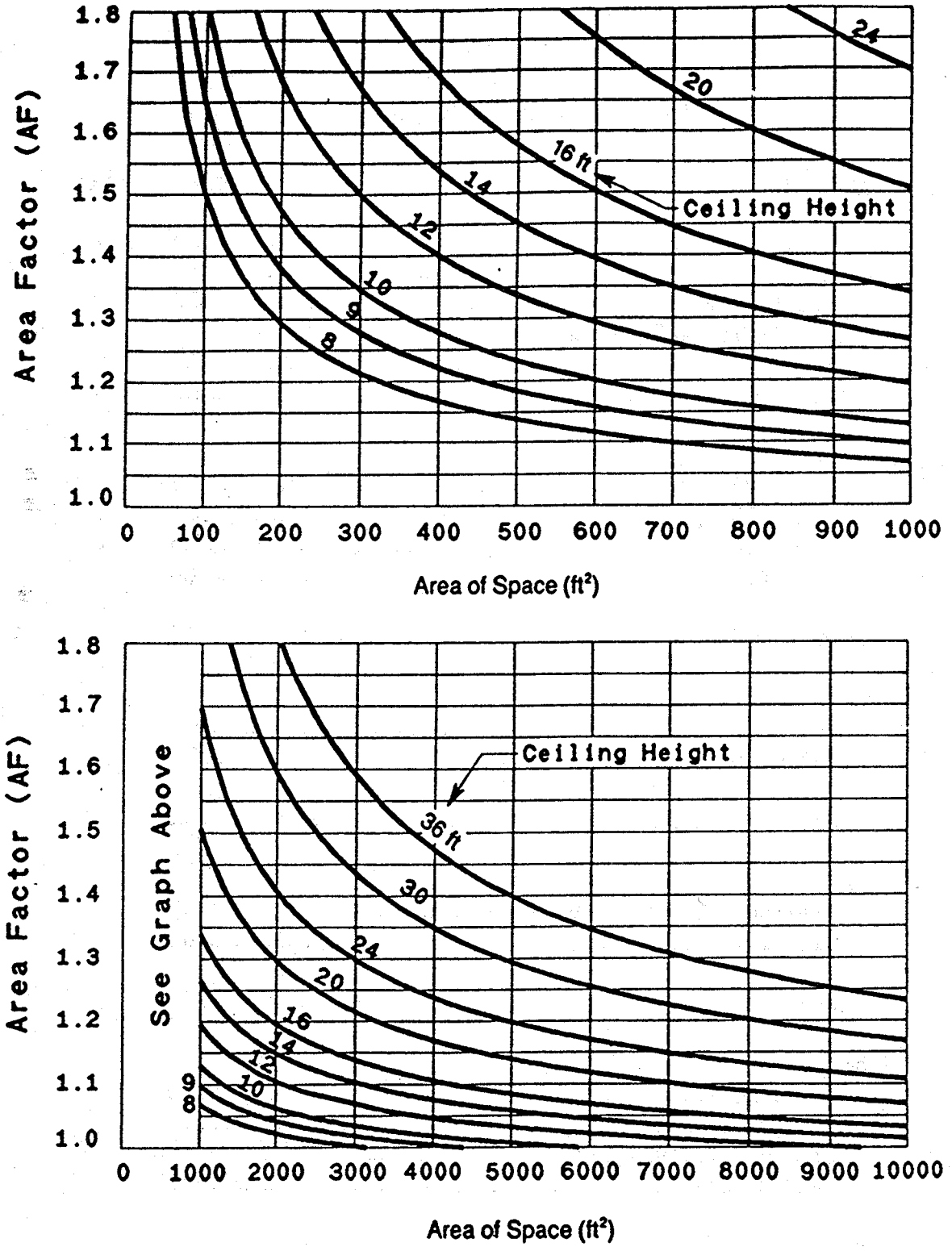

Figure 63.49 Area Factor

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
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	

Table 63.49
Continued

Activity/Area	UPD W/ft^2	Note
Carpentry	2.3	
Welding	1.2	
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.

Table 63.49 (Continued)
Unit Power Densities
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	
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	

Table 63.49
Continued

Activity/Area	UPD W/ft^2	Note
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	
Service Station/Auto Repair	1.0	
Theater		
Performance Arts	1.5	
Motion Picture	1.0	
Lobby.	1.5	

Table 63.49
Continued

Activity/Area	UPD W/ft^2	Note
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	

Table 63.49 (Continued)
Unit Power Densities
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
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.

SECTION 56. Subchapter VII of Chapter ILHR 63 is renumbered Subchapter VI.

SECTION 57. ILHR 63.50 to 63.51 are renumbered 63.60 to 63.61.

SECTION 58. Subchapter VIII of Chapter ILHR 63 is renumbered Subchapter VII.

SECTION 59. ILHR 63.60 is renumbered 63.70 and is amended to read:

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 ~~VI~~ 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.

SECTION 60. ILHR 63.61 to 63.62 are renumbered 63.71 to 63.72.

SECTION 61. Subchapter II (title) of Chapter ILHR 64 is amended to read:

Subchapter II (title) DESIGN AND OPERATION REQUIREMENTS

SECTION 62. ILHR 64.025 is created to read:

ILHR 64.025 DEFINITIONS. In this chapter: (1) "Air conditioning" means the process of treating air to control temperature or humidity and distributing to meet the requirements of the conditioned space.

(2) "Air movement" means the total quantity of air circulated within a 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.

SECTION 63. ILHR 64.05 and 64.06 are repealed and recreated to read:

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 DESIGN REQUIREMENTS. The ventilating system shall be designed 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 determined using the cfm per square foot of net floor area specified in Table 64.05 and with a minimum air movement as specified in s. ILHR 64.06 (3).

(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 determined using the cfm per square foot of net floor area specified in Table 64.05 and with a minimum air movement as specified in

s. ILHR 64.06 (3), 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.

ILHR 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			
			Percent of Openings[4]	CFM/Net Square Feet Floor Area	Air Movement 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)	3	0.10	---	64.54, 64.68
Conference rooms	67	(a)	---	0.50	3	64.54
Court and jury rooms	67	(b)	3	1.25	3	64.54
Factories and machine shops	60	(b)	3	0.10	---	64.54
Flammable liquids storage	NMR	(d)	---	---	---	64.18, ILHR 10
Foundries and boiler shops	50	(b)	3	0.10	---	64.13, 64.54
Funeral homes:						
Chapel	67	(b)	3	1.25	---	64.54
Embalming room	67	(d)	---	2.00	---	64.54
Offices	67	(a)	---	0.10	1.5	64.54
Places of worship, entertainment and recreation which accommodates less than 100 persons	†	(b)	3	†	---	64.54
Printing establishments	60	(a)	---	---	3	64.18, 64.54
Retail establishments	65	(b)	3	0.13	1.0	64.54
Shopping mall corridor areas (except mercantile areas)	NMR	(f)	---	---	---	64.54
Security vaults (occupied)	65	(a)	---	0.03	---	64.54
Warehouses	NMR	---	---	---	---	64.18, 64.54
Dark room	65	(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)						

Use or Occupancy[6]	Minimum Inside Temperature (Degrees F)	Ventilation Requirements[1]				Applicable Occupancy Code Section (ILHR Number)
		Ventilation Classification	Basis of Capacity			
			Percent of Openings[4]	CFM/Net Square Feet Floor Area	Air Movement Minimum Air Change Per Hour With A/C	
Arenas and field houses (use seated area)	60	(a)	---	1.25	2	64.55
Armory drill floors	55	(a)	---	0.25	---	64.55
Assembly halls (other than church)	67	(a)	---	1.25	2	64.55
Bowling alleys	67	(a)	---	0.50	2	Based on occupied areas
Cafeterias, dining areas, restaurants, billiard rooms	67	(a)	---	0.75	2	64.55
Places of worship:						
Chapels	67	(b)	3	1.25	---	64.55 (3)
Dining and social rooms	67	(b)	3	0.50	---	64.55 (3)
Nave or auditorium	67	(b)	3	1.25	---	64.55 (3)
Class rooms	67	(b)	3	0.50	---	64.55 (3) Note 7
Dance halls	67	(a)	---	0.50	2	64.55
Ice skating rinks (indoor)	NMR	(a)	---	0.50	---	64.55
Ice resurfacing (indoor)	NMR	(d)	---	---	---	64.18, 64.55
Lodge halls, club rooms	65	(a)	---	0.50	2	64.55
Roller skating rinks (indoor)	50	(a)	---	0.50	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)	---	1.25	2	64.55
Lobbies	65	(a)	---	0.50	---	64.55
Lounge rooms	67	(a)	---	0.50	---	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)	---	0.50	2	64.55
Gambling casinos	67	(a)	---	0.50	2	64.55
Health care facilities	See s. ILHR 64.57					
Schools or other places of instruction						
Administrative office space	67	(a)	---	0.10	1.5	64.56
Arts, crafts,	67	(a)	---	0.25	2	64.56

Use or Occupancy[6]	Minimum Inside Temperature (Degrees F)	Ventilation Requirements[1]				Applicable Occupancy Code Section (ILHR Number)
		Ventilation Classification	Basis of Capacity			
			Percent of Openings[4]	CFM/Net Square Feet Floor Area	Air Movement Minimum Air Change Per Hour With A/C	
Classrooms	67	(a)	---	0.50	2	64.57
Gymnasiums, field houses, auditoriums, theaters (fixed seats)	67	(a)	---	1.25	2	64.56
Bleachers	---	(a)	---	2.73	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)	---	0.10	2	64.56
Home economics	67	(a)	---	0.25	2	64.56
(cooking)	67	(d)	---	Note 5	---	64.67
Laboratories (science)	67	(a)	---	0.25	2	64.18
Lecture halls	67	(a)	---	1.25	2	64.56
Corridors with lockers	67	---	---	---	10 cfm/lineal foot	64.56
Library and resource centers	67	(a)	---	0.38	2	64.56
Reading rooms	67	(a)	---	0.38	2	64.56
Stack areas	67	(d)	---	0.25	---	64.56
Lunchrooms	65	(a)	---	0.75	1	64.56
Museums and art galleries	67	(a)	---	0.19	2	64.56
Music rooms (instrumental)	67	(a)	---	0.38	2	64.56
(vocal)	67	(a)	---	0.75	2	64.56
Special education	67	(a)	---	0.21	2	64.56
Study halls, common areas with nonfixed seating	67	(a)	---	0.75	2	64.56
Toilet rooms	65	(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)	---	0.15	2	64.18
Wardrobes, coat rooms	NMR	(d)	---	2.00	---	64.65

Use or Occupancy[6]	Minimum Inside Temperature (Degrees F)	Ventilation Requirements[1]				Applicable Occupancy Code Section (ILHR Number)
		Ventilation Classification	Basis of Capacity			
			Percent of Openings[4]	CFM/Net Square Feet Floor Area	Air Movement Minimum Air Change Per Hour With A/C	
Detention facilities						
Sleeping rooms	67	(a)	---	---	---	64.58
Residential occupancies						
Living and sleeping areas	67	(b)	4	Note 4	---	64.59
Day care facilities	67	(a)	---	0.21	2	64.60
Garages and service stations						
Automobile showrooms:						
Less than 6 vehicles	60	(b)	3	---	---	64.64
6 or more vehicles	60	(d)	---	0.50	---	64.64
New vehicles only	60	(a)	---	0.10	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 cfm/sink	---	64.65
Locker rooms and shower rooms	70	(d)	---	2 or 35 cfm/locker	---	64.65
Toilet rooms	65	(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 cfm/locker	---	64.65 & 54.13

Use or Occupancy[6]	Minimum Inside Temperature (Degrees F)	Ventilation Requirements[1]				Applicable Occupancy Code Section (ILHR Number)
			Basis of Capacity			
		Ventilation Classification	Percent of Openings[4]	CFM/Net Square Feet Floor Area	Air Movement Minimum Air Change Per Hour With A/C	
Changing rooms	70	(b)	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)	3	0.50	---	64.68
Living and sleeping areas	NMR	(e)	4	---	---	64.68
Club houses	NMR	(b)	3	0.50	---	64.68
Drive-ins	NMR	(b)	3	0.50	---	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 facilities (water closets and urinals)

† 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 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.

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 shall be determined in accordance with either par. (a) or (b) or (c). Exhaust ventilation in equal volume shall be maintained simultaneously. Where the amount of outside air is based on the number of occupants, the number of occupants shall be determined using the peak anticipated occupancy levels. Where peak occupancy levels of less than 3 hours duration occur, the amount of outside air may be determined on the basis of average occupancy over the duration of the system operation, provided the average occupancy used is not less than one-half the maximum.

(a) The amount of outside air delivered to each room may be based on the net area of the room and Table 64.05.

(b) The amount of outside air delivered to each room may be based on 15 cfm for each person occupying the room.

(c) 1. Where more than one room is served by a common supply system, the minimum system outdoor air quantity may be determined using the following equations:

$$\text{Minimum system outdoor air} = Y \times \text{system supply air}$$

and $Y = X/[1 + X - Z]$

Where

$Y = V_{ot}/V_{st}$ = corrected fraction of outdoor air in system supply

$X = V_{on}/V_{st}$ = uncorrected fraction of outdoor air in system supply

$Z = V_{oc}/V_{sc}$ = fraction of outdoor air in the critical room. The critical room is that room with the greatest required fraction of outdoor air in the supply to the room.

V_{ot} = corrected total outdoor air flow rate

V_{st} = total supply flow rate, i.e., the sum of all supply for all branches of the system

V_{on} = sum of outdoor air flow rates for all branches on system based on 15 cfm per occupant

V_{oc} = outdoor air flow rate required in the critical room based on 15 cfm per occupant

V_{sc} = supply flow rate in the critical room

2. The corrected fraction of outdoor air, or more, shall make up the system supply when the space is occupied. If the amount of supply air varies, the corrected fraction of outside air shall also vary so that the equation specified in subd. 1. is always satisfied.

3. The minimum air movement shall be provided in accordance with this subdivision. The minimum air movement shall be the greater of the minimum determined in accordance with sub. (2) below, or the minimum for any space for any operating condition determined in accordance with subd. 1. above.

4. The number of people assumed to occupy each room shall be provided in the operation and maintenance manual specified in s. ILHR 64.53. When the number of occupants varies during periods of system operation, the length of time periods of the different occupancy levels shall be provided. The information shall be made available to the department upon request.

Note: See Appendix A and ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality, for additional explanatory information.

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 (5).

(2) AIR MOVEMENT. Air movement shall be provided while people are present. The air movement 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.

(a) Six air changes per hour. When required for (a) and (b) ventilation classifications, as specified in s. ILHR 64.05, the total air movement shall be at least 6 air changes per hour.

(b) Less than 6 air changes per hour. An air movement 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 movement may not be less than the minimum air changes per hour if specified in Table 64.05.

(c) Where the amount of outside air is provided in accordance with sub. (1)(c), the minimum air movement shall be determined in accordance with that subsection and shall not be waived in accordance with par. (d).

(d) Air movement requirement waived. The air movement 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.

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.

SECTION 64. ILHR 64.07 (2) is amended to read:

ILHR 64.07 (2) VESTIBULE OPENINGS. Vestibule type openings may be used to satisfy the requirements specific in sub. (1) only for the areas into which the vestibule opens and which are not separated from the vestibule by an additional door.

SECTION 65. ILHR 64.08 (2) is renumbered 64.08 (2)(a).

SECTION 66. ILHR 64.08 (2)(b) is created to read:

ILHR 64.08 (2)(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.

SECTION 67. ILHR 64.08 (3) is amended to read:

ILHR 64.08 (3) OPERATION. The required building exhaust ventilation system shall operate continuously ~~during periods of occupancy~~ 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.

SECTION 68. ILHR 64.09 (intro.) is amended to read:

ILHR 64.09 (intro.) 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.

SECTION 69. ILHR 64.09 (1)(d) is amended to read:

ILHR 64.09 (1)(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, ~~or~~ and where 150% of the air required for theoretical complete combustion is no greater than 1/4 air change govern the design.

Note: See s. ILHR 64.22 for special conditions.

SECTION 70. ILHR 64.09 (2)(b) is amended to read:

ILHR 64.09 (2)(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 ~~when~~ before the burner is in operation.

SECTION 71. ILHR 64.12 is repealed.

SECTION 72. ILHR 64.14 (1) is repealed and recreated to read:

ILHR 64.14 (1) MAKE-UP AIR. A supply of tempered outside air shall be provided when the volume of exhaust exceeds 1/2 air change per hour in the area served by the exhaust.

SECTION 73. ILHR 64.17 (1) is amended to read:

ILHR 64.17 (1) GENERAL. Except as provided by sub. (2), automatic controls shall be provided to maintain design temperatures, control ventilation to provide 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, ~~during periods of occupancy~~ when occupied.

SECTION 74. ILHR 64.18 (1)(c) is created to read:

ILHR 64.18 (1)(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.

SECTION 75. ILHR 64.18 (2) is created to read:

ILHR 64.18 (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.

SECTION 76. ILHR 64.19 (1)(a) is repealed and recreated to read:

ILHR 64.19 (1)(a) Location to prevent contamination. Outside air intake openings for ventilation including 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, exhaust vents and plumbing vents. Exceptions to this paragraph are given in subds. 1. to 3.

1. Exhaust vents of 100 cfm or less shall be located at least 12 inches, measured in any direction, from 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.

Note: 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.

SECTION 77. ILHR 64.19 (5) is amended to read:

ILHR 64.19 (5) DAMPERS. (a) Intake. All required 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. ~~All 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.

SECTION 78. ILHR 64.20 (3) (Note) is amended to read:

Note: The department accepts heating equipment listed by the American Gas Association (AGA), Underwriters Laboratories (UL), ETL Testing Laboratories, Warnock Hersey International, Inc., ~~Northwest Testing Laboratories, Inc~~. Braun Intertec Corp. (Formerly Northwest Testing Laboratories, Inc.) and PFS Corporation.

SECTION 79. ILHR 64.21 (2)(a) is amended to read:

ILHR 64.21 (2)(a) The boiler or water heater conforms to those parts of ANSI Z.21.13, Z.21.10.1, or Z.21.10.3, whichever is applicable, relating to direct vent ~~sealed combustion chamber~~ appliances.

SECTION 80. Table 64.21 is repealed and recreated to read:

TABLE 64.21 -
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.		

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] Gas- and oil-fired equipment shall be provided with a one-hour fire-rated enclosure. Solid fuel burning equipment shall be provided with a 2-hour fire-rated enclosure. All openigns shall be protected by 3/4-hour fire-rated door assemblies equipped with self-closing devices as specified in ILHR 51.047. Use of hold-open devices is prohibited. All fire-rated construction shall comply with ss. ILHR 51.04 to 51.049.

[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 enlcosure described in Note 19.

SECTION 81. ILHR 64.22 (1)(b) is amended to read:

ILHR 64.22 (1)(b) Installation notification. The installing contractor shall notify the department of boiler installation, in accordance with the requirements of s. ILHR ~~41.05~~ 41.41 (1), before the boiler or pressure vessel is put into operation.

SECTION 82. ILHR 64.22 (3) is renumbered 64.22 (3)(a).

SECTION 83. ILHR 64.22 (3)(b) to (e) are created to read:

ILHR 64.22 (3)(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.

(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.

Note: See Electical 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.

SECTION 84. ILHR 64.22 (5)(c) is repealed and recreated to read:

ILHR 64.22 (5)(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.

SECTION 85. ILHR 64.22 (10) and (11) are created to read:

ILHR 64.22 (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.

SECTION 86. ILHR 64.33 (2) is amended to read:

ILHR 64.33 (2) DUCT INSULATION. All underground ducts shall be insulated as specified in s. ILHR ~~63.22 (1)~~ 63.29.

SECTION 87. ILHR 64.34 (1) is amended to read:

ILHR 64.34 (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 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 ~~Low Pressure or High Pressure~~ HVAC Duct

Construction Standards, Metal and Flexible and HVAC Air Duct Leakage Test Manual as published by the Sheet Metal and Air Conditioning Contractors National Association, Inc.

SECTION 88. ILHR 64.34 (2) is amended to read:

ILHR 64.34 (2) COMBUSTIBLE DUCTS. All ducts or airways of wood or other combustible ~~material~~ building elements shall be lined with sheet metal or other approved noncombustible material unless specifically exempted by this code.

SECTION 89. ILHR 64.34 (3)(c) is repealed and recreated to read:

ILHR 64.34 (2)(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.

SECTION 90. ILHR 64.34 (5) is created to read:

ILHR 64.34 (5) 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.

SECTION 91. ILHR 64.39 is repealed and recreated to read:

ILHR 64.39 VENTILATION DISCHARGE. All gravity and mechanical ventilation ducts shall be protected from the weather and shall be so located and constructed as 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.

SECTION 92. ILHR 64.41 (1)(b) is created to read:

ILHR 64.41 (1)(b) Ceiling systems with fire-resistive ratings. Return air plenums shall not be placed in rated ceiling systems unless specifically allowed by the listing.

SECTION 93. ILHR 64.42 (1)(intro.) is amended to read:

ILHR 64.42 (1)(intro.) 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 or floor-ceiling assemblies ~~as specified in Table 51.03-A~~ and rated enclosures shall be protected as follows:

SECTION 94. ILHR 64.42 (1)(a) and (b) are repealed and recreated to read:

ILHR 64.42 (1)(a) Openings in 1-hour rated wall assemblies shall be protected by at least 6 feet of horizontal continuous steel duct work leading to the air handling device on at least one side of the wall assembly or shall be protected by a 1 1/2-hour rated fire damper.

(b) Two-hour rated assemblies and enclosures shall be protected with 1 1/2-hour rated fire dampers.

SECTION 95. A note is created at the end of ILHR 64.42 (2)(a) to read:

Note: See ss. ILHR 51.04 to 52.044 for information on fire-resistive assemblies and approved testing laboratories.

SECTION 96. ILHR 64.42 (2)(b) is repealed.

SECTION 97. ILHR 64.42 (2)(c) is renumbered 64.42 (2)(b).

SECTION 98. ILHR 64.42 (2)(c) is created to read:

ILHR 64.42 (2)(c) Fire-resistive assemblies that have openings protected in accordance with a method approved by a nationally recognized testing lab. The protection shall not conflict with the certified design and shall be limited to openings of 100 square inches or less and to 100 square inches of opening are a per 100 square feet of assembly area;

Note: See Underwriters Laboratory fire-resistance directory, "Air Ducts and Protection Systems" for roof/ceiling assemblies.

SECTION 99. Notes are created at the end of s. ILHR 64.42 to read:

Note #4: Health care facilities may have additional requirements, see s. ILHR 64.57.

Note #5: Vertical ducts that serve 2 or more floor levels may need to be protected in accordance with s. ILHR 51.02 (11).

SECTION 100. A note is created at the end of ILHR 64.50 (1)(d) to read:

Note: Engineered venting systems designed in accordance with NFPA 54, "National Fuel Gas Code" are acceptable to the department.

SECTION 101. ILHR 64.51 (2) is renumbered 64.51 (2)(a).

SECTION 102. ILHR 64.51 (2)(b) is created to read:

ILHR 64.51 (2)(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.

SECTION 103. ILHR 64.52 (1) is amended to read:

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.

SECTION 104. ILHR 64.53 is renumbered ILHR 64.53 (1).

SECTION 105. ILHR 64.53 (2) to (4) are created to read:

ILHR 64.53 (2)(a) Air system balancing shall be accomplished in a manner to first minimize throttling losses, then fan speed shall be adjusted to meet design flow conditions. Balancing procedures shall be acceptable to the department. Damper throttling 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 system balancing shall be accomplished in a manner to first minimize throttling losses, then the pump impeller shall be trimmed or pump speed shall be adjusted to meet design flow conditions.

2. As an exception to subd. 1., valve throttling 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.

SECTION 106. ILHR 64.54 (2) is amended to read:

ILHR 64.54 (2) VENTILATION. The air movement, supply and distribution for all occupancies in this class shall conform to the requirements of s. ILHR 64.05, ~~Table 1,~~ except that natural ventilation or mechanical ventilation need not be provided in warehouses and cold storage buildings.

SECTION 107. ILHR 64.54 (3)(b) is repealed and recreated to read:

ILHR 64.54 (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.

SECTION 108. ILHR 64.54 (4) is repealed and recreated to read:

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.

SECTION 109. ILHR 64.54 (5) is repealed.

SECTION 110. ILHR 64.55 (2) is amended to read:

ILHR 64.55 (2) VENTILATION. The air movement, supply and distribution for all occupancies under this classification shall conform to the requirements of s. ILHR 64.05~~, Table 1~~.

SECTION 111. ILHR 64.56 (2) is repealed and recreated to read:

ILHR 64.56 (2) VENTILATION. (a) The air movement, 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.

SECTION 112. ILHR 64.58 (2) is amended to read:

ILHR 64.58 (2) VENTILATION. The air movement, supply and distribution for all areas of this class shall conform to the requirements of s. ILHR 64.05~~, Table 1~~.

SECTION 113. ILHR 64.59 (2) is amended to read:

ILHR 64.59 (2) VENTILATION. The air movement, supply and distribution for all areas of this class shall conform to the requirements of s. ILHR 64.05~~, Table 1~~.

SECTION 114. ILHR 64.59 (2)(a) is repealed.

SECTION 115. ILHR 64.60 (2) is amended to read:

ILHR 64.60 (2) VENTILATION. The air movement, supply and distribution for all areas of this class shall conform to the requirements of s. ILHR 64.05~~, Table 1~~.

SECTION 116. ILHR 64.61 (2) is amended to read:

ILHR 64.61 (2) VENTILATION. The air movement, supply and distribution shall be provided in accordance with the requirements of s. ILHR 64.05~~, Table 1~~. The exhaust air shall be drawn from not more than 18 inches above the floor.

SECTION 117. ILHR 64.61 (4) is amended to read:

ILHR 64.61 (4) MISCELLANEOUS REPAIR AREAS. Areas involved in the servicing of small internal combustion engines such as lawn mowers, snowmobiles, chain saws, cycles, boat engines, and similar types of engines, and battery charging areas, shall be ~~provided with at least 3/4 cubic foot per minute of outside air per square foot of enclosed service floor area and an equivalent exhaust~~ ventilated as required for repair areas under s. ILHR 64.05.

SECTION 118. ILHR 64.62 (2)(a) is amended to read:

ILHR 64.62 (2)(a) Air movement, supply, distribution and exhaust shall be provided as specified in s. ILHR 64.05~~, Table 1~~.

SECTION 119. ILHR 64.62 (2)(c) is created to read:

ILHR 64.62 (2)(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.

SECTION 120. ILHR 64.63 (1) and (2)(a) are amended to read:

ILHR 64.63 (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 ~~where motor driven vehicles are stored~~.

(2)(a) Except as permitted in ~~par. (b)~~ pars. (b), (c) and (d), the air movement, supply and distribution for garages shall be provided in accordance with the requirements of s. ILHR 64.05~~, Table 1~~. Exhaust air shall be drawn not more than 18 inches above the floor.

SECTION 121. ILHR 64.63 (2)(c) is repealed and recreated to read:

ILHR 64.63 (2)(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.

SECTION 122. ILHR 64.63 (2)(d) is created to read:

ILHR 64.63 (2)(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.

SECTION 123. ILHR 64.64 (2) is amended to read:

ILHR 64.64 (2) VENTILATION*:* The air movement, supply and distribution shall be provided in accordance with the requirements of s. ILHR 64.05~~, Table 1~~.

SECTION 124. ILHR 64.65 (1) and (3) are repealed and recreated to read:

ILHR 64.65 (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.

(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.

SECTION 125. ILHR 64.65 (4) is created to read:

ILHR 64.65 (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.

SECTION 126. ILHR 64.66 (1) is amended to read:

ILHR 64.66 (1) POOL VENTILATION. In natatoriums, a volume of tempered ~~outside~~ air supply and exhaust shall be provided at a rate ~~of at least 2 cubic feet per minute per square foot of pool surface~~ 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 ~~outside~~ air and exhaust may be reduced to a minimum of 1 cubic foot per minute per square foot of pool surface provided automatic humidity controls are used to limit the relative humidity to 60%.

SECTION 127. ILHR 64.67 (2)(a) is amended to read:

ILHR 64.67 (2)(a) Required exhaust ventilation. When cooking equipment is being operated, mechanical exhaust ventilation shall be provided at a rate ~~not less than 2 cubic feet per minute per square foot of floor area~~ 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 ~~the 5~~ 15 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.

SECTION 128. A note is created after ILHR 64.67 (4)(c) to read:

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.

SECTION 129. ILHR 64.67 (5)(i) is amended to read:

ILHR 64.67 (5)(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.

SECTION 130. ILHR 64.67 (7) is created to read:

ILHR 64.67 (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.

SECTION 131. 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 132. 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 133. ILHR 66.46 (2) is repealed.

SECTION 134. ILHR 66.47 is amended 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 solid fuel heating equipment and~~ 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. ~~These isolations~~

Isolation of heating equipment shall ~~also~~ comply with ss. ILHR 64.21 and 64.22. ~~except that flammable~~ 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 nonsolid fuel heating equipment and~~ 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. ~~These isolations~~ Isolation of heating equipment shall ~~also~~ comply with ss. ILHR 64.21 and 64.22. ~~except that flammable~~ 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) Direct vent sealed combustion chamber appliances may be used without a fire resistive rated enclosure.~~

~~(c)~~ (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 135. Chapter ILHR 72 is repealed.

SECTION 136. ILHR 82.40 (5)(b) 3. is repealed.

SECTION 137. ILHR 82.40 (5)(b) 4. and 5. are renumbered 82.40 (5)(b) 3. and 4.

SECTION 138. A note to s. ILHR 82.40 (5)(b) is created to read:

Note: See s. ILHR 63.29 for pipe insulation requirements.

APPENDIX MATERIAL

The following is inserted in Appendix A of Chs. ILHR 50 to 64 for explanatory purposes only.

SECTION 138m. A63.01 is created to read:

BUILDING ENVELOPE PLAN CHECK DOCUMENTS

This section describes the forms and procedures for documenting compliance with the envelope energy efficiency requirements of the code. It does not describe the details of the requirements; these are presented in the code. Determination of code compliance will be based on the actual code section. The following discussion is addressed to the designer preparing construction documents and compliance statements and to the plan reviewers who are examining those documents for compliance with the code.

The use of each form is briefly described below. The complete instructions for each form are presented in the following subsections.

E-1: Envelope Summary.

This information is required for every project.

E-2: Fenestration Worksheet.

Used only for the Component Standards and System Standards methods. This worksheet produces area-weighted average values for the Fenestration U-Value and Shading noefficient (SC_x). For the System Standards method of s. ILHR 63.16, one of these worksheets should be completed for each orientation. (It is not necessary to fill this out if there is only one Fenestration U-Value and Shading Coefficient for the entire project.)

E-3: Opaque Surfaces Worksheet.

This worksheet is used only for the Component Standards method and System Standards method. This worksheet produces the area-weighted average values for the U-values of roof, walls (including opaque doors), and floor assemblies. For the System Standards method, one of these worksheets should be completed for each orientation.

E-4: Skylight Exemption Worksheet.

This information will only be required when skylights are to be exempt from the roof area thermal performance calculation.

ENVELOPE SUMMARY E-1

This worksheet is applicable to all projects.

Project Information

This information asks for the project name and address and those people responsible for the building design and compliance forms.

Compliance Approach

Check one of the three boxes:

Component Standards:	If this box is checked, provide the number of the region in which the building is located from Figure 63.15-2 of the code and the Alternate Component Package (ACP) Table letter.
System Standards:	If this box is checked, provide the computer printout or other documentation of envelope compliance and E-1 form.
System Analysis Design:	If the project is demonstrating compliance through the System Analysis Design method, check this box. A complete analysis must be provided.

Basic Requirements

Fill the boxes in this column with either a check mark or "X" to indicate a positive response or "N/A" to indicate a negative response. If the skylight exemption is marked (see "Special Considerations"), attach the Skylight Exemption Worksheet (E-4).

Prescriptive/Performance Requirements

If the project is demonstrating compliance through the Component Standards method, all of these items must be completed. The area-weighted properties such as components U-values and fenestration SC_x are obtained from the Fenestration Worksheet (E-2) and Opaque Surfaces Worksheet (E-3). The items under "Requirements" are obtained from the ACP Table.

If the System Standards method is used (e.g., ASHRAE's ENVSTD Program), only the items in the "Design" column need to be completed. Where there is more than one of a particular assembly, enter all of the values.

If the System Analysis Design method (e:g., ASHRAE's Energy Cost Budget method) is used, the items in the design column should be filled in, where applicable, to speed the plan review.

Worksheets

Indicate which worksheets are attached. None of the specified worksheets should be used if the project is demonstrating compliance through the System Analysis Design method. Additional blanks are provided to indicate attached calculations such as calculation of mass wall heat capacity or interpolations of tables.

FENESTRATION WORKSHEET E-2

This worksheet is applicable to projects that demonstrate compliance through the Component Standards method or the System Standards method. It is not applicable to projects that demonstrate compliance through the System Analysis Design method.

Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the Envelope Summary (E-1) form.

Area-Weighted Properties

Assembly ID:	Insert a descriptor of the particular assembly. A separate ID must be supplied for each group of assemblies that have unique U-values or shading coefficients.
Area:	Enter the Total area (in ft^2) for that fenestration assembly (glazing and frame) on a project-wide basis. For the System Standards method, this would be the area for that assembly on an orientation basis. The values from all entries in this column should be summed into the box marked "Total Area" at the bottom of the column.
U-Value (or shading coefficient, SC_x):	Enter the appropriate property for each fenestration assembly (glazing and frame).
U (or SC_x) •Area:	This column is the product of the assembly area (second column) by the fenestration U-value (or SC_x from the third column). The values from all entries in this column should be summed into the box marked "Total U•A" at the bottom of the column. The area-weighted U-value (or SC_x) is calculated by dividing the value in "Total U•A" by the value in "Total Area."

OPAQUE SURFACES WORKSHEET E-3

This worksheet is applicable to projects that demonstrate compliance through either the Component Standards method or System Standards method. It is not applicable to projects that demonstrate compliance through the System Analysis Design method.

Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the Envelope Summary (E-1) form.

Assembly ID: Insert a descriptor of the particular assembly. This may be a descriptor or number from the appropriate schedule in the plans. A separate item must be supplied for each group of assemblies that have unique U-values.

Area: Enter the Total area (in ft^2) for that assembly (wall, roof, or floor) on a project-wide basis. For the System Standards method, this would be the area for that assembly on an orientation basis. The values from all entries in this column should be summed into the box marked "Total Area" at the bottom of the column.

U-Value: Enter the appropriate property for each assembly. Overall thermal transmittance of assemblies must be calculated in accordance with s. ILHR 63.18. The calculation procedure must consider the effect of framing.

If skylights are installed, they must be included in the overall U-value calculation of the roof unless an exemption is obtained under s. ILHR 63.12. A skylight exemption worksheet (E-4) must be included.

U•Area: This column is the product of the assembly area (second column) by the assembly U-value. The values from all entries in this column should be summed into the box marked "Total U•A" by the value in "Total Area."

The area-weighted U-value is calculated by dividing the value in "Total U•A" by the value in "Total Area."

SKYLIGHT EXEMPTION WORKSHEET E-4

This worksheet is applicable when skylights are exempt from the roof area overall U-value calculation per the requirements of ILHR 63.12. It may be used with any method of compliance.

Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the Envelope Summary (E-1) form.

Skylight Exemption Worksheet

All of the boxes except the item marked "Special Consideration" (50% shading device credit) must be filled in with a check or "X" to indicate affirmation. The 50% shading device credit box must be filled in with either a check, "X," or "N/A."

All of the "Design" and "Requirement" information must be completed. The skylight-to-roof ratio requirement is the maximum percent of skylight area taken from ASHRAE 90.1, Tables 8-3a and 8-3b of Table A63.12. the maximum area will depend on the visible light transmittance (VLT) and whether or not shading is provided for the skylight.

The lighting power density may be taken from the allowed lighting power density from s. ILHR 63.47, 63.48, or 63.49, or the actual installed lighting power density adjusted for controls under s. ILHR 63.45 (2) may be used.

The design lighting level, in foot-candles, is the judgment of the designer, but should be in general agreement with the recommendations of the Illuminating Engineering Society. (Refer to the IES Lighting Handbook, application volume, 1987.) The designer should choose the lighting level in the table closest to the condition in the proposed building. Interpolation or extrapolation for lighting level is not permitted.

ENVELOPE SUMMARY E-1

WISCONSIN DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS — DILHR

Project Information

Submitter's Name

Owner's Name | Date

Building Location (Number & Street) | ☐ City ☐ Village ☐ Township of

Compliance Approach ☐ Component Standards (See ILHR 63.15) ☐ System Standards (See ILHR 63.16) ☐ System Analysis Design (See ILHR 63.70-72)

Region_____ ACP Table _____
(See Fig. 63.15-2)

Fenestration

Basic Requirements

- ☐ U-values reported on this form are area-weighted averages. ILHR 63.18 (1)
- ☐ Windows and doors meet the air infiltration requirements. ILHR 63.11
- ☐ Fenestration U-values are certified by NFRC or from Table 63.18-3. ILHR 63.18 (2)(b)
- ☐ Fenestration shading coefficients are obtained from either the 1989 ASHRAE Handbook of Fundamentals or manufacturer's data. ILHR 63.18 (4)
- ☐ Exterior joints, cracks, and holes in the building envelope are caulked, gasketed, weather stripped, or otherwise sealed. ILHR 63.11
- ☐ Double entry vestibule? (Optional--check if provided)
- ☐ Windows with reflective glazing? (Optional---check if provided)

Prescriptive/Performance Requirements

Fenestration Properties	Design	Requirement If using Component Standards, see ACP Table Fig. 63.15-2
Gross wall area (GWA) ILHR 63.05 (28) ILHR 63.18 (2)(b) & (3)	_____	
Fenestration area (FA) ILHR 63.05 (26)	_____	
Window-wall ratio (FA/GWA) ILHR 63.05 (82)	_____	≤_____
Fenestration U-value ILHR 63.18 (2)(b)	_____	≤_____
Fenestration SCx ILHR 63.18 (4)	_____	

Skylights installed ____ Yes ____ No

Worksheets

- ☐ Fenestration Worksheet (E-2)
- ☐ Opaque Surfaces Worksheet (E-3)
- ☐ Skylight Exemption Worksheet (E-4)
- ☐ Marked Up ACP Table
- ☐ ENVSTD Output
- ☐ _____

Exterior Opaque Surfaces

Basic Requirements

- ☐ U-values reported on this form are area-weighted averages. ILHR 63.18 (1)
- ☐ An approved method which accounts for the thermal bridging of framing is used to calculate U-values for envelope assemblies. ILHR 63.18 (2)
- ☐ Exterior joints, cracks, and holes in the building envelope are caulked, gasketed, weather stripped, or otherwise sealed. ILHR 63.11
- ☐ Vapor barriers are installed to prevent deterioration of insulation performance. ILHR 63.11 (4)
- ☐ **Special Consideration** The skylight exemption is applied. ILHR 63.12

  (Attach Skylight Exemption Worksheet E-4)

Prescriptive/Performance Requirements

Wall Design	Design	Requirement
U-value ILHR 63.18 (2)(a)	_____	≤_____
Heat capacity (HC) ILHR 63.05 (35) Appendix A63.15 (3)(b)	_____	
Insulation position (interior or exterior) ILHR 63.05 (45)	_____	

U-Values	Design	Requirement
Roof ILHR 63.18 (2)(a)	_____	≤_____
Walls adjacent to unconditioned space ILHR 63.18 (2)(a)	_____	≤_____
Floors over unconditioned space ILHR 63.18 (2)(a)	_____	≤_____

Worksheets

- ☐ _____

Below Grade

Basic Requirements

- ☐ R-values reported on this form for slab-on-grade floors and walls below grade include only the insulating material. ILHR 63.15 (5) and (6)
- ☐ Insulation continuity is maintained. ILHR 63.15 (5)

Prescriptive/Performance Requirements

R-Values	Design	Requirement
Walls below grade ILHR 63.18 (2)(a)	_____	≤_____
Slab-on-grade ILHR 63.18 (2)(a)	_____	≤_____

FENESTRATION WORKSHEET E-2

Project Information	Submitter's Name
Owner's Name	Date
Building Location (Number & Street)	☐ City ☐ Village ☐ Township of

Fenestration Orientation: _____
For System Standards Method

Area-Weighted Properties - ILHR 63.18

Fenestration U-Value (U_{of}) see ILHR 63.18 (2)(b)

Assembly ID	Area		U-Value		U•Area
		X		=	
		X		=	
		X		=	
		X		=	
		X		=	
		X		=	
		X		=	
		X		=	
Total Area→			Total U•A→		

$$\frac{\text{Total U•A}}{\text{Total Area}} = \boxed{}$$

Fenestration Shading Coefficient (SC_x) see ILHR 63.18 (4)

Assembly ID	Area		SC_x		SC_x•Area
		X		=	
		X		=	
		X		=	
		X		=	
		X		=	
		X		=	
		X		=	
		X		=	
Total Area→			Total SC_x•A→		

$$\frac{\text{Total } SC_x\text{•A}}{\text{Total Area}} = \boxed{}$$

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04 (1)(m)]

WISCONSIN DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS DILHR

Project Information	Submitter's Name
Owner's Name	Date
Building Location (Number & Street)	☐ City ☐ Village ☐ Township of

Exterior Wall Orientation: _____
For System Standards Method

Area-Weighted Properties - ILHR 63.18

Roofs see ILHR 63.18 (2)(a)

Assembly ID	Area		U-Value		U•Area
		X		=	
		X		=	
		X		=	
		X		=	
Total Area→			Total U•A→		

Total U•A / Total Area = ☐

Walls Adjacent to Unconditioned Spaces see ILHR 63.18 (2)(a)

Assembly ID	Area		U-Value		U•Area
		X		=	
		X		=	
		X		=	
		X		=	
Total Area→			Total U•A→		

Total U•A / Total Area = ☐

Above Grade Exterior Walls see ILHR 63.18 (2)(a)

Assembly ID	Area		U-Value		U•Area
		X		=	
		X		=	
Aboveground foundation		X		=	
		X		=	
Total Area→			Total U•A→		

Total U•A / Total Area = ☐

Floors Over Unconditioned Spaces see ILHR 63.18 (2)(a)

Assembly ID	Area		U-Value		U•Area
		X		=	
		X		=	
		X		=	
		X		=	
Total Area→			Total U•A→		

Total U•A / Total Area = ☐

SKYLIGHT EXEMPTION WORKSHEET E-4

WISCONSIN DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS
DILHR

Project Information

Submitter's Name

Owner's Name	Date
Building Location (Number & Street)	☐ City ☐ Village ☐ Township of

Skylight Exemption Requirements see ILHR 63.12		Design	Requirement	Documentation
☐ U-values of skylight curbs are less than 0.21 Btu/hr•ft^2•°F.	**Skylight Design U-value**	_____		☐ ENVSTD output
☐ Overall thermal transmittance of skylight assemblies is less than 0.70 Btu/hr•ft^2•°F.	Gross roof area (GRA)	_____		☐ Calculation of allowed skylight percent.
	Skylight area (SA)	_____		
	Skylight-to-roof ratio (SA/GRA)	_____	≤ _____	
☐ Air leakage is less than 0.5 cfm/ft^2 of skylight.				☐ Sketch of shading devices.
☐ Automatic daylighting controls installed to reduce electric lighting to 50%.	Skylight U-value	_____		
	Skylight VLT	_____		
Special Consideration ☐ Shading devices used to block 50% of the solar gain during peak cooling conditions.	Lighting power density (LPD)(/ft^2)	_____		
	Design lighting level (fc)	_____		

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04 (1)(m)]

HVAC SYSTEMS PLAN CHECK DOCUMENTS

This section describes the forms and procedures for documenting compliance of Heating, Ventilation and Air Conditioning (HVAC) system with the energy efficiency requirements of the code. It does not describe the details of the requirements; these are presented in the code. Determination of compliance will be based on the actual code section. The following discussion is addressed to the designer preparing construction documents and compliance statements, and to the plan reviewers who examine those documents for compliance with the code.

Note: These forms cannot be used to demonstrate compliance with the Ch. ILHR 64 ventilation requirements. That information must be provided separately.

The use of each form is briefly described below. The complete instructions for each form are presented in the following subsections.

H-1: HVAC Systems Summary.

This information is required for every project.

H-2: HVAC Prescriptive Worksheet.

This information is applicable to projects that demonstrate compliance through a prescriptive means by following the requirements of Subchapter IV. It is not applicable to projects that demonstrate compliance through the System Analysis Design method of ss. ILHR 63.70-72.

H-3: HVAC Equipment Summary.

This information is required for every project.

HVAC SYSTEMS SUMMARY H-1

This worksheet is applicable to all projects

Project Information

This information asks for the project name and address and those people responsible for the HVAC design and compliance forms. The project name and address must match the information given on the building envelope forms. Check the box as indicated if the System Analysis Design method will be used to show compliance.

Basic Requirements Check List

All of the boxes in this column must be filled with either a check or "X" to indicate affirmation or "N/A" to indicate that the item or issue is not applicable.

Worksheet

If using the System Analysis Design method, the HVAC Prescriptive worksheet (H-2) does not need to be completed. Fill in the box with a check or "X" if it is included.

Special Considerations

Fill in these boxes with a check or "X" where applicable.

HVAC PRESCRIPTIVE WORKSHEET H-2

This worksheet provides detailed information on zone controls and economizer controls. It is not required if the System Analysis Design method is used.

Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the HVAC Systems Summary (H-1) form.

Prescriptive Requirements

Each of the requirements is organized in a similar fashion. A major check box certifies compliance with each requirement. Each one of these is followed by a series of minor check boxes that are used to identify exceptions to that requirement. All of the major check boxes must be filled in with either a check, "X," or "N/A." In addition, a check or "X" should be placed in each applicable exception box. On the line adjacent to these exception descriptions, identify the systems or equipment to which the exception applies.

HVAC EQUIPMENT SUMMARY H-3

Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Basic Project Information section of the HVAC Equipment Summary (H-1) form.

Equipment Efficiency Information

Each piece of HVAC equipment that has efficiency requirements under ASHARE 90.1 should be listed here. See Code Appendix A63.20 for reprinted standards.

System ID Number:	List the system identification number or zone identification number or other descriptor.
Unit Type and Category:	List the unit type and category from the appropriate table.
Table Number:	Give the table number, Table A63.20-1 through A63.20-15 of the Code Appendix, on which the equipment and its required efficiency are listed.
Rated Output (Btu/h):	This is the unit capacity (heating or cooling as appropriate) at rated conditions. The rating conditions should match those from the reference column of the corresponding table.
Unit Efficiency:	For each unit, list the efficiency of the selected unit at rated conditions on the left and the required minimum efficiency from the corresponding table on the right. Under "Rating Units" place "EER," "IPLV," "ET," etc., as applicable.

HVAC SYSTEMS SUMMARY H-1

WISCONSIN DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS
DILHR

Project Information

Submitter's Name

Owner's Name	Date
Building Location (Number & Street)	☐ City ☐ Village ☐ Township of

☐ Check here if using System Analysis Design (see ILHR 63.70-72)

	Basic Requirements Checklist	Worksheet
Design	☐ Load calculations using htg/clg outside design temperatures given in code or no lower/greater than ASHRAE's 99%/2.5% values or annualized 0.2%/0.5% values. ILHR 63.23 (3)	☐ HVAC Prescriptive Worksheet (H-2)
Design	☐ Cooling pull-down/heating pick-up loads were either calculated or did not exceed 10%/30% of design load. ILHR 63.23 (7)	
Design	☐ Equipment is properly sized. ILHR 63.24	
Design	☐ Process loads are served by separate systems from comfort conditioning loads. ILHR 63.25	
Design	☐ HVAC fan and pumping system motors meet efficiency standards. ILHR 63.32	
Controls	☐ Temperature controls are provided as required: one for each HVAC system and individual controls for each thermal zone. ILHR 63.26	
Controls	☐ Thermostatic controls meet the setpoint adjustment requirements: heating down to 55°F, cooling setpoints up to 85°F, and deadbands of 5°F minimum. ILHR 63.26	
Controls	☐ Systems do not reheat, recool or mix air. ILHR 63.27*	
Controls	☐ Variable volume systems have minimum stops adjusted as required. ILHR 63.27*	
Controls	☐ Each system that does not need to operate continuously is provided with either automatic time or setback/setup controls. ILHR 63.27 (3)	
Controls	☐ Ventilation supply systems and exhaust systems are provided with either gravity or motorized dampers as required to limit infiltration during off hours. ILHR 64.19 (5)	
Controls	☐ Combustion air dampers provided per s. ILHR 64.09 (2).	
Controls	☐ Humidity controls for comfort are adjustable to limits of 30% maximum for humidification and 60% minimum for dehumidification. ILHR 63.28	
Controls	☐ Fan cooling systems employ air or water economizer controls. ILHR 63.31*	
Controls	☐ Heat pumps with supplementary heaters have controls to prevent heater operation when heating load can be met by heat pump. ILHR 63.22	
Completion & Construction	☐ Pipe insulation meets the requirements of ILHR Table 63.29-1. Duct insulation meets the requirements of Table 63.29-2. ILHR 63.29	
Completion & Construction	☐ The plans or specifications spell out the requirements for leakage testing ductwork. ILHR 64.34	
Completion & Construction	☐ Low and medium pressure supply ductwork which is located outside of the conditioned space is sealed in accordance with SMACNA Seal Class C. ILHR 64.34	
Completion & Construction	☐ Complying air and water system balancing procedures are spelled out on the plans or in the specifications. ILHR 64.53	
Completion & Construction	☐ Testing, adjusting and calibration of control systems is spelled out on the plans or in the specifications. ILHR 64.43 and ILHR 64.53	
Completion & Construction	☐ Plans or specifications require that equipment is provided with operation and maintenance manuals and system schematics. ILHR 64.52	

Special Considerations:

☐ Heat recovery utilized

☐ Continuous system operation required

* If the ASHRAE 90.1 Energy Cost Budget method is used for system analysis design, these items do not have to be met prescriptively. Complete documentation must be provided.

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HVAC PRESCRIPTIVE WORKSHEET H-2

WISCONSIN DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS DILHR

Project Information Submitter's Name

Owner's Name	Date
Building Location (Number & Street)	☐ City ☐ Village ☐ Township of

Zone Controls - Constant Volume Systems ILHR 63.27

☐ Systems have controls which prevent simultaneous heating and cooling including: reheat, recool, mixing of heated and cooled airstreams, and simultaneous heating and cooling by separate systems within a zone.

System or Zone Number or ID

Exceptions

☐ 75% of reheat energy is from site-recovered or solar energy (provide documentation). _____

☐ System serves zones with process-driven humidity requirements. _____

☐ Multiple reheat systems serving multiple zones with controls or dual duct and multizone systems with controls to reset supply temperatures per Paragraphs (f), (g), or (n). _____

☐ Zones with a peak supply of 150 cfm or less or multizone systems with reheating or recooling limited to 5,000 cfm or 20%, whichever is less. _____

Zone Controls - Variable Volume Systems ILHR 63.27

☐ Before reheating or mixing of airstreams, zone controls reduce air supply to a minimum which is no larger than all of the following: 30% of the peak zone airflow, 0.4 cfm/ft^2, or minimum ventilation flow requirements of ILHR 64.05

System or Zone Number or ID

Exceptions

☐ There is no reheating or mixing of airstreams in these zones. _____

☐ Pressurization requirements prevent such reduction of airflow (provide documentation). _____

☐ 75% of reheat energy is from site-recovered or solar energy (provide documentation). _____

☐ System serves zones with process-driven humidity requirements. _____

☐ Zones with a peak supply of 150 cfm or less or multizone systems with reheating or recooling limited to 5,000 cfm or 20%, whichever is less. _____

Economizer Controls ILHR 63.31

☐ Fan-cooling systems are equipped with complying air or water economizers.

System Number or ID

Exceptions

☐ System capacity is less than either 2,000 cfm or 62,000 Btuh total cooling for a split system or less than 55,000 Btuh for all other types. _____

☐ Economizers would not save energy (provide documentation). _____

☐ Benefit of air economizer would be offset by increased energy use for humidity control. _____

HVAC EQUIPMENT SUMMARY

WISCONSIN DEPARTMENT OF INDUSTRY, LABOR AND HUMAN RELATIONS
DILHR

Project Information	Submitter's Name	
Owner's Name		Date
Building Location (Number & Street)	☐ City ☐ Village ☐ Township of	

System ID Number	Unit Type and Category From Tables A63.20-1 to 15 of Ch. 63 Appendix	Table Number	Rated Output (Btu/hr)	Unit Efficiency		
				Rating Units	Rated	Min Required
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	
					≥	

Note: Where more than one requirement is made for a single piece of equipment (such as full-load and part-load ratings), provide information on subsequent lines.

Personal information you provide may be used for secondary purposes [Privacy Law, s. 15.04 (1)(m)].

s:\admin\wp\energywh\hvacsyss.doc

LIGHTING PLAN CHECK DOCUMENTS

This section describes the forms and procedures for documenting compliance with the lighting energy efficiency requirements of the code. It does not describe the details of the requirements; these are presented in the code. The following discussion is addressed to the designer preparing construction documents and compliance statements and to the plan reviewers who are examining those documents for compliance with the code.

The use of each form is briefly described below. The complete instructions for each form are presented in the following subsections.

L-1: Lighting Summary.

This information is required for every project.

L-2: Exterior Lighting Power Worksheet.

This information is also required for every project.

L-3: Installed Interior Lighting Power Worksheet.

This information is also required for every project.

L-4: Complete Building/Area Category Methods Worksheet

This information will only be required when calculating the Interior Lighting Power Allowance using either the Complete Building Method or the Area Category Method.

L-5: Activity Method Worksheet.

This information will only be required when calculating the Interior Lighting Power Allowance using the activity method.

LIGHTING SUMMARY L-1

The Lighting Summary (L-1) form is in four parts. A copy of these forms must be submitted to the Division along with the rest of the compliance submittal at the time of building plan review.

A. Lighting Summary (L-1) Part 1

Project Information

Part 1 of the Lighting Summary form asks for the project name and address and those people responsible for the lighting design and compliance forms. The project name and address should be the same as on the Building Envelope forms for the project.

Method of Interior Lighting Compliance

Check one of the four boxes:

Complete Building:	If this box is checked, the Complete Building/Area Category Methods Worksheet (L-4) must be provided.
Area Category:	If this box is checked, the Complete Building/Area Category Methods Worksheet (L-4) must be provided.
Activity:	If this box is checked, the Activity Method Worksheet (L-5) must be provided.
Other:	If compliance for the project is demonstrated through the System Analysis Design method of ss. ILHR 63.70-72 where all energy-using systems are considered together, check this box. A complete analysis must be provided.

Basic Requirements

All of the boxes in this column must be filled with either a check or "X" to indicate affirmation or "N/A" to indicate not applicable. For exterior lighting, enter the Exterior Lighting Power (ELP) and the Exterior Lighting Power Allowance (ELPA). These are obtained from the Exterior Lighting Power Worksheet (L-2).

Prescriptive/Performance Requirements

Enter the Installed Interior Lighting Power (ILP) and the Interior Lighting Power Allowance (ILPA). The ILP is obtained from the Interior Lighting Power Allowance Worksheet (L-3). The ILPA is obtained from the Complete Building/Area Category Methods Worksheet (L-4) if either the Complete Building Method or the Area Category Method is used. The ILPA is obtained from the Activity Method Worksheet (L-5) if the if the Activity Method is used. The lighting power control credits box is filled with a check or "X" when control credits are taken, otherwise enter "N/A."

Worksheets

Indicate which worksheets are attached.

B. Lighting Summary (L-1) Parts 2 to 4

Parts 2 to 4 of the Lighting Summary should be used to describe the lighting fixtures and control devices designed to be installed in the building. If necessary, make extra copies of the forms. Use as many sheets as needed for the project. The information on the L-1 parts 2 to 4 forms may be incorporated into equipment schedules on the plans, rather than presented on the forms. If this is done, however, the same information should be included in one schedule and in a similar format as the forms.

Installed Lighting Schedule (L-1) Part 2

Luminaire Name: Record the description by name or type as shown on the plans.

Lamp Type: Check the type of lamp (Incandescent, Fluorescent or High-Intensity discharge).

Number of Lamps: Record the number of lamps per fixture. If track lighting is used and the fixtures are not shown on the plans, the length of track is entered in this column.

Watts/Lamp: Record the listed watts per lamp. For track and incandescent medium base socket fixtures, see s. ILHR 63.45 (4) for how to determine the watts of these types of luminaires. If track lighting is used and the fixtures are not shown on the plans, 45 watts per foot of track is entered in this column.

Ballasts Type: Record the ballast type—Standard Energy-Saving Magnetic (S), Electronic High Frequency* (E) or Other* (O). If Electronic High Frequency or Other ballast types are used, the exact ballast type and model number should be specified on the plans.

Number/Luminaire: Record the number of ballasts installed in each Luminaire.

Mandatory Automatic Controls (L-1) Part 3

The Mandatory Automatic Controls portion is where those devices to meet the mandatory control requirements are listed. This would include devices for building shut-off, individual room control, and control of exterior lights. If some mandatory controls meet the requirements of s. ILHR 63.45 (2), the information should also be recorded on Part 4, Controls for Credit, if control credits are taken in the ILP calculation.

Control Location: Record the location of the control on the plans.

Control Identification: Record the symbol of the control on the plans.

Control Type: Record the type of certified control device used to meet the mandatory automatic control requirement.

Space Controlled: Record the location of controlled lights.

Typical controls may be covered by general notation.

Controls for Credit (L-1) Part 4

The Control for Credit portion is similar to the Mandatory Automatic Controls portion. The only difference is the last column.

Luminaires Controlled: Record the luminaire type and quantity controlled for credit.

Type: Record the same name as on the plans.

Number of Luminaires: Record the number of luminaires of that type that are controlled by the control type.

Typical controls may be covered by general notation.

Notes to Field

This space is used by the building department plans examiner to alert the field inspector to look for important inspection items.

EXTERIOR LIGHTING POWER WORKSHEET L-2

This worksheet is applicable to all projects.

Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Project Information section of the Lighting Summary (L-1) form.

Exterior Lighting Power Allowance -- ELPA

Area Description: This is a descriptor of each line. These descriptors match those in ILHR Table 63.43.

Allowance: This is the allowance in either W/ft^2 or watts of lineal feet. These allowances match those in ILHR Table 63.43.

Area or Lineal Feet in Proposed Design: Record the area (ft^2) or lineal footage (lf) as appropriate. These values should be project-wide values.

ELPA: Multiply the allowance from Column B by the area (or lineal footage) from Column C. Record the resultant ELPA in Column D. The values should be summed into the box marked "Total ELPA" at the bottom of the column.

Installed Exterior Lighting Power

Do not include luminaires that are exempted under s. ILHR 63.42.

Fixture Type: Record the description of the luminaires that are included.

Number of Luminaires: Record the total number of similar luminaires in the project.

Watts per Luminaire: Record the input wattage for each luminaire, including the ballast.

Installed Wattage: Multiply the number of luminaires from Column B by the wattage per luminaire from Column C. Enter the resultant installed wattage in Column D. The values from all entries in the column should be summed into the box marked "Total ELP" at the bottom of the column.

INSTALLED INTERIOR LIGHTING POWER WORKSHEET L-3

The Installed Interior Lighting Power Worksheet (L-3) will be completed and submitted with all applications. Either the Complete Building/Area Category Method Worksheet (L-4), the Activity Method Worksheet (L-5), or System Analysis Design documentation will be included with L-3, depending on the ILPA calculation method chosen.

Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Project Information section of the Lighting Summary (L-1) form.

Installed Interior Lighting Power

The calculated interior lighting power to be installed is determined by completing this form. Do not include luminaires that are exempted under s. ILHR 63.45. If necessary, make extra copies of this form. Use as many sheets as needed for the project.

Luminaire Name or ID No.: Record the name or symbol. It should be consistent with what is used in the lighting schedule.

Description: Record a short list of the technical features (i.e., luminaire size and type, lamp type and number, ballast type, lens/louver type).

Number of Luminaires: Record the quantity of each fixture type in the building. If track lighting is used and the fixtures are not shown on the plans, the length of the track is entered in this column.

(Tip: If control credits are to be used and all of any type of luminaires are not controlled or used with the same control, split the luminaries up over several lines, one for each control type.)

Watts per Luminaire: Record the total wattage of each luminaire type (including ballasts for fluorescent or high intensity discharge fixtures). For track and incandescent medium base socket fixtures, see s. ILHR 63.45 (4) for how to determine the watts of these types of luminaires. If track lighting is used and the fixtures are not shown on the plans, 45 watts per foot of track is entered in this column. The wattage may be a standard value from the data in Table A63.45. Nonstandard values not from Table A63.45 must be substantiated with manufacturer's data sheets.

Total Watts: Record the product of the quantity of each luminaire listed times its watts per luminaire. If credit for automatic lighting controls is not sought, the interior lighting power is the sum of this Column E.

LPAF for Automatic Controls: If lighting power control credits are used, enter the appropriate lighting power adjustment factor from Table 63.45. If this credit is not used, leave Columns F, G, and H blank.

Control Credit: Multiply the total watts of luminaires associated with the control of Column E by the LPAF of Column F. Record the resultant control credit in Column G.

Adjusted Watts: Subtract the control credit of Column G from the total watts of Column E. Record the remainder in Column H.

The sum of Column E (or Column H if control credits are used) is the calculated interior lighting power for the building. If more than one sheet is used, enter the total for all sheets. This total cannot be greater than the Interior Lighting Power Allowance calculated on worksheet L-4 or L-5.

COMPLETE BUILDING/AREA CATEGORY METHODS
WORKSEET L-4

This worksheet will be attached to L-3 whenever the Complete Building Method or the Area Catgegory Method is used to calculate the Interior Lighting Power Allowance.

Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Project Information section of the Lighting Summary (L-1) form.

Interior Lighting Power Allowance

The Interior Lighting Power Allowance (ILPA) is determined by calculating the maximum total watts of lighting that may be installed. As noted on the Lighting Summary, L-1, there are four different methods that may be used. These methods may not be mixed in the same building permit application. This form is used when the ILPA is calculated by the Complete Building or Area Category Method.

Complete Building Method

This method may only be used when plans and specifications for the entire building are included in the application.

Building Type of Use: This is taken from Table 63.47 for the type of use of the building. If the building has a mixture of uses, the major use must be at least 80 percent of the conditioned floor area. If there is no major use, this method may not be used.

Watts per Square Foot: Record the allowed lighting power density in watts per square foot for this building type taken from ILHR Table 63.47.

Complete Building Area: Record the conditioned floor area of the entire building, including the conditioned floor area of minor occupancies. See 63.05 (6) for the definition of conditioned floor area.

Allowed Watts: Record the product of the watts per square foot times the complete building area. This becomes the Interior Lighting Power Allowance for the building.

Area Category Method

This method may be used when different primary function areas of a building are included in the application.

Primary Function: This is taken from ILHR Table 63.48 for the primary function of the area. If the building has a mixture of functions, each function area must be listed separately.

Watts per Square Foot:	Record the allowed lighting power density watts per square foot for this building type taken from ILHR Table 63.48.
Area:	Record the conditioned floor area (in square feet) of the primary function area measured from the inside of partitions.
Allowed Watts:	Record the product of the watts per square foot times the primary function area. This becomes the allowed lighting power for the area.

The sum of the allowed lighting power for each primary function area is the Interior Lighting Power Allowance for the building.

ACTIVITY METHOD WORKSHEET L-5

This worksheet is applicable to all projects including those that use the Activity Method of s. ILHR 63.49. If necessary, make extra copies of this form. Use as many sheets as needed for the project.

Project Information

A box for basic project information and identification of the document author is provided in the upper part of this form. This should match the information contained in the Project Information section of the Lighting Summary (L-1) form.

Interior Lighting Power Allowance -- ILPA

Column A: Record the room number or room name. A range of similar rooms may also be entered.

Column B: Record the average ceiling height of the room in feet.

Column C: Record a description of each line item. The description shall match the appropriate description from Table 63.49.

Column D: Record the appropriate unit lighting power density (UPD) from Table 63.49.

Column E: Record the floor area of the room (inside wall to inside wall, ft^2). Where multiple rooms are included in single line, this is the average area of each type of room and not the total area of all rooms.

Column F: Record the area factor from either s. ILHR 63.49, Figure 63.49, or an applicable footnote from Table 63.49.

Column G: Record the number of similar spaces.

Column H: Multiply the UPD from Column D by the floor Column E by the area factor from Column F by the number of similar rooms from Column G. Record the resultant lighting power budget in Column H. The values from all entries in this column should be summed into the box marked "ILPA" at the bottom of the column.

LIGHTING SUMMARY

Part 1 of 4 L-1

Project Information Submitter's Name

Owner's Name Date

Building Location (Number & Street) ☐ City ☐ Village ☐ Township of

Method of Interior Lighting Compliance

- ☐ Complete Building s. ILHR 63.47
- ☐ Area Category s. ILHR 63.48
- ☐ Activity s. ILIHR 63.49
- ☐ Other s. ILHR 63.70-72

	Basic Requirements	Prescriptive/Performance	Worksheets
Exterior Lighting	☐ Exterior lighting not intended for 24-hour use controlled by photocell ILHR 63.50 (6) Installed ELP ≤ ELPA ILHR 63.43		☐ Exterior Lighting Power Worksheet (L-2)
Mandatory Interior Controls	☐ Shut-off control in each space enclosed by ceiling-high partitions. ILHR 63.50 (1) ☐ Controls to reduce lighting by 50%. ILHR 63.50 (2) ☐ Controls to reduce lighting in daylit areas. ILHR 63.50 (3) ☐ Shut-off controls. ILHR 63.50 (4) ☐ Display lighting separately switched on circuits ≤ 20 amps. ILHR 63.50 (5) ☐ Hotel/motel guest rooms have master switches at the main door to turn off lights and receptacles. ILHR 63.50 (7)		
Interior Lighting	☐ Exit signs have installed wattage of 20 watts or less. ILHR 63.52 ☐ Fluorescent lamps use multiple lamp ballasts with tandem wiring as required. ILHR 63.53	ILP ≤ ILPA ILHR 67.47, .48 or .49 ☐ Lighting Power Control Credits Applied. ILHR 63.45 ☐ Daylight Sensing Controls ☐ Occupancy Sensors ☐ Programmable Timing Controls ☐ Lumen Maintenance Controls	☐ Interior Lighting Power Worksheet (L-3) ☐ Interior Lighting Power Allowance Worksheet (L-4) ☐ Activity Method Worksheet (L-5)

The information you provide may be used by other agency programs [Privacy Law, s. 15.04 (1)(m)]

Project Name: Date:

INSTALLED LIGHTING SCHEDULE

(Optional if included on plans) (Use as many sheets as necessary)

Luminaire Name (e.g., Type 1, Type 2, etc.)	Lamps					Ballasts				Note to Field
	Type					Type				
	I	F	H	No. of Lamps	Watts/Lamp	S	E*	O*	No./Luminaire	
	☐	☐	☐			☐	☐	☐		
	☐	☐	☐			☐	☐	☐		
	☐	☐	☐			☐	☐	☐		
	☐	☐	☐			☐	☐	☐		
	☐	☐	☐			☐	☐	☐		
	☐	☐	☐			☐	☐	☐		
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***Provide Supporting Documentation for total watts for lamp and ballast.**

NOTES FOR FIELD - For Building Department Use Only

LIGHTING SUMMARY Part 3 of 4 L-1

Project Name:	Date:

MANDATORY AUTOMATIC CONTROLS

(Optional if included on plans) (Use as many sheets as necessary)

Control Location (Room #)	Control Identification	Control Type (Auto time switch, exterior, etc.)	Space Controlled	Note to Field

NOTES FOR FIELD - For Building Department Use Only

LIGHTING SUMMARY Part 4 of 4 L-1

Project Name: Date:

CONTROLS FOR CREDIT

(Optional if included on plans) (Use as many sheets as necessary)

Control Location (Room # or Dwg. #)	Control Identification	Control Type (Occupant, Daylight, Dimming, etc.)	Luminaires Controlled		Note to Field
			Type	# of Lumin.	

NOTES FOR FIELD - For Building Department Use Only

EXTERIOR LIGHTING POWER WORKSHEET L-2

Project Information	Submitter's Name	
Owner's Name		Date
Building Location (Number & Street)	City Village	Township of

EXTERIOR LIGHTING POWER ALLOWANCE - ELPA (s. ILHR 63.43)

A	B	C	D
Area Description	**Allowance (Table 6-1)**	**Area or Lineal Feet in Proposed Design**	**ELPA (B•C)**
Exit (with or without canopy)	25 W/lf of door opening		
Entrance (without canopy)	30 W/lf of door opening		
High Traffic Entrance (with canopy)	10 W/ft^2 of canopied area		
Light Traffic Entrance (with canopy)	4 W/ft^2 of canopied area		
Loading Area	0.40 W/ft^2		
Loading door	20 W/lf of door opening		
Building Exterior Surfaces or Facades	0.25 W/ft^2 of illuminated surface		
Storage and Nonmanufacturing Work Areas	0.20 W/ft^2		
Casual Use Areas (gardens, etc.)	0.10 W/ft^2		
Private Driveways or Walkways	0.10 W/ft^2		
Public Driveways or Walkways	0.15 W/ft^2		
Private Parking Lots	0.12 W/ft^2		
Public Parking Lots	0.18 W/ft^2		
		Total ELPA→	

INSTALLED EXTERIOR LIGHTING POWER (s. ILHR 63.42)

A	B	C	D
Fixture Type	**# of Luminaires Installed**	**Watts per Luminaire (including ballast)**	**Installed Watts (B•C)**
		Total Installed ELP→	

The information you provide may be used by other agency programs [Privacy Law, s. 15.04 (1)(m)].

INSTALLED INTERIOR LIGHTING POWER WORKSHEET L-3

Project Name:

Project Address: Date:

INSTALLED INTERIOR LIGHTING POWER (s. ILHR 63.45)

(Use as many sheets as necessary)

Luminaire Name or ID No.	Luminaire Description	Number of Luminaires	Watts per Luminaire	Total Watts (C•D)	LPAF for Auto Controls	Control Credit (E•F)	Adjusted Watts (E-C)

Total for this Sheet →		Total for this Sheet →	
Total for all Sheets→		Total for all Sheets→	
	(If control credits not taken)		(Adjusted with control credits)

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The information you provide may be used by other agency programs [Privacy Law, s. 15.04 (1)(m)].

COMPLETE BUILDING/AREA CATEGORY METHODS WORKSHEET L-4

Project Information	Submitter's Name		
Owner's Name		Date	
Building Location (Number & Street)	City	Village	Township of

INTERIOR LIGHTING POWER ALLOWANCE (ILPA) (Choose one method or use the Activity Method and Form L-5)

Complete Building Method

Building Type of Use From Table 63.47	Watts/ ft²	Complete Bldg. Area	Allowed Watts

Area Category Method

Primary Function From Table 63.48	Watts/ft²	Area	Allowed Watts
	Totals		
		Area	Watts

The information you provide may be used by other agency programs [Privacy Law, s. 15.04 (1)(m)].

ACTIVITY METHOD WORKSHEET L-5

Project Information	Submitter's Name
Owner's Name	Date
Building Location (Number & Street)	City Village Township of

INTERIOR LIGHTING POWER ALLOWANCE - ILPA (s. ILHR 63.49)

(Use as many sheets as necessary.)

A	B	C	D	E	F	G	H
Room Number or Name	**Ceiling Height (ft)**	**Area/Activity**	**UPD (W/ft^2)**	**Floor Area (ft^2)**	**Area Factor**	**# of Similar Spaces**	**LPB (W) (D•E•F•G)**

Sheet Total Area→ | Sheet Total **ILPA**→

Total area from all sheets | Total ILPA from all sheets

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The information you provide may be used by other agency programs [Privacy Law, s. 15.04 (1)(m)]

SECTION 139. A63.05 (14) is created to read:

A63.05 (14) Daylit Area is the space on the floor that is the larger of (a) or (b);

(a) 1. For areas daylit by vertical glazing, the daylit area has a 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. Such methods include DOE 2.1D and E, Superlite, Quicklite and other computer-based models that determine the daylit area based on modeling the features of the space.

Figures A63.05-A and A63.05-B illustrate the determination of daylit areas. The dimensions given in Figure A63.05-B are for demonstration only and will vary with each space.

Figure A63.05-A Window Daylit Area

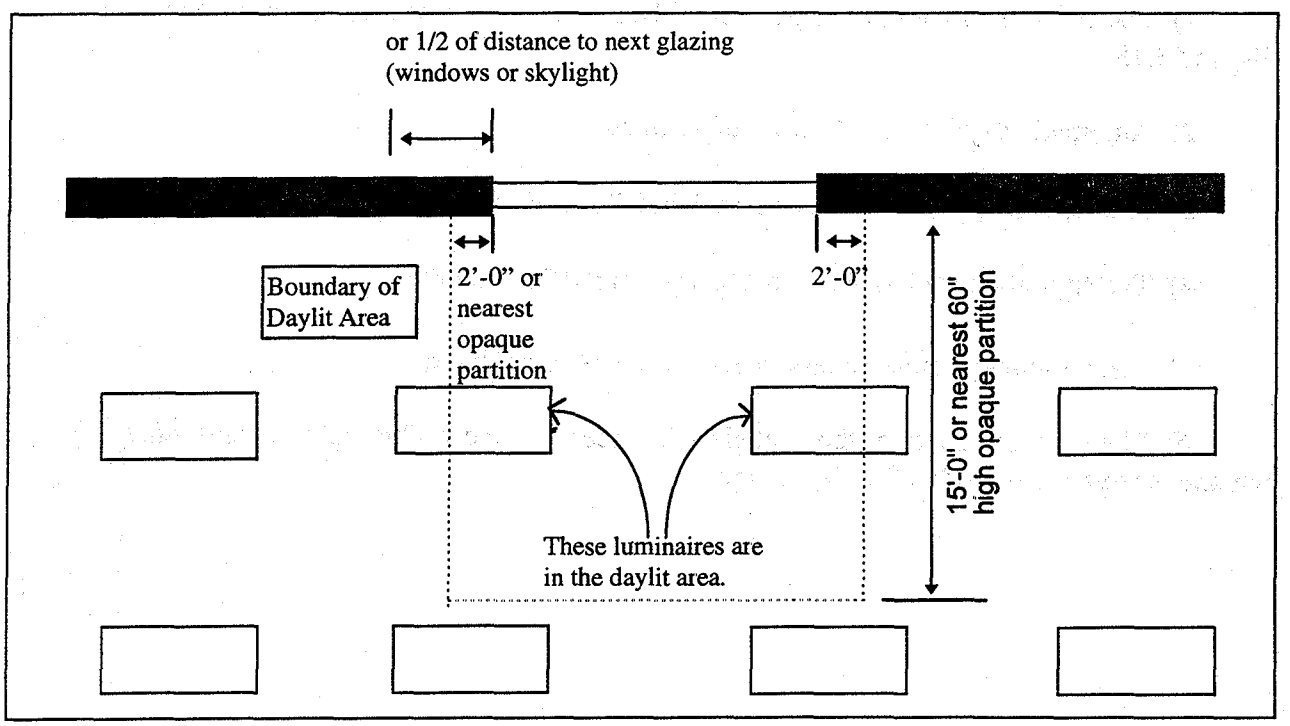
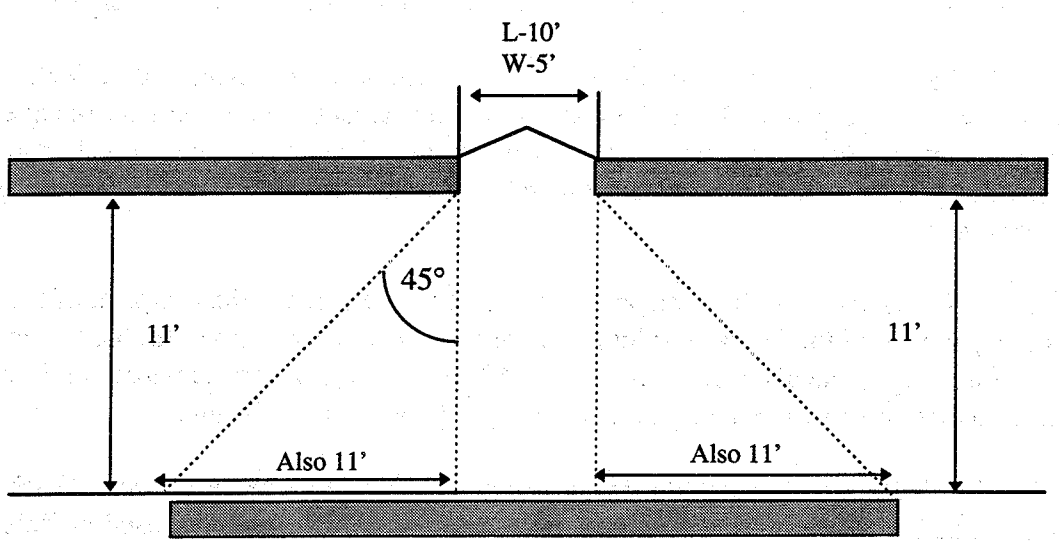


Figure A63.05-B Skylight Daylit Area



SECTION 140. A63.12 is created to read:

A63.12 Section 8.4.8 of ASHRAE Standard 90.1 requires the following criteria to be met for exemption of skylights:

1) The U-value of the opaque portion of the roof must be less than the criteria given in Figure 63.15;

2) Automatic daylighting controls are required;

3) The skylight U-value must be less than 0.70 Btu/hr°F;

4) The skylight curb U-value must be less than 0.21 Btu/hr°F;

5) The air leakage must be less than 0.5 cfm/ft^2 of skylight;

6) The maximum area of the skylight will depend on the visible light transmittance and whether shading is provided for the skylight.

Table A63.12
Maximum Percent Skylight Area

Visible Light Transmission (VLT)	Light Level (fc)	Range of Lighting Power (W/ft^2)				
		<1.00	1.01-1.50	1.51-2.00	2.01-2.50	>2.50
.075	30	2.3	3.4	4.5	5.6	5.6
	50	2.5	4.0	5.5	7.0	7.0
	70	2.8	4.6	6.4	8.2	8.2
.050	30	3.6	5.1	6.6	8.1	8.1
	50	3.9	6.0	8.1	10.2	10.2
	70	4.2	6.9	9.6	12.3	12.3

The maximum allowable skylight area may be increased by 50 percent if shading devices are installed that block more than 50 percent of the solar gain during the peak cooling design condition. If this credit is taken, calculations on data must be prepared that show that solar gains are reduced by 50 percent. Exterior shading devices such as fixed louvers on opaque parapet walls will qualify if all direct solar radiation is eliminated during the peak design condition. Integral, interior or movable exterior shading devices will qualify if they cut the shading coefficient in half when closed.

This summary is provided for general information only. For exact compliance criteria, see the ASHRAE 90.1 Standard.

SECTION 141. A63.15 (3)(b) is created to read:

A63.15 (3)(b) Heat Capacity (HC) of an assembly is the amount of heat necessary to raise the temperature of all the components of a unit area in the assembly one degree F. It is calculated as the sum of the average thickness times the density times the specific heat for each component, and is expressed in Btu per square foot per degree F.

Heat capacity describes the thermal mass of an assembly. It is used in the prescriptive envelope requirements for walls and floors, where the U-value criterion is tied to the heat capacity of the assembly.

For a single layer, homogeneous wall or floor, such as poured concrete walls with no applied finish materials, heat capacity can be calculated by multiplying the weight of the wall (pounds per square foot) times the specific heat. For instance, a 6-inch concrete wall (specific heat = 0.20 Btu/lb°F) with a weight of 70 pounds per square foot would have an HC of 70 x 0.20 or 14 Btu/sf°F. The wall weight is calculated from the density (pounds per square foot); density divided by 12 and multiplied by the thickness (inches) gives the wall weight (pounds per square foot).

For assemblies made up of many layers, HC may be calculated separately for each layer and summed.

The following Table A63.15-1 lists the thermal properties of typical, thermally massive construction materials.

The heat capacity of unit masonry walls, such as those made of concrete block or brick, are too complicated to calculate by this method. Tables A63.15-2 and A63.15-3 include HC calculated for a large variety of masonry wall assemblies. These tables also give the U-value (U) and the total R-value (Rt) for the wall, including interior and exterior air films.

A63.15-1 Thermal Mass Properties

Matter	Conductivity $\frac{\text{Btu. in}}{\text{hr.sf.°F}}$	Density (lbs/cf)	Specific Heat (Btu/lb°F)
Adobe	0.33	120	0.20
Heavy Concrete	0.98	140	0.20
Lightweight Concrete	0.36	85	0.20
Gypsum	0.09	50	0.26
Masonry Veneer	0.62	127	0.20
Masonry Infill	0.44	120	0.20
Concrete Masonry Unit	0.59	105	0.20
Grouted Concrete Masonry Unit	1.00	134	0.20
Stucco	0.47	105	0.20
Tile in Mortar	0.67	120	0.20
Solid Wood (fir)	0.07	32	0.33
From: ASHRAE Handbook of Fundamentals, Table 4, Chapter 22			

Table A63.15-2 Properties of Hollow Unit Masonry Walls

Thickness/Material Type			Core Treatment		
				Partly Grouted with Ungrouted Cells	
			Solid Grout	Empty	Insulated
12"	LW CMU	U	0.51	0.43	0.30
		R_t	2.0	2.3	3.3
		HC	23.0	14.8	14.8
	MW CMU	U	0.54	0.46	0.33
		R_t	1.9	2.2	3.0
		HC	23.9	15.6	15.6
	NW CMU	U	0.57	0.49	0.36
		R_t	1.8	2.0	2.8
		HC	24.8	16.5	16.5
10"	LW CMU	U	0.55	0.46	0.34
		R_t	1.8	2.2	2.9
		HC	18.9	12.6	12.6
	MW CMU	U	0.59	0.49	0.37
		R_t	1.7	2.1	2.7
		HC	19.7	13.4	13.4
	NW CMU	U	0.62	0.52	0.41
		R_t	1.6	1.9	2.4
		HC	20.5	14.2	14.2
8"	LW CMU	U	0.62	0.50	0.37
		R_t	1.6	2.0	2.7
		HC	15.1	9.9	9.9
	MW CMU	U	0.65	0.53	0.41
		R_t	1.5	1.9	2.4
		HC	15.7	10.5	10.5
	NW CMU	U	0.69	0.56	0.44
		R_t	1.4	1.8	2.3
		HC	16.3	11.1	11.1
	Clay Unit	U	0.57	0.47	0.39
		R_t	1.8	2.1	2.6
		HC	15.1	11.4	11.4
6"	LW CMU	U	0.68	0.54	0.44
		R_t	1.5	1.9	2.3
		HC	10.9	7.9	7.9
	MW CMU	U	0.72	0.58	0.48
		R_t	1.4	1.7	2.1
		HC	11.4	8.4	8.4
	NW CMU	U	0.76	0.61	0.52
		R_t	1.3	1.6	1.9
		HC	11.9	8.9	8.9
	ClayUnit	U	0.65	0.52	0.45
		R_t	1.5	1.9	2.2
		HC	11.1	8.6	8.6

Notes:

LW CMU is a Light Weight Concrete Masonry Unit per ASTM C 90, calculated at 105 PCF density.

MW CMU is a Medium Weight concrete Masonry Unit per ASTM C 90, calculated at 115 PCF density.

NW CMU is a Normal Weight Concrete Masonry Unit per ASTM C 90, calculated at 125 PCF density.

Clay Unit is a hollow clay unit per ASTM C 652, calculated at 130 PCF density.

Values include thermal resistance of interior air film (R = 0.68) and exterior air film (R = 0.17).

Calculations based on Energy Calculations and Data, CMACN, 1986.

Grouted Cells at 32" x 48" in partly grouted walls

[Source: Berkeley Solar Group; Concrete Masonry Association of California and Nevada (CMACN).]

Table A63.15-3 Properties of Solid Unit Masonry and Solid Concrete Walls

Type		3	4	5	6	7	8	9	10	11	12
LW CMU	U	na	0.71	0.64	na	na	na	na	na	na	na
	R_t	na	1.4	1.6	na	na	na	na	na	na	na
	HC	na	7.00	8.75	na	na	na	na	na	na	na
MW CMU	U	na	0.76	0.70	na	na	na	na	na	na	na
	R_t	na	1.3	1.4	na	na	na	na	na	na	na
	HC	na	7.67	9.58	na	na	na	na	na	na	na
NW CMU	U	0.89	0.82	0.76	na	na	na	na	na	na	na
	R_t	1.1	1.2	1.3	na	na	na	na	na	na	na
	HC	6.25	8.33	10.42	na	na	na	na	na	na	na
ClayUnit	U	0.80	0.72	0.66	na	na	na	na	na	na	na
	R_t	1.3	1.4	1.5	na	na	na	na	na	na	na
	HC	6.30	8.40	10.43	na	na	na	na	na	na	na
Concrete	U	0.96	0.91	0.86	0.82	0.78	0.74	0.71	0.68	0.65	0.63
	R_t	1.0	1.1	1.2	1.2	1.3	1.4	1.4	1.5	1.5	1.6
	HC	7.20	9.60	12.00	14.40	16.80	19.20	21.60	24.00	26.40	28.80

Notes:
LW CMU is a Light Weight Concrete Masonry Unit per ASTM C 90 or 55, calculated at 105 PCF density.

MW CMU is a Medium Weight concrete Masonry Unit per ASTM C 90 or 55, calculated at 115 PCF density.

NW CMU is a Normal Weight Concrete Masonry Unit per ASTM C 90 or 55, calculated at 125 PCF density.

Clay Brick is a clay unit per ASTM C 62, calculated at 130 PCF density.

Concrete is structural poured or precast concrete, calculated at 144 PCF density.

Calculations based on Energy Calculations and Data, CMACN, 1986.

Values include thermal resistance of interior air film (R = 0.68) and exterior air film (R = 0.17).

[Source: Berkeley Solar Group; Concrete Masonry Association of California and Nevada (CMACN).]

SECTION 142. Section A63.18 (2)(a) 3. is created to read:

A63.18 (2)(a) 3.

Default U-Values for Wood and Steel Swinging Doors Btu/(h-ft^2-°F) - Part I

Nominal Thickness (Inches)	Description	No. Storm Door	Wood Storm Door[c]	Metal Storm Door[d]
Wood Doors [a,b]				
1 3/8	Panel door with 7/16" panels[e]	0.57	0.33	0.37
1 3/8	Hollow-core flush door	0.47	0.30	0.32
1 3/8	Solid-core flush door	0.39	0.26	0.28
1 3/4	Panel door with 7/16" panels[e]	0.54	0.32	0.36
1 3/4	Hollow-core flush door	0.46	0.29	0.32
1 3/4	Panel door with 1 1/8" panels[e]	0.39	0.26	0.28
1 3/4	Solid-core flush door	0.33	0.25	0.28
2 1/4	Solid-core flush door	0.27	0.29	0.21
Steel Doors[b]				
1 3/4	Fiberglass or mineral wool core with steel stiffeners, no thermal break[f]	0.60	na	na
1 3/4	Paper honeycomb core without thermal break[f]	0.56	na	na
1 3/4	Solid urethane foam core without thermal break[f]	0.40	na	na
1 3/4	Solid fire-rated mineral fiberboard core without thermal break[f]	0.38	na	na
1 3/4	Polystyrene core without thermal break (18 gage commercial steel)[f]	0.38	na	na
1 3/4	Polyurethane core without thermal break (18 gage commercial steel)[f]	0.29	na	na
1 3/4	Polyurethane core without thermal break (24 gage commercial steel)[f]	0.29	na	na
1 3/4	Polyurethane core with thermal break and perimeter (24 gage commercial steel)[f]	0.20	na	na
1 3/4	Solid urethane foam core with thermal break[a]	0.19	0.16	0.17

Note: All U-Values for exterior doors in this table are for doors with no glazing, except for the storm doors which are in addition to the main exterior door. Any glazing area in exterior doors shall be included with the appropriate glass type and analyzed as fenestration. Interpolation and moderate extrapolation are permitted for door thicknesses other than those specified. In order to take credit for a thermal break, the door must have a thermal break in both the door slab and the frame.

[a] Values are based on a nominal 32" by 80" door size with no glazing.

[b] U-values include the thermal resistance of air films. Outside air conditions: 15 mph wind speed, 0°F air temperature; inside air conditions: natural convection, 70°F air temperature.

[c] Values for wood storm door are for approximately 50% glass area.

[d] Values for metal storm door are for any percent glass area.

[e] 55% panel area.

[f] ASTM C 236 hotbox data on a nominal 3' x 7' door size with no glazing.

Default U-Values for Sliding and Roll-Up Doors Btu/h-ft^2-°F) - Part II

Door Description	Overall U-Factor
Uninsulated, single-layer	1.15
Nominal 2" thick with 1 3/4" polyurethane foam core and vinyl thermal breaks and section joint seals	0.14
Nominal 3" thick with 2 7/8" expanded polystyrene core and continuous vinyl extrusion to form a thermal break and weather-tight seal along section joint	0.12
Other doors	Use value from most similar swinging door above

Note: See s. ILHR 51.06 for thermal barrier requirements for foam plastic insulation.

SECTION 143. Section A63.20 is created to read:

A63.20 Tables A63.20-1 through 10 specify the ASHRAE 90.1-1989 efficiency standards for equipment not covered by federal efficiency standards, but are covered by s. ILHR 63.20.

Table A63.20-1
Standard Rating Conditions and Minimum Performance, Unitary Air Conditioners and Heat Pumps --Air-Cooled, Electrically Operated, <135,000 Btu/h Cooling Capacity-- Except Packaged Terminal and Room Air Conditioners

Reference Standards*	Category	Sub-Category & Rating Condition (Outdoor Temp. °F)		Minimum Performance**
ARI 210-81 ARI 240-81 ARI 210/240-84	≤65,000 Btu/h Cooling Capacity Cooling Mode	3ø	Standard Rating (95°F db) Split System & Single Package Integrated Part Load Value (80°F db) Split System & Single Package	 9.5 EER 8.5 IPLV
	≥65,000 <135,000 Btu/h Cooling Mode	All ø	Standard Rating (95°F db) Integrated Part Load Value (80°F db)	8.9 EER 8.3 IPLV
	<65,000 Btu/h Cooling Capacity Heating Mode	3ø	Split System & Single Package High Temp. Rating (47°F db/43°F wb) Low Temp. Rating (17°F db/15°F wb)	 3.0 COP 2.0 COP
	≥65,000 <135,000 Btu/h Cooling Capacity Heating Mode	All ø	Split System & Single Package High Temp. Rating (47°F db/43°F wb) Low Temp. Rating (17°F db/15°F wb)	 3.0 COP 2.0 COP

* For detailed references, see ASHRAE Standard 90.1.
** COP = Coefficient of Performance, EER = Energy Efficiency Ratio, ILPV = Integrated Part Load Value. See reference documents for detailed definitions.

Table A63.20-2
Standard Rating Conditions and Minimum Performance Unitary Air Conditioners and Heat Pumps --Evaporatively Cooled, Electrically Operated, Cooling Mode <135,000 Btu/h Cooling Capacity-- Except Packaged Terminal and Room Air Conditioners

Reference Standards*	Category	Rating Condition °F Indoor Temp. Outdoor Temp.	Minimum Performance**
ARI 210-81	≤65,000 Btu/h Cooling Capacity	Standard Rating 80°F db/67°F wb 95°F db/75°F wb	 9.3 EER
	<65,000 Btu/h	Integrated Part Load Value (80°F db/67°F wb)	8.5 IPLV
ARI 210/240-84	≥65,000 <135,000 Btu/h	Standard Rating 80°F db/67°F wb 95°F db/75°F wb	 10.5 EER
CTI 201 (86)	≥65,000 <135,000 Btu/h	Integrated Part Load Value (80°F db/67°F wb)	9.7 IPLV

* For detailed references, see ASHRAE Standard 90.1.
** EER = Energy Efficiency Ratio, ILPV = Integrated Part Load Value. See reference documents for detailed definitions.

Table A63.20-3
Standard Rating Conditions and Minimum Performance, Water-Cooled Air Conditioners and Heat Pumps --Cooling Mode <135,000 Btu/h Cooling Capacity, Electrically Operated

Reference Standards*	Category	Rating Condition °F Indoor Air / Entering Water	Minimum Performance**
Water-Source Heat Pumps ARI 320-86 CTI 201 (86)	<65,000 Btu/h Cooling Capacity	Standard Rating 80°F db/67°F wb / 85	9.3 EER
		Low Temperature Rating 80°F db/67°F wb / 75	10.2 EER
	≥65,000 <135,000 Btu/h Cooling Capacity	Standard Rating 80°F db/67°F wb / 85	10.5 EER
Groundwater Cooled Heat Pumps ARI 325-85	<135,000 Btu/h Cooling Capacity	Standard Rating 70	11.0 EER
		Low Temperature Rating 50	11.5 EER
Water-Cooled Unitary Air Conditioners ARI 210-81 ARI 210/240-84 CTI 201 (86)	<65,000 Btu/h Cooling Capacity	Standard Rating 80°F db/67°F wb / 85	9.3 EER
		Integrated Part Load Value 75	8.3 IPLV
	≥65,000 <135,000 Btu/h Cooling Capacity	Standard Rating 80°F db/67°F wb / 85	10.5 EER

* For detailed references, see ASHRAE Standard 90.1.
** EER = Energy Efficiency Ratio, ILPV = Integrated Part Load Value. See reference documents for detailed definitions.

Table A63.20-4
Standard Rating Conditions and Minimum Performance, Packaged Terminal Air Conditioners and Heat Pumps --Air-Cooled, Electrically Operated[a]

Reference Standards[c]	Category TACs & PTAC H.P.'s	Sub-Category & Rating Condition (Outdoor Temp.)	Efficiency Rating	Minimum Performance[b]
ARI 310-87	Cooling Mode	Standard Rating (95°F db)	EER	10.0 - (0.16 x Cap./1000)
		Low Temp. Rating (82°F db)	EER	12.2 - (0.20 x Cap./1000)
ARI 380-87	Heating Mode	Standard Rating (47°F db/43°F wb)	COP	2.9 - (0.026 x Cap./1000)

[a] For multicapacity equipment, the minimum performance shall apply to each capacity step provided. Multicapacity refers to manufacturer published ratings for more than one capacity mode allowed by the product's controls.

[b] Cap. means the rated cooling capacity of the product in Btu/h in accordance with the cited ARI Standard. If the unit's capacity is less than 7000 Btu/h, use 7000 Btu/h in the calculation. If the unit's capacity is greater than 15,000 Btu/h, use 15,000 Btu/h in the calculation. COP = Coefficient of Performance, EER = Energy Efficiency Ratio. See reference documents for detailed definitions.

[c] For detailed references, see ASHRAE Standard 90.1.

Table A63.20-5
Standard Rating Conditions and Minimum Performance, Water-Source and Groundwater-Source Heat Pumps --Electrically Operated, <135,000 Btu/h Cooling Capacity

Reference Standards[c]	Rating Condition °F[a]	Minimum Performance[d]
Water-Source Heat Pumps ARI 320-86 CTI 201-(86)	Standard Rating 70°F Entering Water[b]	3.8 COP
Groundwater-Source Heat Pumps ARI 325-85	1. High Temperature Rating 70°F Entering Water[b]	3.4 COP
	2. Low Temperature Rating 50°F Entering Water[b]	3.0 COP

[a] Air entering indoor section 70°F db/60°F wb (max.)

[b] Water flow rate per manufacturer's specifications.

[c] For detailed references, see ASHRAE Standard 90.1.

[d] COP = Coefficient of Performance. See reference documents for detailed definitions.

Table A63.20-6
Standard Rating Conditions and Minimum Performance, Large Unitary Air Conditioners and Heat Pumps-- Electrically Operated, >135,000 Btu/h Cooling Capacity

Category Reference Standards[c]	Efficiency Rating[d]	Minimum Performance	
Air Conditioners[a] Air Cooled ARI 360-86	EER	≤760,000 Btu/h: 8.5	>760,000 Btu/h: 8.2
	IPLV	7.5	
Air Conditioners[a] Water/Evaporatively Cooled ARI 360-86 CTI 201-86	EER	9.6	
	IPLV	9.0	
Heat Pumps[a] Air Cooled-Cooling Air Cooled-Heating ARI 340-86	EER	<760,000 Btu/h: 8.5	≥760,000 Btu/h: 8.2
	IPLV	7.5	
	COP (47°F)	2.9	
	COP (17°F)	2.0	
Condensing Units[b] Air Cooled ARI 365-87	EER	9.9	
	IPLV	11.0	
Condensing Units[b] Water/Evaporatively Cooled ARI 365-87 CTI 201-86	EER	12.9	
	IPLV	12.9	

[a] For units that have a heating section, deduct 0.2 from all required EERs and IPLVs.

[b] Condensing unit requirements are based on single-number ratings defined in paragraph 5.1.3.2 of ARI Standard 365.

[c] For detailed references, see ASHRAE Standard 90.1.

[d] COP = Coefficient of Performance, EER = Energy Efficiency Ratio, ILPV = Integrated Part Load Value. See reference documents for detailed definitions.

Table A63.20-7
Standard Rating Conditions and Minimum Performance, Water Chilling Packages, Water and Air Cooled, Electrically Operated

Reference Standards[b]	Category	Efficiency Rating[c]	Minimum Performance
ARI 550-86 & ARI 590-86 CTI 201-86	Water-Cooled		
	≥300 Tons	COP	5.2[a]
		IPLV	5.3[a]
	≥150 Tons <300 Tons	COP	4.2
		IPLV	4.5
	<150 Tons	COP	3.8
		IPLV	3.9
	Air-Cooled With Condenser		
	≥150 Tons	COP	2.5
		IPLV	2.5
	<150 Tons	COP	2.7
		IPLV	2.8
	Condenserless, Air-Cooled		
	All Capacities	COP	3.1
		IPLV	3.2

[a] Where R-22, or CFC refrigerants with ozone depletion factors less than or equal to those for R-22 is used, these requirements are reduced to 4.7 COP and 4.8 IPLV.

[b] For detailed references, see ASHRAE Standard 90.1.

[c] COP = Coefficient of Performance, EER = Energy Efficiency Ratio, ILPV = Integrated Part Load Value. See reference documents for detailed definitions.

Table A63.20-8
Standard Rating Conditions and Minimum Performance, Gas- and Oil-Fired Boilers

Reference[b]	Category	Rating Condition[a]	Minimum Performance[c]
ANSI Z21.13-87 H.I. Htg. Boiler Std. 86 ASME PTC 4.1-64 U.L. 795-73	Gas-Fired ≥300,000 Btu/h	1. Max. Rated Capacity Steady-State	E_c 80%
		2. Min. Rated Capacity Steady-State	E_c 80%
U.L. 726-75 H.I. Htg. Boiler Std. 86	Oil-Fired ≥300,000 Btu/h	1. Max. Rated Capacity Steady-State	E_c 83%
		2. Min. Rated Capacity Steady-State	E_c 83%
H.I. Htg. Boiler Std. 86 ASME PTC 4.1-64	Oil-Fired (Residual) ≥300,000 Btu/h	1. Max. Rated Capacity Steady-State	E_c 83%
		2. Min. Rated Capacity Steady-State	E_c 83%

[a] Provided and allowed by the controls.

[b] For detailed references, see ASHRAE Standard 90.1.

[c] E_c = Combustion efficiency, 100%-flue losses.

Table A63.20-9
Standard Rating Conditions and Minimum Performance, Warm Air Furnaces and Combination Warm Air Furnaces/Air Conditioning Units

Reference[b]	Category	Rating Condition[a]	Minimum Performance[c]
ANSI Z21.47-83	Gas-Fired ≥225,000 Btu/h	1. Max. Rated Capacity Steady-State	E_t 80%
		2. Min. Rated Capacity Steady-State	E_t 78%
U.L. 727-86	Oil-Fired[d] ≥225000 Btu/h	1. Max. Rated Capacity Steady-State	E_t 81%
		2. Min. Rated Capacity Steady-State	E_t 81%

[a] Provided and allowed by the controls.

[b] For detailed references, see ASHRAE Standard 90.1.

[c] E_t = Thermal efficiency, 100%-flue losses. See referenced document for detailed definition.

Table A63.20-10
Warm Air Duct Furnaces and Unit Heaters

Reference[b]	Category	Rating Condition[a]	Minimum Performance[c]
ANSI Z83.9-86	Duct Furnaces Gas-Fired	1. Max. Rated Capacity Steady-State	E_t 78%
		2. Min. Rated Capacity Steady-State	E_t 75%
ANSI Z83.8-55	Unit Heaters Gas-Fired	1. Max. Rated Capacity Steady-State	E_t 78%
		2. Min. Rated Capacity Steady-State	E_t 74%
U.L. 731-88	Unit Heaters Oil-Fired	1. Max. Rated Capacity Steady-State	E_t 81%
		2. Min. Rated Capacity Steady-State	E_t 81%

[a] Provided and allowed by the controls.

[b] For detailed references, see ASHRAE Standard 90.1.

[c] E_t = Thermal efficiency, 100%-flue losses. See reference document for detailed definition.

Equipment efficiencies for the following appliances are established under federal Department of Energy rules 10 cfr Part 430 - Energy Conservation Program for Consumer Products and are not contained in this code:

Central air conditioners other than packaged terminal air conditioners which are powered by single phase electric current, air cooled, rated below 65,000 Btu per hour, not contained within the same cabinet as a furnace, the rated capacity of which is above 225,000 Btu per hour, and is a heat pump or a cooling unit only.

Furnaces which utilize only single-phase electric current, or single-phase electric current or DC current in conjunction with natural gas, propane, or home heating oil, and which comply with the following:

(a) Are designed to be the principal heating sources for the living space of a residence;

(b) Are not contained within the same cabinet with a central air conditioner whose rated cooling capacity is above 65,000 Btu per hour;

(c) Are electric central furnaces, electric boilers, forced-air central furnaces; gravity central furnaces, or low pressure steam or hot water boilers, and

(d) Have a heat input rate of less than 300,000 Btu per hour for electric boilers and low pressure steam or hot water boilers and less than 225,000 Btu per hour for forced-air central furnaces, gravity central furnaces, and electric central furnaces, gravity central furnaces, and electric central furnaces.

Heat pumps other then packaged terminal heat pumps which consist of one or more assemblies, powered by single-phase electric current, rated below 65,000 Btu per hour, utilizing an indoor conditioning coil, compressor, and refrigerant-to-outdoor air heat exchanger to provide air heating, and may also provide air cooling, dehumidifying, humidifying circulating, and air cleaning.

Direct heating equipment which is self-contained, and provides heat directly to the space proximate to the heater by gravity or fan circulation without duct connections.

The Department of Energy rules, section 430.31, requires the following efficiencies for heating and cooling equipment and water heaters.

Table A63.20-11
Room Air Conditioners

	Product Class	Energy Efficiency Ratio
1.	Without reverse cycle and with louvered sides less than 6,000 Btu	8.0
2.	Without reverse cycle and with louvered sides 6,000 to 7,999 Btu	8.5
3.	Without reverse cycle and with louvered sides 8,000 to 13,999 Btu	9.0
4.	Without reverse cycle and with louvered sides 14,000 to 19,999 Btu	8.8
5.	Without reverse cycle and with louvered sides 20,000 and more Btu	8.2
6.	Without reverse cycle and without louvered sides less than 6,000 Btu	8.0
7.	Without reverse cycle and without louvered sides 6,000 to 7,999 Btu	8.5
8.	Without reverse cycle and without louvered sides 8,000 to 13,999 Btu	8.5
9.	Without reverse cycle and without louvered sides 14,000 to 19,999 Btu	8.5
10.	Without reverse cycle and without louvered sides 20,000 and more Btu	8.2
11.	With reverse cycle and with louvered sides	8.5
12.	With reverse cycle and without louvered sides	8.0

Table A63.20-12
Central Air Conditioners and
Central Heat Pumps

	Product Class	Seasonal Energy Efficiency Ratio	Heating Seasonal Performance Factor
1.	Split systems	10.0	6.8
2.	Single package systems	9.7	6.6

Table A63.20-13
Water Heaters

Product Class	Energy Factor
1. Gas water heater	0.62-(.0019 x rated storage volume in gallons)
2. Oil water heater	0.59-(.0019 x rated storage volume in gallons)
3. Electric water heater	0.93-(.00132 x rated volume storage in gallons)

Note: Rated storage volume = the water storage capacity of a water heater, in gallons, as specified by the manufacturer.

Table A63.20-14
Furnaces

Product Class	AFUE[1] (percent)
1. Furnaces (excluding classes noted below) (percent)	78
2. Mobile home furnaces (percent)	75
3. Small furnaces (other than furnaces designed solely for installation in mobile homes) having an input rate of less than 45,000 Btu/hr	
(A) Weatherized (outdoor)	78
(B) Nonweatherized (indoor)	78
4. Boilers (excluding gas steam) (percent)	80
5. Gas steam boilers (percent)	75

[1] Annual Fuel Utilization Efficiency, as determined in s. 430.22 (n)(2) of the DOE rules.

Table A63.20-15
Direct Heating Equipment

	Product Class	Annual Fuel Utilization Efficiency (percent)
1.	Gas wall fan type up to 42,000 Btu/hour	73
2.	Gas wall fan type over 42,000 Btu/hour	74
3.	Gas wall gravity type up to 10,000 Btu/hour	59
4.	Gas wall gravity type over 10,000 Btu/hour up to 12,000 Btu/hour	60
5.	Gas wall gravity type over 12,000 Btu/hour up to 15,000 Btu/hour	61
6.	Gas wall gravity type over 15,000 Btu/hour up to 19,000 Btu/hour	62
7.	Gas wall gravity type over 19,000 Btu/hour up to 27,000 Btu/hour	63
8.	Gas wall gravity type over 27,000 Btu/hour up to 46,000 Btu/hour	64
9.	Gas wall gravity type over 46,000 Btu/hour	65
10.	Gas floor up to 37,000 Btu/hour	56
11.	Gas floor over 37,000 Btu/hour	57
12.	Gas room up to 18,000 Btu/hour	57
13.	Gas room over 18,000 Btu/hour up to 20,000 Btu/hour	58
14.	Gas room over 20,000 Btu/hour up to 27,000 Btu/hour	63
15.	Gas room over 27,000 Btu/hour up to 46,000 Btu/hour	64
16.	Gas room over 46,000 Btu/hour	65

SECTION 144. A63.29 is created to read:

A63.29 ALTERNATIVE HVAC PIPING INSULATION TYPES. Insulation thicknesses in Table 63.29-A are based on insulation with thermal conductives within the range listed in Table 63.29-A for each fluid operating temperature range, rated in accordance with ASTM C335-84 at the mean temperature listed in the table. For insulation that has a conductivity outside the range shown in Table 63.29-A for the applicable fluid operating temperature range at the mean rating temperature shown (when rounded to the nearest 0.01 Btu in./(h °F ft^2)), the minimum thicknesses shall be determined in accordance with the equation given below:

$$T = PR[(1 + t/PR)^{K/k} - 1]$$

where:

T = minimum insulation thickness for material with conductivity K, in.

PR = pipe actual outside radius, in.

t = insulation thickness from Table 63.31-A in.

K = conductivity of alternate material at the mean rating temperature indicated in Table 63.31-A for the applicable fluid temperature range, Btu in./(h ft^2 °F)

k = the lower value of the conductivity range listed in Table 63.31-A for the applicable fluid temperature range, Btu in./(h ft^2 °F)

SECTION 146. Tables A63.45-1 to 6 are created to read:

Table A63.45-1

Typical Lighting Power for Magnetically Ballasted Fluorescent Lamp-Ballast Systems (watts)

	4 Lamps 2 Ballasts		3 Lamps 2 Ballasts		3 Lamps Tandem-Wired Ballasts		2 Lamps 1 Ballast	
	ANSI	Enclosed	ANSI	Enclosed	ANSI	Enclosed	ANSI	Enclosed
Standard Magnetic Energy Saving Ballasts								
31-watt FB31T8			105	97	104	96	69	64
32-watt F32T8	140	129	106	98	105	97	70	65
34-watt F40T12/ES	144	137	112	107	108	103	72	68
40-watt F40T12	176	160	134	121	129	117	88	80
40-watt FB40T12			134	121	129	117	86	78
40-watt F40T5 Twin Tube			130	120			86	79
60-watt F96T12/ES Slimline							123	
75-watt F96T12 Slimline							158	
95-watt F96T12/High Output/ES							199	
110-watt F96T12/High Output/ES							237	

Notes: Data listed are for standard energy efficient magnetic ballasts.
Values listed for 3-lamp systems with 2 magnetic ballasts have 1 single-lamp ballast and 1 double-lamp ballast.

Table A63.45-2

Typical Lighting Power for Electronically Ballasted Rapid-Start Fluorescent Lamp-Ballast Systems

Lamp/Ballast Combination	4 Lamps 1 Ballast		3 Lamps 1 Ballast		2 Lamps 1 Ballast		1 Lamp 1 Ballast	
	ANSI	Enclosed	ANSI	Enclosed	ANSI	Enclosed	ANSI	Enclosed
265 mA T-8 Lamps								
17-watt F17T8					34	33	16	15
25-watt F25T8			66	63	46	44	23	22
32-watt F32T8	120	116	90	87	61	59	31	30
40-watt F40T8			108		73	71	39	
T-12 and T-10 Lamps								
25-watt F30T12/ES			77		49	47	27	25
30-watt F30T12			87		59	57	32	30
34-watt F40T12/ES	117		90	87	62	60	31	30
40-watt F40T10			109	106	73	71	39	38
40-watt F40T12	140		106	103	72	70	38	36
40-watt FB40T12			100	93	67	62		
85-watt F72T12 High Output					164		82	
95-watt F96T12/HO/ES					170			
110-watt F96T12/HO					201			
Twin Tube Biax Lamps								
36-watt FT36T5 Twin Tube			106		72		37	
39-watt FT39T5 Twin Tube			104		70		37	
40-watt FT40T5 Twin Tube				69	67		37	
50-watt FT50T5 Twin Tube			125		106		54	

Notes: Data listed represents averages of rapid-start products available in 1994 from established manufacturers of electronic ballasts.
Actual input wattages for these system may be tuned by using specific products and will differ from these values.
Systems shown have minimum 0.85 ballast factor.

Table A63.45-3

Typical Lighting Power for Electronically Ballasted Instant-Start Fluorescent Lamp-Ballast Systems (watts)

Lamp/Ballast Combination	4 Lamps 1 Ballast		3 Lamps 1 Ballast		2 Lamps 1 Ballast		1 Lamp 1 Ballast	
	ANSI	Enclosed	ANSI	Enclosed	ANSI	Enclosed	ANSI	Enclosed
265 mA T-8 Lamps								
17-watt F17T8	62	60	50	49	34	32	18	17
25-watt F25T8	87	85	68	67	48	46	28	27
31-watt FB31T8			88	79	61	55	31	30
32-watt F32T8	110	104	89	88	61	57	33	31
36-watt F36T8	150		112		78			
55-watt F96T8					110			
T-12 Slimline Lamps								
55-watt F72T12					109			
60-watt F96T12 Slimline/ES					110		72	
75-watt F96T12 Slimline					135		85	
Twin Tube Biax Lamps								
39-watt FT39T5					64		42	
40-watt FT40T5			103		72		43	
55-watt FT55T5 Twin Tube						115		

Notes: Data listed represents averages of rapid-start products available in 1994 from established manufacturers of electronic ballasts. Actual input wattages for these system may be tuned by using specific products and will differ from these values. Systems shown have minimum 0.85 ballast factor.

Table A63.45-4

Typical Lighting Power for Electronically Ballasted Low-Wattage Reduced-Output Fluorescent Lamp-Ballast Systems (watts)

Lamp/Ballast Combination	4 Lamps 1 Ballast		3 Lamps 1 Ballast		2 Lamps 1 Ballast		1 Lamp 1 Ballast	
	ANSI Watts	Ballast Factor	ANSI Watts	Ballast Factor	ANSI Watts	Ballast Factor	ANSI Watts	Ballast Factor
17-watt F17T8	54(RS)	0.77			27(RS)	0.77	14(RS)	0.77
25-watt F25T8	80(IS)	0.82			41(RS)	0.77	21(RS)	0.77
	79(RS)	0.77						
32-watt F32T8	99(IS)	0.79	79(IS)	0.82	54(IS)	0.82	28(RS)	0.77
	101(RS)	0.77	78(RS)	0.75	55(RS)	0.79		
34-watt F40T12/ES	117	0.83	85	0.83	61	0.83	31	0.82
39-watt F39T5 Twin Tube			73(IS)	0.63	52(IS)	0.64		
40-watt F40T5 Twin Tube					60(RS)	0.7		
40-watt F40T8			69(IS)	0.8	66(IS)	0.82		
					69(RS)	0.80		
40-watt F40T12			85	0	61	0.73	57	
40-watt F40T10					72	0.84	37	0.84
59-watt F96T8					105	0.83		
85-watt F72T12/HO					160	0.80		
110-watt F96T12						190	0.8	

Notes: All systems with ballast factor of <0.85

RS = rapid start operation

IS = instant start operation

Ballast factor listed is typical for the average input wattage given for all available products. Note that reducing the ballast factor decreases light output in addition to reducing input wattage.

Table 63.45-5

Typical Lighting Power for Compact Fluorescent Lamps

Lamp Type	Ballast Type	Input Watts
5-watt Twin Tube	Reactor preheat	9
7-watt Twin Tube	Reactor preheat	11
9-watt Twin Tube	Reactor preheat	13
13-watt Twin Tube	Reactor preheat	17
9-watt Quad Tube	Reactor preheat	13
13-watt Quad Tube	Reactor preheat	17
10-watt Quad Tube	Autotransformer preheat	16
	Reactor preheat	13
13-watt Quad Tube	Autotransformer preheat	18
	Reactor preheat	16
15-watt Quad Tube	Reactor preheat	20
18-watt Quad Tube	Autotransformer preheat	25
	Reactor preheat	22
18-20-watt Twin Tube	370 mA preheat or rapid start	22
18-watt Twin Tube	270 MA rapid start	23
	265 mA electronic IS	17
20-watt Quad Tube	Reactor preheat	27
24-27-watt Twin Tube	340 mA rapid start	32
	265 mA electronic IS	21
26-watt Quad Tube	Autotransformer preheat	37
	Reactor preheat HPF	33
	Electronic HPF	23
27-watt Quad Tube	Reactor preheat	34

Table A63.45-6

Typical Lighting Power for High-Intensity Discharge Lamps

Lamp Watts	Ballast Watts	Fixture Input Watts
Mercury Vapor Lamps		
75	15	90
100	18	118
175	25	200
250	35	285
400	50	450
1,000	75	1,075
Metal Halide Lamps		
32	6	38
50	13	63
70	18	88
100	25	125
175	35	210
250	42	292
400	55	455
1,000	70	1,070
High Pressure Sodium Lamps		
35	8	43
50	13	63
70	18	88
100	30	130
150	38	188
250	50	300
400	65	465
1,000	90	1,090

Notes: Source: Pacific Gas & Electric
Figures listed represent average values taken from Osram-Sylvania, Philips, and General Electric lamp catalogs.

SECTION 147. A64.06 (1) is created to read:

A64.06 (1) This paragraph gives three options for determining the minimum amount of outside air that must be provided to occupants of buildings or spaces that fall within the (a) or (b) ventilation classification.

1. The first option allows the amount of outside air to be delivered to each room to be based on the area of the room and determined using Table 64.05.

2. The second option allows the minimum amount of outside air for each room to be calculated by multiplying the number of occupants by 15 cfm per person. One acceptable way of achieving this goal is to have a constant volume air outside air supply to meet the outside air requirement and a separate variable air volume system for thermal comfort.

3. In the third option, credit is given for the recirculation of relatively "clean" air from spaces that receive more than the minimum amount of outside air. The procedure for calculating this credit, the corrected fraction of outdoor air is adopted from ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality:

$$Y = X/[1 + X - Z] \qquad \text{(Equation A)}$$

where

$Y = V_{ot}/V_{st}$ = corrected fraction of outdoor air in system supply

$X = V_{on}/V_{st}$ = uncorrected fraction of outdoor air in system supply

$Z = V_{oc}/V_{sc}$ = fraction of outdoor air in the critical room. The critical room is that room with the greatest required fraction of outdoor air in the supply to the room.

V_{ot} = Corrected total outdoor air flow rate

V_{st} = total supply flow rate, i.e., the sum of all supply for all branches of the system

V_{on} = sum of outdoor air flow rates for all branches of the system

V_{oc} = outdoor air flow rate required in the critical room based on 15 cfm per occupant

V_{sc} = supply flow rate in the critical room

To determine which room is the "critical room," divide the uncorrected outdoor air for each space (15 cfm/person x # occupants = the minimum uncorrected outdoor air requirement) by the maximum supply flow rate in each space. The room which has the largest ratio of outside air to supply air is the critical room. That ratio is the critical ratio.

The calculation procedure is as follows:

1. Calculate the uncorrected outdoor air fraction by dividing the sum of all the branch outdoor air requirements by the sum of all the branch supply flow rates ($X = V_{on}/V_{st}$).

2. Calculate the critical room outdoor air fraction by dividing the critical room outdoor air requirement by the critical room supply flow rate ($Z = V_{oc}/V_{sc}$).

3. Evaluate Equation A to find the corrected fraction of outdoor air to be provided in the system supply (Y).

The corrected fraction of outside air Y, or more, must always be provided in the system supply. If the amount of outside air varies, Y must also vary.

In a supply system where the number of occupants, system flow rates or individual room ventilation flow rates vary, such as a variable air volume system with occupancy sensors, the corrected fraction of outdoor air may vary. The corrected fraction of outdoor air determined in accordance with Equation A, or more, shall be supplied at all times the room is occupied. A real time monitoring system for critical factors such as outdoor air supply, total ventilation rate, and occupancy sensors may adjust the corrected fraction of outdoor air to reflect the actual occupancy conditions in the rooms.

Another strategy is to apply equation A to the minimum and maximum operating conditions for the HVAC system to determine the corrected fraction of outdoor air in the system supply (Y) for each condition. Choose the largest value of Y and always operate the ventilation system with that fraction of outside air in the total supply. This assures that the necessary amount of outside air will always be provided although the minimum will be exceeded at some times.

Where the corrected fraction of outdoor air is used, the air minimum movement must be the greater of either the air movement required by s. ILHR 63.08 (2) or s. ILHR 63.08 (1)(c) 3. which may be calculated as described below.

1. Determine the room with the largest ratio of outdoor air to the supply air (the critical space and critical ratio).

2. Determine the maximum and minimum air flows for the system and the uncorrected outside air requirements.

3. Determine the corrected fraction of outside air in the building supply (Y) using Equation A for each of the minimum and maximum air flows.

4. Take the smaller of the two "Y" values calculated under 3. and determine the minimum individual space ventilation rate for each room by dividing the uncorrected outside air requirement for each room by the smaller Y value.

5. The minimum air movement for each room will be the larger of the air movement calculated in accordance with s. ILHR 63.08 (2) or the ventilation rate calculated under 4.

As given in 64.06 (1)(intro.), where the amount of outside air is based on the number of occupants, as in options 2 or 3, the system designer may use an average occupancy value when determining the required outside air flow for variable occupancies to prevent over ventilating, provided the average used is not less than one-half the anticipated peak occupancy load and the duration of the peak occupancy does not exceed three hours. The average occupancy must be calculated over the entire period of system operation and more than one peak period may occur.

This provision applies to occupancy profiles that permit pollution reduction through over ventilation (on a per-person basis) during intervening periods of reduced occupancy between peaks.

For example, in an airport terminal building with 24-hour daily operation, the occupancy is as follows:

100 people for 6 hours
500 people for 2 hours
200 people for 6 hours
500 people for 2 hours
100 people for 5 hours
10 people for 4 hours

Because the periods of peak occupancy occur for less than three hours, this provision may be used. The average occupancy would be calculated as:
((100 x 6) + (500 x 2) + (200 x 6) + (500 x 2) + (100 x 4) + (10 x 4))/24 = 176

In this case, the average occupancy (176) is less than half the peak occupancy (500/2 = 250). The outdoor air flow rate is determined on the basis of one-half the peak occupancy (250 people) for the full 24-hour operation period.

Note that the number of occupants is averaged over the "duration of the system operation," which in this case is 24 hours. If it was determined that for 4 hours at night the occupancy would be less than one person per 5,000 cubic feet and the outside air would be eliminated as allowed in s. ILHR 64.05 (5), then the period of system operation would be 20 hours and the calculation of the average occupancy would be based on that 20-hour period.

Based on 20 hours of operation, the average occupancy would be calculated as:
((100 x 6) + (500 x 2) + (200 x 6) + (500 x 2) + (100 x 4))/20 = 210

Since the average occupancy is still less than half the peak occupancy, the outdoor air flow rate is determined on the basis on one-half the peak occupancy (250 people) for the 20-hour operation period.

SECTION 148. A64.20 (1)(w) is created to read:

A64.20 (1)(w) DIRECT GAS-FIRED DOOR HEATERS, ANSI Z83.17.

(END)

* *

Pursuant to s. 227 (2)(b), Stats., these rules shall take effect on November 1, 1995, or the first day of the fourth month following publication in the Wisconsin Administrative Register, whichever is later.

* *

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August 8, 1995

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Dear Messrs. Poulson and LaFollette:

TRANSMITTAL OF RULE ADOPTION

CLEARINGHOUSE RULE NO.: 94-116

RULE NO.: Chs. ILHR 50-64 and 72

RELATING TO: Energy Conservation and Heating, Ventilating and Air Conditioning (HVAC)

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,

Carol Skornicka
Secretary

ADM-7239(R.01/95)