RULES CERTIFICATE

Department of Commerce

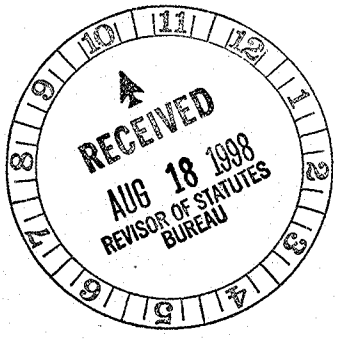
TO ALL TO WHOM THESE PRESENTS SHALL COME, GREETINGS:

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

Uniform Dwelling Code, Chapters ILHR 20-25

were duly approved and adopted by this department.

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



IN TESTIMONY WHEREOF, I have hereunto set my hand at 201 West Washington Avenue in the city of Madison, this 10th day of August A.D. 19 98

For Secretary

COM-10530 (R.11/97)

12-1-98

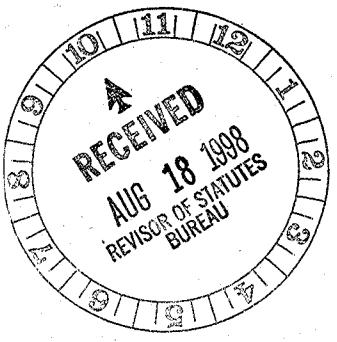
ORDER OF ADOPTION

Department of Commerce

Pursuant to authority vested in the Department of Commerce by section(s) 101.02 (1), 101.63 (1), and 101.64 (3) Stats., the Department of Commerce [X] creates; [X] amends; [X] repeals and recreates; [X] repeals and adopts rules of Wisconsin Administrative Code chapter(s):

ILHR 20-25	Uniform Dwelling Code
(number)	(Title)

The attached rules shall take effect on December 1, 1998 pursuant to section 227.22, Stats.



Adopted at Madison, Wisconsin this date:

8-10-98

DEPARTMENT OF COMMERCE

Secretary

COM-10529 (N.03/97)

State of Wisconsin \ Department of Commerce

RULES in FINAL DRAFT FORM

Rule No.: Chapters ILHR 20-25

Relating to: Uniform Dwelling Code

Clearinghouse Rule No.: 97-138

The Wisconsin Department of Commerce (formerly Industry, Labor and Human Relations) proposes an order to repeal ss. ILHR 20.07 (22), ILHR 20.07 (27m), ILHR 20.07 (39), ILHR 20.07 (73r), ILHR 20.07 (74), ILHR 21.03 (6m) (b) 3., ILHR 21.08 (6) (e), and ILHR 21.29 (12);

to renumber ss. ILHR 21.29 (13) and (14);

to renumber and amend s. ILHR 21.02 (1) (c);

to amend ss. ILHR 21.02 (3) (d), ILHR 21.03 (6m) (b) 1. and 2., ILHR 21.042 (5) (b) and (c), ILHR 21.045 (3) (b), ILHR 21.05 (3), ILHR 21.08 (6) (c) and (d), ILHR 21.18 (2), ILHR 21.205, ILHR 21.25 TABLE 21.25-A, and ILHR 21.27 (3) (a) 2. c.;

to repeal and recreate chapter ILHR 22 and ss. ILHR 20.24, ILHR 21.05 (4), ILHR 21.05 (5), ILHR 21.08 (5), ILHR 21.08 (6) (b), ILHR 21.17, ILHR 21.20, ILHR 21.22 (9), ILHR 21.27 (3) (a) 1., ILHR 23.02 (1), ILHR 23.02 (3) (a), ILHR 23.08 (2) (b) 15, ILHR 23.08 (5), and ILHR 23.15 (2) (d);

and to create ss. ILHR 20.09 (5) (b) 1. c. and d., ILHR 21.02 (1) (c) 2. and 3., ILHR 21.08 (7), ILHR 23.065, and ILHR 23.14 (2) (a) Note relating to the Uniform Dwelling Code.

Analysis of Proposed Rules

Statutory Authority: ss. 101.63 (1) and (1m), 101.64 (1) and (6), 101.72, 101.73 (1m) and 101.74, Stats.
Statutes Interpreted: ss. 101.60, 101.615, 101.62, 101.651, 101.66, 101.70, 101.76, and 101.761, Stats.

Under s. 101.63, 101.64 (1) and (6), 101.72, 101.73 (1m) and 101.74 (1), Stats., the Department of Commerce has the responsibility of adopting rules to establish standards for the construction of 1- and 2-family dwellings. The first edition of chapter ILHR 22 was effective December 22, 1978; chapters ILHR 20, 21, 23 through 25 were first effective June 1, 1980. The last update to the energy efficiency requirements in chapter 22 was in 1989. The last general update to the rest of the code was in 1995.

s. ILHR 21.02 is revised to require mechanical attachment of most roof framing using clips and prohibiting toe-nailing as a means of permanent fastening.

s. ILHR 21.03 is amended to remove the exemption for casement windows from the clear opening requirement for egress windows.

ss. ILHR 21.042 and 21.045 are amended to have handrail heights and railing spacings consistent throughout the code for stairs, ramps and ladders.

s. ILHR 21.05 (5) has been revised to require safety glazing in certain stairway and bathroom configurations.

s. ILHR 21.08 (5) has been amended to address fire separation for multiple, detached dwellings on a single property and the new issue of adjacent, zero-lot-line dwellings. Also, the requirements for joints in

gypsum drywall, used to form the fire separation between a dwelling and an attached garage, have been clarified and more options given.

s. ILHR 21.08 (6) reduces the fire separation requirements between duplex units for consistency.

s. ILHR 21.17 has been amended to clarify when a complete drain tile or pipe system is required and when a partial system may be installed. Definitions have been added for complete and partial systems. A complete drain tile system may still be required in municipalities that enforce this code. However, the clarification is added that a municipality enforcing this code is always free to allow a partial system if site conditions allow.

s. ILHR 21.22 (9) is amended to require bridging on floor joists made of 2X10 and 2X12 sawn lumber.

Chapter ILHR 22

The proposed rule changes include a complete repeal and recreation of ch. ILHR 22, relating to energy conservation.

Some of the new provisions are taken from the 1995 Model Energy Code, (MEC). The impetus to use model code requirements came from three areas, federal law, state law, and Safety and Buildings Division policy.

The federal Energy Policy Act, EPACT, of October 1992 requires states to review their present codes. Each state is required to certify to the Secretary of the U.S. Department Of Energy, that it has reviewed the provisions of its residential building code regarding energy efficiency and made a determination as to whether it is appropriate for such state to revise their residential building code provisions to meet or exceed the MEC.

State laws, ss. 101.63 (1) and 101.73 (1) require the department to establish energy conservation standards for dwellings based on costs and benefits to homeowners and appropriate national standards.

The Safety & Building Division's strategic plan includes using model codes, such as the MEC for the following reasons: 1) To take advantage of economy of scale in the development of the code and compliance tools such as software, 2) To allow all staff and customers to use training and certification materials developed from the national standards, 3) To provide more opportunities for Wisconsin businesses and more choices for consumers and, 4) To benefit from general uniformity across the states.

The department held public hearings in October and November of 1994 to ask for comments on whether the UDC should be revised to meet or exceed the provisions of the 1992 MEC. The department received comments both in favor of and against using MEC. The UDC council recommended formation of an advisory sub-committee to study the issue and develop a proposal to revise Chapter ILHR 22 of the UDC.

The subcommittee decided to review the 1995 MEC and choose portions to incorporate into the Wisconsin code. The subcommittee developed a draft proposal which was then reviewed and revised by the full UDC Council.

The proposed Chapter ILHR 22 is divided into the following seven subchapters: Purpose, Scope and Application; Materials and Equipment; Definitions; Design Criteria; Heating and Air Conditioning

Equipment and Systems; Dwelling Envelope Design; and Design by Systems Analysis and Design of Dwellings Utilizing Renewable Energy Sources.

Chapter 22, Subchapter I

Subchapter I-Purpose, Scope and Application has only editorial changes.

Chapter 22, Subchapter II

The proposed Subchapter II-Materials and Equipment, includes three sections: s. ILHR 22.03 Identification, s. ILHR 22.04 Maintenance Information and s. ILHR 22.05 Fenestration Product Rating Certification and Labeling.

S. ILHR 22.03 requires batt or board insulation to have a thermal resistance identification mark applied by the manufacturer or that the insulation installer provide a signed and dated certification as to the R-value. Blown or sprayed insulation is required to be installed with depth markers. These changes are to make it easier for owners and inspectors to verify the installed insulation levels.

S. ILHR 22.04 requires the maintenance instructions for installed equipment to be provided to the owner.

In the past, window performance was not evaluated by consistent methods and manufacturer's claims could not be compared to each other or to the code. There is a new national standard and certification program developed by the National Fenestration Rating Council (NFRC). **S. ILHR 22.05** gives two options for determining window performance. It specifies that U-values of windows, doors and skylights must be determined in accordance with the NFRC procedures for determining fenestration product thermal properties by an accredited laboratory, and labeled and certified by the manufacturer. As an alternative, U-values may be taken from the default table given in the code.

Chapter 22, Subchapter III

Subchapter III-Definitions was created to put all definitions relating to energy efficiency into Chapter ILHR 22. Some definitions in the current s. ILHR 20.07 that apply to energy conservation are also added to the proposed definitions in this subchapter.

Chapter 22, Subchapter IV

Subchapter IV-Design Criteria, contains two sections, ILHR 22.07 Indoor and Outdoor Temperatures and ILHR 22.08 Ventilation and Moisture Control.

S. ILHR 22.07 Indoor and Outdoor Temperatures, specifies the indoor and outdoor temperatures used to determine the total dwelling heat loss or gain and for selecting the size of the heating or cooling equipment and remains unchanged from the current code.

S. ILHR 22.08 Ventilation and Moisture Control, specifies what ventilation must be provided in attics and crawl spaces and requires the outdoor termination of clothes dryer vents. These provisions are the same as in the current code.

Chapter 22, Subchapter V

Subchapter V-Heating and Air Conditioning Equipment and Systems has proposed sections, ILHR 22.09 through ILHR 22.19. These sections specify requirements for calculation of system heating and cooling loads; equipment sizing limits; equipment controls and duct and pipe insulation.

New provisions in Subchapter V include requirements for a maximum of 0.5 air changes per hour allowance in infiltration in equipment sizing calculations, use of ASHRAE Fundamentals guidelines in equipment sizing calculations, supplementary heater controls for heat pumps, controls and dampers for mechanical ventilation, and operation ranges for humidistats and thermostats. Heating pipes in unheated spaces and all cooling pipes in uncooled spaces are required to be insulated to R4, rather than the current requirement for one inch of insulation, which was vague. Duct insulation remains at R5.

Chapter 22, Subchapter VI

Subchapter VI-Dwelling Envelope Design, has requirements for vapor retarders, insulation levels for the assemblies that make up the thermal envelope, air leakage for windows and doors, thermal performance calculations, and recessed lighting fixtures in insulated ceilings in sections ILHR 22.20 through ILHR 22.32.

In **s. ILHR 22.22**, vapor retarder materials are required to have a consistent one perm rating for both electrically and nonelectrically heated homes. The requirements are written to be more performance based and would allow a vapor retarder to be installed between the basement wall and interior basement wall insulation. A vapor retarder is still required to be placed under basement and slab-on-grade floors.

The proposed insulation requirements for walls, attics, floors and foundations were based on the MEC, with some modifications. The MEC insulation levels were analyzed using Wisconsin climate and construction costs in a life cycle cost analysis. Insulation levels that were more stringent than those that gave the lowest life cycle cost were reduced to that level. This way the insulation levels are cost effective for the home owner.

Thermal envelope requirements for electrically-heated dwellings remain unchanged unless they were less stringent than those for non-electrically-heated dwellings. In those cases, the requirements for electrically-heated dwellings were made equivalent to those for non-electrically-heated.

Under the proposed rules, the maximum overall thermal transmittance (U-value) for a non-electrically-heated home with a fully insulated basement is 27% lower than under the current code. The proposed rules also give an automatic credit for furnaces that exceed the minimum national efficiency standards. When a 90% efficient furnace is installed, the maximum overall thermal transmittance (U-value) for a home with a fully insulated basement is 14% lower than under the current code

In the current code, the design standards for non-electrically heated and electrically heated homes are handled in separate subchapters. The proposed requirements of **s. ILHR 22.21** combine them and have the same format of application for both types, which will simplify code application and enforcement.

Since steel stud framing is becoming more popular, **s. ILHR 22.23** contains proposed code language for metal studs. There is an equation for recalculating the U-value using a series-parallel heat flow path procedure, to correct for parallel path thermal bridging.

In **s. ILHR 22.30**, the air leakage limits for windows and doors are updated to current national standards.

In **s. ILHR 22.31**, the proposed rules include updated default framing factors for wall construction to be used when the actual percent of framing is not calculated. The new wall framing factors from the 1993 ASHRAE Handbook of Fundamentals are 22% and 25% for 24 and 16 inch stud spacing, respectively. The framing factors were updated to more realistically account for all the sills, plates, headers, etc. that make up walls. Some framing factors used in the past considered only the studs and underestimated the impact of the framing on the insulation value of the whole wall assembly.

In **s. ILHR 22.32**, the proposed rules require recessed light fixtures that are installed in insulated assemblies to be protected from insulation contact and to be sealed or enclosed to reduce air leakage. Warm, moist air passing through these fixtures is a frequent cause of condensation and moisture damage.

Chapter 22, Subchapter VII

Subchapter VII-Design By Systems Analysis and Design of Dwellings Utilizing Renewable Energy Sources, has been expanded to give more direction for the energy analysis that is done under this section. Similar to the current code, this subchapter would be used only to demonstrate that a proposed design is equivalent to a design that meets all of the code's prescriptive standards. It allows trade-offs between energy using systems and gives credit for renewable energy sources. The analysis can be simple for limited trade-offs or can be more complex for trade-offs that effect several energy using systems.

The UDC energy worksheet has been updated to reflect the new envelope requirements. A new simpler prescriptive method is included. Designers can simply choose from a number of prescriptive package options. With this method calculations are minimized. The prescriptive packages automatically give credit for the installation of high efficiency furnaces.

The appendix includes default tables of U-values for various insulated assemblies. These tables will further reduce the need for calculations.

s. ILHR 23.02 (3) is amended to clarify the amount of makeup air needed for balancing and to clarify how range hoods are balanced.

s. ILHR 23.08 (5) is amended to require duct construction to be in accordance with a national standard.

The proposed rules were developed after consultation with the Uniform Dwelling Code Advisory Subcommittee and the Uniform Dwelling Code Council. The current memberships of the Subcommittee and Council are given below.

UNIFORM DWELLING CODE ENERGY SUB-COMMITTEE

Oscar Bloch, Public Service Commission
*Joseph Chudnow, Contractor-Private
Ross DePaola, Wisconsin Environmental Decade
John Griebler, Building Inspectors
Len Linzmeier, Housing Manufacturers
Charles Madden, Architect-Private
Mary Meunier, Wisconsin Energy Bureau
*Dave Crocker, served as a substitute for Joseph Chudnow

UNIFORM DWELLING CODE COUNCIL

James Cauley, Public
Mike Check, Contractors-Private
Dennis Dorn, Material Suppliers
Reimar Frank, Architects
John Griebler, Building Inspectors
Howard Gygax, Building Inspectors
Len Linzmeier, Chairman Housing Manufacturers
Garry L. Nelson, Material Suppliers
William Roehr, Labor
Randolph Thelen , Contractors-Private
Brian Walter, Building Inspectors
Frank Weeks, Housing Manufacturers
Paul Welnak, Labor
Christine Wilson, Building Inspectors

SECTION 1. ILHR 20.07 (22) is repealed.

SECTION 2. ILHR 20.07 (27m) is repealed.

SECTION 3. ILHR 20.07 (39) is repealed.

SECTION 4. ILHR 20.07 (73r) is repealed.

SECTION 5. ILHR 20.07 (74) is repealed.

SECTION 6. ILHR 20.09 (5) (b) 1. c. and d. are created to read:

ILHR 20.09 (5) (b) 1. c. The permit shall expire 24 months after issuance if the dwelling exterior has not been completed.

d. The municipality issuing the Wisconsin uniform building permit shall send a copy of the application to the department.

SECTION 7. ILHR 20.24 is repealed and recreated to read:

ILHR 20.24 ADOPTION OF STANDARDS. Pursuant to s. 227.21 (2), Stats., the attorney general and the revisor of statutes have consented to the incorporation by reference of the following standards. Copies of the standards are on file in the office of the department, the secretary of state and the reviser of statutes. Copies may be purchased from the organizations listed.

(1) American Concrete Institute (ACI), P.O. Box 9094, Farmington Hills, Michigan 48333.

BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE, ACI 318-95.

(2) American Forest & Paper Association, 1111 19th Street NW, Suite 800, Washington, D.C. 20036.

(a) NATIONAL DESIGN SPECIFICATION FOR WOOD CONSTRUCTION, 1997 EDITION, INCLUDING 1997 SUPPLEMENT.

(b) THE PERMANENT WOOD FOUNDATION SYSTEM, BASIC REQUIREMENTS, TECHNICAL REPORT NO. 7, JANUARY, 1987, EXCEPT FOR SECTION 3.3.1.

(3) American Institute of Steel Construction (AISC), One E. Wacker Drive, Suite 3100, Chicago, IL 60601. SPECIFICATION FOR STRUCTURAL STEEL BUILDINGS, ALLOWABLE STRESS DESIGN AND PLASTIC DESIGN, WITH COMMENTARY, JUNE 1, 1989.

(4) American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, Pennsylvania 19103.

(a) STANDARD SPECIFICATION FOR BUILDING BRICK (SOLID MASONRY UNITS MADE FROM CLAY OR SHALE), ASTM C 62-92C.

(b) STANDARD SPECIFICATION FOR HOLLOW LOAD-BEARING CONCRETE MASONRY UNITS, ASTM C 90-94A.

(c) STANDARD SPECIFICATION FOR FACING BRICK (SOLID MASONRY UNITS MADE FROM CLAY OR SHALE), ASTM C 216-94A.

(d) STANDARD SPECIFICATION FOR MORTAR FOR UNIT MASONRY, ASTM C 270-94.

(e) TEST METHOD FOR STEADY STATE HEAT TRANSFER PROPERTIES OF HORIZONTAL PIPE INSULATION, ASTM C 335-95.

(f) TEST METHOD FOR STEADY-STATE HEAT FLUX MEASUREMENTS AND THERMAL TRANSMISSION PROPERTIES BY MEANS OF THE HEAT FLOW METER APPARATUS, ASTM C 518-91.

(g) STANDARD SPECIFICATION FOR HOLLOW BRICK (HOLLOW MASONRY UNITS MADE FROM CLAY OR SHALE), ASTM C 652-94.

(h) STANDARD SPECIFICATION FOR ASPHALT SHINGLES (ORGANIC FELT) SURFACED WITH MINERAL GRANULES, ASTM D 225-86.

(i) STANDARD SPECIFICATION FOR ASPHALT-SATURATED ORGANIC FELT USED IN ROOFING AND WATER PROOFING, ASTM D 226-89.

(j) STANDARD TEST METHOD FOR WIND-RESISTANCE OF ASPHALT SHINGLES (FAN-INDUCED METHOD), ASTM D 3161-93.

(k) STANDARD SPECIFICATION FOR ASPHALT SHINGLES MADE FROM GLASS FELT AND SURFACED WITH MINERAL GRANULES, ASTM D 3462-93A.

(L) STANDARD SPECIFICATION FOR ASPHALT-SATURATED ORGANIC FELT SHINGLE UNDERLAYMENT USED IN ROOFING, ASTM D 4869-88.

(m) TEST METHODS FOR WATER VAPOR TRANSMISSION OF MATERIALS, PROCEDURE A, ASTM E 96-95.

(n) STANDARD TEST METHOD FOR FIRE TESTS OF ROOF COVERINGS, ASTM E 108-93.

(o) STANDARD TEST METHOD FOR THE RATE OF AIR LEAKAGE THROUGH EXTERIOR WINDOWS, CURTAIN WALLS AND DOORS UNDER SPECIFIED PRESSURE DIFFERENCES ACROSS THE SPECIMEN, ASTM E 283-91.

(p) TEST METHOD FOR DETERMINING AIR LEAKAGE RATE BY FAN PRESSURIZATION, ASTM E 779-87.

(5) American Society of Heating, Refrigerating, and Air-conditioning Engineers, Inc. (ASHRAE), 1791 Tullie Circle, N.E., Atlanta, Georgia 30329.

(a) ASHRAE HANDBOOK, FUNDAMENTALS, 1997 EDITION.

(b) ASHRAE HVAC APPLICATIONS HANDBOOK, 1995.

(c) ASHRAE HANDBOOK HVAC SYSTEMS AND EQUIPMENT, 1996 EDITION.

(6) American Wood Preservers Association (AWPA), P.O. Box 849, Stevensville, Maryland 21666.

(a) STANDARD FOR COAL TAR CREOSOTE FOR LAND AND FRESH WATER AND MARINE (COASTAL WATER) USE, P1/P13-91.

(b) STANDARD FOR CREOSOTE SOLUTIONS, P2-90.

(c) STANDARD FOR CREOSOTE-PETROLEUM OIL SOLUTIONS, P3-67.

(d) STANDARDS FOR WATERBORNE PRESERVATIVES, P5-93.

(e) STANDARDS FOR OIL-BORNE PRESERVATIVES, P8-93.

(f) STANDARDS FOR SOLVENTS AND FORMULATIONS FOR ORGANIC PRESERVATIVE SYSTEMS, P9-92.

(g) ALL TIMBER PRODUCTS-PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, C1-93.

(h) LUMBER, TIMBERS, BRIDGE TIES AND MINE TIES-PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, C2-93.

(i) PILES-PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, C3-93.

(j) POLES-PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, C4-93.

(k) PLYWOOD-PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, C9-93.

(L) STANDARD FOR PRESSURE TREATED MATERIAL IN MARINE CONSTRUCTION, C18-92.

(m) LUMBER AND PLYWOOD FOR PERMANENT WOOD FOUNDATIONS-PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, C23-93.

(n) ROUND POLES AND POSTS USED IN BUILDING CONSTRUCTION-PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, C23-93.

(o) SAWN TIMBER PILES USED FOR RESIDENTIAL AND COMMERCIAL BUILDING, C24-93.

(p) STANDARD FOR PRESERVATIVE TREATMENT OF STRUCTURAL GLUED LAMINATED MEMBERS AND LAMINATIONS BEFORE GLUING OF SOUTHERN PINE, COASTAL DOUGLAS FIR, HEMFIR AND WESTERN HEMLOCK BY PRESSURE PROCESSES, C28-91.

(q) STANDARD FOR THE CARE OF PRESERVATIVE-TREATED WOOD PRODUCTS, M4-91.

(7) North American Insulation Manufacturers Association (NAIMA), 44 Canal Canter Plaza, Suite 310, Alexandria, Virginia 22314. FIBROUS GLASS DUCT CONSTRUCTION STANDARDS, THIRD EDITION, 1998.

(8) National Fenestration Rating Council, (NFRC), 962 Wayne Ave., Suite 750, Silver Spring, Maryland 29010. PROCEDURE FOR DETERMINING FENESTRATION PRODUCT THERMAL PROPERTIES, NFRC 100, 1997.

(9) National Fire Protection Association Batterymarch Park, Quincy, Massachusetts 02269. NATIONAL FUEL GAS CODE, NFPA 54-1996, PARTS 2, 3, and 4.

(10) National Institute of Standards and Technology, U.S. Department of Commerce, Washington, D.C. 20234. MODEL DOCUMENTS FOR THE EVALUATION, APPROVAL, AND INSPECTION OF MANUFACTURED BUILDINGS, NBS BUILDING SCIENCE SERIES 87, JULY 1976.

(11) National Wood Window and Door Association, 1400 East Touhy Avenue, Suite 470, Des Plaines, IL 60018. VOLUNTARY SPECIFICATIONS FOR ALUMINUM, VINYL (PVC) AND WOOD WINDOWS AND GLASS DOORS, AAMA/NWWDA 101/I.S.2-97

(12) Portland Cement Association, 5420 Old Orchard Road, Skokie, Illinois 60077. CONCRETE MASONRY HANDBOOK FOR ARCHITECTS, ENGINEERS, BUILDERS, FIFTH EDITION, 1991.

(13) Sheet Metal And Air Conditioning Contractors National Association, (SMACNA), Vienna, Virginia 22180.

(a) RESIDENTIAL COMFORT SYSTEM INSTALLATION STANDARDS MANUAL, SEVENTH EDITION, 1998.

(b) HVAC DUCT CONSTRUCTION STANDARDS-METAL AND FLEXIBLE, SECOND EDITION, 1995, INCLUDING ADDENDUM NO. 1, NOVEMBER 1997.

(c) FIBROUS GLASS DUCT CONSTRUCTION STANDARDS, SIXTH EDITION, WASHINGTON, D.C., 1992.

(14) Truss Plate Institute, Inc., 583 D'Onofrio Drive, Madison, Wisconsin 53719.

NATIONAL DESIGN STANDARD FOR METAL PLATE CONNECTED WOOD TRUSS CONSTRUCTION, ANSI/TPI 1-1995.

SECTION 8. ILHR 21.02 (1) (c) is renumbered 21.02 (1) (c) 1. and amended to read:

ILHR 21.02 (1) (c) Wind loads. 1. ~~Every dwelling~~ Dwellings shall be designed and constructed to withstand a horizontal and uplift pressure of 20 pounds per square foot acting over the surface area.

SECTION 9. ILHR 21.02 (1) (c) 2. and 3. are created to read:

ILHR 21.02 (1) (c) 2. Roof framing members spanning more than 6 feet measured from the outermost edge of the roof shall be permanently fastened to the top plate of load bearing walls using engineered clips, straps or hangers.

3. Roof framing members spanning 6 feet or less measured from the outermost edge of the roof shall be permanently fastened to the top plate of load bearing walls using toe-nailing, or engineered clips, straps or hangers.

Note: For information on toe-nailing, see the fastener schedule table in the appendix.

SECTION 10. ILHR 21.02 (3) (d) is amended to read:

ILHR 21.02 (3) (d) MASONRY. The design and construction of masonry shall conform to the provisions of the Concrete Masonry Handbook for Architects, Engineers, Builders as adopted under s. ILHR 20.24 ~~(9)~~ (12).

SECTION 11. ILHR 21.03 (6m) (b) 1. and 2. are amended to read:

ILHR 21.03 (6m) (b) 1. The nominal size of the net clear window opening shall be at least 20 inches ~~in width~~ by 24 inches ~~in height~~ irrespective of height or width. Nominal dimensions shall be determined by rounding up fractions of inches if they are ½ - inch or greater or rounding down fractions if they are less than ½ - inch.

2. ~~Except as provided in subd. 3., no~~ No portion of the window, including stops, stools, meeting rails and operator arms ~~of awning windows~~, shall infringe on the required opening.

SECTION 12. ILHR 21.03 (6m) (b) 3. is repealed.

SECTION 13. ILHR 21.042 (5) (b) and (c) are amended to read:

ILHR 21.042 (5) (b) Handrails shall be located so the top of the handrail is at least 30 inches, but not more than ~~34~~ 38 inches above the nosing of the treads.

(c) Open handrails shall be provided with intermediate rails or an ornamental pattern such that a sphere with a diameter of 6 inches or larger ~~than 9~~ inches cannot pass through.

SECTION 14. ILHR 21.045 (3) (b) is amended to read:

ILHR 21.045 (3) (b) Handrails shall be ~~mounted~~ located so ~~that~~ the top of the handrail is ~~located between~~ at least 30 inches, ~~to 34~~ but not more than 38 inches above the ramp surface.

SECTION 15. ILHR 21.05 (3) is amended to read:

ILHR 21.05 (3) ATTIC VENTILATION. Ventilation above the ~~ceiling/attic~~ ceiling or attic insulation shall be provided as specified in ~~either s. ILHR 22.05 (3) (a) or 22.11 (3) (a)~~ s. ILHR 22.08 (1).

SECTION 16. ILHR 21.05 (4) is repealed and recreated to read:

ILHR 21.05 (4) CRAWL SPACE VENTILATION. (a) General. Unheated crawl spaces shall be ventilated in accordance with s. ILHR 22.08 (2).

(b) Vapor retarder. 1. Crawl spaces shall be provided with a vapor retarder that has a transmission rate of 0.1 perm or less.

2. All decayable organic material, including topsoil, shall be removed from crawl space floors prior to placing the vapor retarder.

SECTION 17. ILHR 21.05 (5) is repealed and recreated to read:

ILHR 21.05 (5) SAFETY GLASS. Except as provided in par. (e), glazing shall consist of safety glass meeting the requirements of ANSI Z 97.1 when installed in any of the following locations:

(a) In any sidelight adjacent to a door where the nearest point is within 2 feet of the door.

(b) In a wall that comprises part of a tub or shower enclosure where the glazing is within 5 feet vertically of the lowest drain inlet.

(c) Within 4 feet vertically of a tread or landing in a stairway and within 1 foot horizontally of the near edge of the tread or landing.

(d) Within 4 feet vertically of the floor and 3 feet horizontally of the nosing of the top or bottom tread of a stair.

(e) Safety glass is not required where the size of an individual pane of glass is 8 inches or less in the least dimension.

Note: The U.S. Consumer Product Safety Commission requires safety glass for glazing in internal and external doors, including storm doors and patio doors, as well as for the tub or shower enclosures themselves. These federal rules, contained in 16 CFR, subchapter B, part 1201, apply in addition to any state rules or statutes.

SECTION 18. ILHR 21.08 (5) is repealed and recreated to read:

ILHR 21.08 (5) FIRE SEPARATION: Dwelling units shall be separated from garage spaces, accessory buildings and other dwelling units in accordance with Table 21.08 and the following requirements:

TABLE 21.08

BETWEEN DWELLING AND:	DISTANCE BETWEEN OBJECTS [1]	FIRE RATED CONSTRUCTION [2,5]
Detached garage or accessory building on same property	Less than 5 feet	3/4 hour wall [3] 1/3 hour door or window [3]
Another dwelling on same property	Less than 5 feet	3/4 hour wall [4] 1/3 hour door or window [4]
Detached garage, accessory building, or other dwelling on same property	5 to 10 feet	3/4 hour wall [3] No requirement on openings
Detached garage, accessory building, or other dwelling on same property	More than 10 feet	No requirements
Property Lines	Less than 3 feet	3/4 hour wall 1/3 hour door or window
Property Lines	3 feet or more	No Requirements

1 Distance shall be measured perpendicular from wall to wall or property line, ignoring overhangs.
2 Fire rated construction shall protect the dwelling from an exterior fire source.
3 Fire rated construction may be in either facing wall.
4 Fire rated construction shall be in both facing walls.
5 The methods for garage separation in par. (a) 1. are examples of 3/4-hour wall construction.

(a) Attached garages. 1. The walls and ceiling between an attached garage and any portion of the dwelling, including attic or soffit areas, shall be 3/4 hour fire-resistive construction or shall be constructed as specified in any of the following:

a. One layer of 5/8-inch Type X gypsum drywall shall be used on the garage side of the separation wall or ceiling.

b. One layer of 1/2-inch gypsum drywall shall be used on each side of the separation wall or ceiling.

c. Two layers of 1/2-inch gypsum drywall shall be used on the garage side of the separation wall or ceiling.

2. For all methods listed under subd. 1., drywall joints shall comply with one of the following:

a. Joints shall be taped or sealed.

b. Joints shall be fitted so that the gap is no more than 1/20-inch with joints backed by either solid wood or another layer of drywall such that the joints are staggered.

Note: 1/20-inch is approximately the thickness of a U.S. dime.

3. Vertical separations between an attached garage and a dwelling shall extend from the top of a concrete or masonry foundation to the underside of the roof sheathing or fire-resistive ceiling construction.

4. Adjoining garage units are not required to be separated from each other.

(b) Structural elements exposed in an attached garage. Beams, columns and bearing walls which are exposed to the garage and which provide support for habitable portions of the dwelling shall be protected by one of the methods specified in par. (a) 1. a. or c. or other 3/4 hour fire-resistive protection.

(c) Doors. The door and frame assembly between the dwelling unit and an attached garage shall be labeled by an independent testing agency as having a minimum fire-resistive rating of 20 minutes. The test to determine the 20 minute rating is not required to include the hose stream portion of the test.

(d) Other openings. 1. Access openings in fire separation walls or ceilings shall maintain the required separation and shall have any drywall edges protected from physical damage.

2. The cover or door of the access opening shall be permanently installed with hardware that will maintain it in the closed position when not in use.

SECTION 19. ILHR 21.08 (6) (b) is repealed and recreated to read:

ILHR 21.08 (6) (b) Doors. Any door installed in the living unit separation shall have the door and frame assembly labeled by an independent testing agency as having a minimum fire-resistive rating of 20 minutes. The test to determine the 20 minute rating is not required to include the hose stream portion of the test.

SECTION 20. ILHR 21.08 (6) (c) and (d) are amended to read:

ILHR 21.08 (6) (c) Walls. Walls in the living unit separation shall be protected by not less than one layer of ~~5/8-inch Type X~~ 1/2-inch gypsum wallboard or equivalent on each side of the wall with ~~tightly fitted joints.~~ joints in compliance with sub. (5) (a) 2.

(d) Floors and ceilings. A fire protective membrane of one layer of 5/8-inch Type X gypsum wallboard with ~~tightly fitted~~ joints in compliance with sub. (5) (a) 2., shall be provided on the ceiling beneath the floor construction that provides the separation.

SECTION 21. ILHR 21.08 (6) (e) is repealed.

SECTION 22. ILHR 21.08 (7) is created to read:

ILHR 21.08 (7) PENETRATIONS. (a) Ducts. 1. Except as allowed under subd. 2., all heating and ventilating ducts that penetrate a required separation shall be protected with a listed fire damper with a rating of at least 90 minutes.

2. The fire damper required under subd. 1. may be omitted in any of the following cases:

a. There is a minimum of 6 feet of continuous steel ductwork on at least one side of the penetration.

b. The duct has a maximum cross-sectional area of 20 square inches.

(b) Electrical and plumbing components. Penetrations of a required separation by electrical and plumbing components shall be firmly packed with noncombustible material or shall be protected with a listed through-penetration firestop system with a rating of at least one hour.

SECTION 23. ILHR 21.17 is repealed and recreated to read:

ILHR 21.17 DRAIN TILES. (1) DETERMINATION OF NEED. (a) New construction. 1. Except as provided under sub. (2), a complete drain tile or pipe system shall be installed around the foundation of dwellings under construction where groundwater occurs above the bottom of the footing.

2. For the purposes of this section, a complete drain tile or pipe system includes the drain tile or pipe installed inside and outside the foundation at the footing level, bleeders connecting the inside tile or pipe to the outside tile or pipe, the sump pit, the discharge piping, and a pump or means of discharging water to natural grade.

(b) Optional systems. 1. If a complete drain tile or pipe system is not required by natural conditions under par. (a) or by a municipality exercising jurisdiction under sub. (2) (a), a partial drain tile or pipe system may be installed.

2. For the purposes of this section, a partial drain tile or pipe system may include any of the elements under par. (a) 2.

(2) MUNICIPALITIES EXERCISING JURISDICTION. (a) New construction. 1. For new dwelling construction, a municipality exercising jurisdiction under this code may determine the soil types and natural or seasonal groundwater levels for which a complete drain tile or pipe system is required.

2. For new dwelling construction, a municipality may not enact requirements for other than complete drain tile or pipe systems.

(b) Alterations to an existing dwelling. For an alteration to an existing dwelling covered by this code, a municipality may not require a complete drain tile or pipe system.

(c) Partial systems. Municipalities may allow partial drain tile or pipe systems for new dwellings under construction or existing dwellings.

(3) MATERIAL AND INSTALLATION REQUIREMENTS FOR REQUIRED SYSTEMS. (a) General. Complete drain tile or pipe systems required by natural conditions under sub. (1) (a) or by a municipality exercising jurisdiction under sub. (2) (a) shall comply with the requirements of this subsection.

(b) Basement floor slabs. The basement slab shall be placed on at least 4 inches of clean graded sand, gravel or crushed stone.

(c) Manufactured drainage systems. Manufactured drainage systems not meeting the requirements of this section shall be submitted to the department for review and approval prior to installation.

(d) Drain tile or pipe installation. Drain tile or pipe used for foundation drainage shall comply with the following requirements:

1. Drain tile or pipe shall have an inside diameter of at least 3 inches.

2. Drain tile or pipe shall have open seams, joints or perforations to allow water to enter.

3. Where individual tiles are used, they shall be laid with 1/8 inch open joints. Joints between tiles shall be covered with a strip of asphalt or tar impregnated felt.

4. The tile or pipe shall be placed upon at least 2 inches of washed rock and shall be covered on the top and the side facing away from the dwelling with at least 12 inches of washed rock that meets all of the following criteria:

a. 90-100% of the rock shall pass a 3/4 inch sieve.

b. 20-25% of the rock shall pass a 3/8 inch sieve.

5. Bleeder tiles or pipes shall be provided at no more than 8-foot intervals to connect the exterior drain tile or pipe to the interior drain tile or pipe.

6. The drain tiles or pipe that lead from the footing tiles to the sump pit shall be laid at a grade of at least 1/8 inch per foot leading to the sump pit. The remaining drain tiles or pipe shall be level or graded downward to the line leading to the sump pit.

(e) Drain tile or pipe discharge. 1. Drain tiles or pipe shall be connected to the sump pit.

2. The sump pit shall discharge to natural grade or be equipped with a pump.

3. All other aspects of drain tile discharge shall be in accordance with the uniform plumbing code, chs. Comm 82 to 87.

Note: The following is a reprint of the pertinent sections of the plumbing code:

Comm 82.36 (11) SUMPS AND PUMPS. (a) *Sumps*. 2. Construction and installation. The sump shall have a rim extending at least one inch above the floor immediately adjacent to the sump, except where the sump is installed in an exterior meter pit. The sump shall have a removable cover of sufficient strength for anticipated loads. The sump shall have a solid bottom.

3. Location. All sumps installed for the purpose of receiving clear water, basement or foundation drainage water shall be located at least 15 feet from any water well.

4. Size. The size of each clear water sump shall be as recommended by the sump pump manufacturer, but may not be smaller than 16 inches in diameter at the top, 14 inches in diameter at the bottom, and 22 inches in depth.

5. Removable covers. Penetrations through the top of removable sump covers shall be limited to those for the electrical supply, the vent piping and the discharge piping for the pump or pumps.

(b) *Sump pump systems*. 1. Pump size. The pump shall have a capacity appropriate for anticipated use.

2. Discharge piping. Where a sump discharges into a storm building drain or sewer, a free flow check valve shall be installed.

Comm 82.36 (3) DISPOSAL. (a) *Storm sewer*. Storm water, surface water, groundwater and clear water wastes shall be discharged to a storm sewer system or a combined sanitary-storm sewer system where available. Combined public sanitary-storm sewer systems shall be approved by the department of natural resources. Combined private sanitary-storm sewer systems shall be approved by the department.

(b) *Other disposal methods*. 1. Where no storm sewer system or combined sanitary-storm sewer system is available or adequate to receive the anticipated load, the final disposal of the storm water, surface water, groundwater or clear water wastes shall be discharged in accordance with local governmental requirements. If the final disposal of such waters or wastes is by means of subsurface discharge, documentation shall be submitted to this department to determine whether the method of disposal is acceptable.

2. Where approved by the local governmental authority, storm water, surface water, groundwater and clear water wastes of the properties of one- and 2-family dwellings may be discharged onto flat areas, such as streets or lawns, so long as the water flows away from the buildings and does not create a nuisance.

3. a. The clear water wastes from a drinking fountain, water heater relief valve, storage tank relief valve or water softener shall be discharged to either a sanitary drain system or a storm drain system.

b. The clear water wastes from equipment other than those listed in subpar. a. may be discharged to a sanitary drain system if not more than 20 gallons of clear water wastes per day per building are discharged.

(c) *Segregation of wastes.* 1. a. Except as provided in subpar. b., where a sanitary sewer system and a storm sewer system are available the drain piping for storm water or clear water wastes may not connect to any part of the sanitary drain system.

b. Where a combined sanitary-storm sewer system is available storm water wastes, clear water wastes and sanitary wastes may not be combined until discharging to the building sewer.

2. Storm water wastes and clear water wastes shall not be combined until discharging into the storm building drain.

SECTION 24. ILHR 21.18 (2) is amended to read:

ILHR 21.18 (2) CONCRETE FOUNDATION WALLS. (a) Except as provided in par. (b), unless designed through structural analysis, the minimum thickness of concrete foundation walls shall be determined from Table 21.18-A, but in no case shall the thickness of the foundation wall be less than the thickness of the wall it supports.

(b) A 6-inch nominal wall thickness may be used provided the fill on one side of the wall is within 12 inches vertically of the fill on the other side of the wall.

SECTION 25. ILHR 21.20 is repealed and recreated to read:

ILHR 21.20 CONCRETE FLOORS. (a) When concrete floors are provided, the thickness of the concrete shall measure at least 3 inches.

(b) When a concrete floor is placed in clay soils, a 4-inch thick base course shall be placed in the subgrade consisting of clean graded sand, gravel or crushed stone.

(c) When a concrete floor is placed on sand or gravel soils, the base course may be omitted unless drain tile is installed. If drain tile is installed, the requirements of s. ILHR 21.17 shall be met.

SECTION 26. ILHR 21.205 is amended to read:

ILHR 21.205 WOOD FLOORS IN CONTACT WITH GROUND. Wood may be used for floors in contact with ground unless prohibited by ordinance by the municipality exercising jurisdiction in accordance with s. ILHR 20.20. The floor shall conform to the standards specified in ~~s.~~ ss. ILHR 20.24 ~~(4)~~ (2) (b) and 21.10 (1).

SECTION 27. ILHR 21.22 (9) is repealed and recreated to read:

ILHR 21.22 (9) BRIDGING. (a) Sawn lumber. Bridging shall be provided for sawn lumber framing at intervals not exceeding 8 feet where the nominal depth to thickness ratio is greater than 4 to 1.

(b) Engineered products. Bridging shall be provided for engineered framing products in accordance with the manufacturer's recommendations.

SECTION 28. ILHR 21.25 Table 21.25-A is amended to read:

TABLE 21.25-A

MAXIMUM SPACING AND HEIGHT OF STUDS

			Spacing (inches)			
Size	Grade	Maximum height (feet)	Supporting roof and ceiling only	Supporting one floor, roof and ceiling	Supporting two floors, roof and ceiling	Interior and nonload-bearing
2x3	Standard & better	8	16	N/P	N/P	24
2x4 or larger	Utility	8	24	16	12	24
2x4	Standard or better	~~12~~ 10	24	24	12	24
2x6 or larger	No. 3 & better	~~18~~ 10	24	24	16	24

N/P = Not permitted.

Note: A 3-story frame house with walls constructed of 2 x 4 ~~utility~~ standard grade studs would require a 12-inch stud spacing on the lowest level, a ~~16~~ 24-inch stud spacing on the intermediate level, and a 24-inch stud spacing on the upper level.

SECTION 29. ILHR 21.27 (3) (a) 1. is repealed and recreated to read:

ILHR 21.27 (3) (a) 1. 'General'. a. Underlayment consisting of number 15 asphalt-impregnated felt paper or equivalent or other type I material conforming to ASTM D 226 or ASTM D 4869 shall be provided under shingles.

Note: Underlayment materials meeting the requirements of ASTM D 1970 meet the performance requirements of this section.

b. Fasteners shall be corrosion resistant.

Note 1: See s. ILHR 20.07 (62) for definitions of shingle terms.

Note 2: *The Residential Asphalt Roofing Manual* can be purchased from the Asphalt Roofing Manufacturers Association at 6000 Executive Boulevard, Suite 201, Rockville, Maryland 20852-3803. This manual contains extensive information on shingles from manufacture through installation, inspection and maintenance. It includes a recommendation that properly driven and applied nails are the preferred fastening system for asphalt shingles.

Note 3: Section 20.04 (2) requires compliance with all parts of this code, including these roofing provisions, for an alteration to any dwelling that is regulated under this code.

SECTION 30. ILHR 21.27 (3) (a) 2. c. is amended to read:

ILHR 21.27 (3) (a) 2. c. Shingles that have a self-sealing adhesive strip shall include a sealant which has ~~a~~ an average bond strength of at least 1.5 pounds per ~~3.5~~ 3.75 inches of shingle width at 32° F.

SECTION 31. ILHR 21.29 (12) is repealed.

SECTION 32. ILHR 21.29 (13) and (14) are renumbered (12) and (13).

SECTION 33. Chapter ILHR 22 is repealed and recreated to read:

Chapter ILHR 22
ENERGY CONSERVATION

Subchapter I - Scope and Application

ILHR 22.01 SCOPE. This chapter applies to all one- and 2-family dwellings covered by this code.

ILHR 22.02 APPLICATION. (1) This chapter is not intended to conflict with any safety or health requirements. Where such conflict occurs, the safety and health requirements shall govern.

(2) This chapter allows the designer the option of using Subchapters V and VI or Subchapter VII to demonstrate compliance with equipment and thermal performance requirements. The designer shall identify on the plan submittal form what method or subchapter is being used, and indicate the design criteria and how it is being applied. Requirements of all other subchapters apply regardless of choice.

Note: The UDC Energy Worksheet specifies the insulation requirements to apply to the dwelling envelope. A copy of the worksheet is in the appendix. Other code requirements apply to material and equipment identification, sealing of the building envelope, the heating and cooling system including ducts, and the hot water system. Copies of worksheets may be obtained from the Department of Commerce, Safety and Buildings Division P.O. Box 2509 Madison, WI 53701.

Subchapter II - Materials and Equipment.

ILHR 22.03 IDENTIFICATION. (1) DWELLING ENVELOPE INSULATION. (a) Except as provided in par. (b), a thermal resistance identification mark shall be applied by the manufacturer to each piece of dwelling envelope insulation 12-inches or greater in width.

(b) Insulation without a thermal resistance identification mark may be used if the insulation installer provides a signed and dated certification for the insulation installed in each element of the building envelope, listing the type of insulation, the manufacturer and the R-value. For blown-in or sprayed insulation, the installer shall also provide the initial installed thickness, the calculated settled thickness, the coverage area and the number of bags installed. The installer shall post the certification in a readily accessible conspicuous place on the job site.

(2) INSULATION INSTALLATION. (a) Roof and ceiling, floor and wall cavity batt or board insulation shall be installed in a manner which will permit inspection of the manufacturer's R-value identification mark.

(b) The thickness of roof and ceiling insulation that is either blown in or sprayed shall be identified by thickness markings that are labeled in inches installed at least one for every 300 square feet through the attic space. The markers shall be affixed to trusses or joists marking the minimum initial installed thickness and minimum settled thickness with numbers a minimum of one-inch in height. Each marker shall face the attic access. The thickness of installed insulation shall meet or exceed the minimum initial installed thickness shown by the marker.

ILHR 22.05 FENESTRATION PRODUCT RATING CERTIFICATION AND LABELING. (1) CERTIFIED PRODUCTS. Except as provided in sub. (2), fenestration product rating, certification and labeling, U-values of windows, doors and skylights shall be determined in accordance with the National Fenestration Rating Council standard 100, Procedures for Determining Fenestration Product Thermal Properties, by an accredited, independent laboratory. Fenestration products shall be labeled and certified by the manufacturer. Such certified and labeled values shall be accepted for purposes of determining compliance with the dwelling envelope requirements of this code.

(2) DEFAULT VALUES. When a manufacturer has not determined product U-value in accordance with NFRC 100 for a particular product line, compliance with the dwelling envelope requirements of the code shall be determined by assigning such products a default U-value in accordance with Tables 22.05-1 and 22.05-2. Product features must be verifiable for the product to qualify for the default value associated with those features. Where the existence of a particular feature cannot be determined with reasonable certainty, the product shall not receive credit for that feature. Where a composite of materials of two different product types is used, the product shall be assigned the higher U-value.

TABLE 22.05-1
U-VALUE DEFAULT TABLE FOR WINDOWS, GLAZED DOORS AND SKYLIGHTS*

	Single Glazed	Double Glazed
METAL WITHOUT THERMAL BREAK		
Operable	1.27	0.87
Fixed	1.13	0.69
Garden Window	2.60	1.81
Curtain Wall	1.22	0.79
Door	1.26	0.80
Skylight	1.98	1.31
Site Assembled Skylight	1.36	0.82
METAL WITH THERMAL BREAK		
Operable	1.08	0.65
Fixed	1.07	0.63
Curtain Wall	1.11	0.68
Door	1.10	0.66
Skylight	1.89	1.11
Site Assembled Skylight	1.25	0.70
REINFORCED VINYL OR METAL-CLAD WOOD		
Operable	0.90	0.57
Fixed	0.98	0.56
Door	0.99	0.57
Skylight	1.75	1.05
WOOD/VINYL/FIBERGLASS		
Operable	0.89	0.55
Fixed	0.98	0.56
Garden Window	2.31	1.61
Door	0.98	0.56
Skylight	1.47	0.84

* Glass block assemblies shall have a default U-value of 0.60.

TABLE 22.05-2
U-VALUE DEFAULT TABLE FOR NON-GLAZED DOORS

STEEL DOORS (1-3/4 inches thick)	**With Foam Core**	**Without Foam Core**
	0.35	0.60
WOOD DOORS (1-3/4 inches thick)	**Without Storm Door**	**With Storm Door**
Panel with 7/16-inch panels	0.54	0.36
Hollowcore flush	0.46	0.32
Panel with 1-1/8-inch panels	0.39	0.28
Solid core flush	0.40	0.26

Subchapter III - Definitions

ILHR 22.06 DEFINITIONS. In ch. ILHR 22:

(1) "Accessible", as applied to equipment, means admitting close approach to equipment not guarded by locked doors, elevation or other effective means.

Note: See "readily accessible".

(2) "Air conditioning" means the process of treating air to control simultaneously its temperature, humidity, cleanness, and distribution to meet the requirements of the conditioned space.

(3) "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.

(4) "Basement wall" is the opaque portion of a wall that encloses one side of a basement and is partially or totally below grade.

(5) "Conditioned space" means space within the dwelling envelope which is provided with heated or cooled air or surfaces.

(6) "Cooled space" means a space directly or indirectly supplied with mechanical cooling to maintain air temperature within the space of 85°F or less at design conditions.

(7) "Crawl space wall" means the opaque portion of a wall which encloses a crawl space and is partially or totally below grade.

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

(9) "Dwelling envelope" means the elements of a dwelling with enclosed conditioned space through which thermal energy may be transferred to or from the exterior.

(10) "Electrically heated" means provided with permanently installed electrical space heating equipment which has an input capacity of 3 kilowatts or more to meet all or part of the space heating requirements.

(11) "Energy" means the capacity for doing work, taking a number of forms which may be transformed from one form into another, such as thermal heat, mechanical work, electrical and chemical in customary units, measured in kilowatt-hours (kWh) or British thermal units (Btu).

Note: See "New energy".

(12) "Energy, Recovered". See "Recovered energy".

(13) "F-value" means the rate of heat loss through a slab per foot of perimeter measured in Btu/h • ft • °F.

(14) "Glazing area" means the interior surface area of all glazed surfaces including sash, curbing or other framing elements that enclose conditioned spaces.

Note: Glazed surfaces include windows, sliding glass doors, and skylights.

(15) "Gross exterior wall area " means the normal projection of the dwelling envelope wall area bounding interior space which is conditioned by an energy-using system including opaque wall, window and door area. The gross area of exterior walls consists of all opaque wall areas, including between floor spandrels, peripheral edges of floors, window area including sash, and door areas when they are exposed to outdoor air or unconditioned spaces and enclosed heated or mechanically cooled space, including interstitial area between two such spaces. The gross exterior wall area includes the total basement wall area if it is less than 50 percent below grade. The gross exterior wall area includes non-opaque areas such as windows and doors of all basement walls.

(16) "Gross floor area" means the sum of areas of all floors of the structure, including basements, cellars, and intermediate floored tiers measured from the exterior faces of exterior walls or from the center line of interior walls, excluding covered walkways, open roofed-over areas, porches, pipe trenches, exterior terraces or steps, chimneys, roof overhangs and similar features.

(17) "Heat" means energy that is transferred by virtue of a temperature difference or a change in state of a material.

(18) "Heated slab" means slab-on-grade construction in which the heating elements or hot air distribution system is in contact with or placed within the slab or the subgrade.

(19) "Heated space" means any enclosed space provided with a direct or indirect supply of heat to maintain the temperature of the space to at least 50° F at design conditions.

Note: An example of an indirect heat supply would be heat supplied by convection from uninsulated energy consuming systems.

(20) "Humidistat" means a regulating device, actuated by changes in humidity, used for automatic control of relative humidity.

(21) "HVAC" means heating, ventilating and air conditioning.

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

(23) "Infiltration" means the uncontrolled inward air leakage through cracks and interstices in any dwelling element and around windows and doors of a dwelling caused by the pressure effects of wind, and the effect of differences in the indoor and outdoor air density.

(24) "Inherently protected type IC" means tested and listed by an independent testing laboratory as being suitable for installation in a cavity where the fixture may be in direct contact with thermal insulation or combustable materials and the fixture construction is such that , even without a thermal protector, the fixture cannot be overlamped or mislamped.

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

Note: See "Automatic ".

(26) "New energy" means energy other than recovered energy, utilized for the purpose of heating or cooling.

Note : See "Energy".

(27) "Opaque areas" means all exposed areas of a dwelling envelope which enclose conditioned space except openings for windows, skylights, doors and dwelling service systems.

(28) "Readily accessible" means capable of being reached quickly for operation, renewal or inspections, without requiring a person to climb over or remove obstacles or to resort to portable ladders or access equipment.

Note: See "Accessible".

(29) "Recovered energy" means energy utilized which would otherwise be wasted and would not contribute to a desired end use, from an energy utilization system.

(30) "Renewable energy sources" means sources of energy, excluding minerals, derived from incoming solar radiation, including natural daylighting and photosynthetic processes: from phenomena resulting therefrom, including wind, waves and tides, lake or pond thermal differences and from the internal heat of the earth, including nocturnal thermal exchanges.

(31) "Roof assembly" means all components of the roof and ceiling envelope through which heat flows, thus creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses a heated or mechanically cooled space. The gross area of a roof assembly consists of the total interior surface of the assembly, including skylights exposed to the heated or mechanically cooled spaced.

(32) "Sequence" means a consecutive series of operations.

(33) "Service systems" means all energy-using systems in a dwelling that are operated to provide services for the occupants or processes housed therein, including HVAC, service water heating, illumination, transportation, cooking or food preparation, laundering and similar functions.

(34) "Service water heating" means a supply of hot water for purposes other than comfort heating.

(35) "Service water heating demand" means the maximum design rate of energy withdrawal from a service water heating system in a designated period of time; usually an hour or a day.

(36) "Slab-on-grade floor insulation" means insulation around the perimeter of the floor slab or its supporting foundation.

(37) "Solar energy source" means a source of natural daylighting and of thermal, chemical or electrical energy derived directly from conversion of incident solar radiation.

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

(39) "Thermal conductance" means the time rate of heat flow through a body, frequently per unit area, from one of its bounding surfaces to the other for a unit temperature difference between the two surfaces, under steady state conditions. It is expressed as Btu/h • ft^2 • °F.

(40) "Thermal resistance" or "R" means a measure of the ability to retard the flow of heat. The R-value is the reciprocal of thermal transmittance or U-Value expressed as R= 1/U.

Note: The higher the R-value of a material, the more difficult it is for heat to be transmitted through the material.

(41) "Thermal resistance overall" or "R_O" means the reciprocal of overall thermal conductance expressed as Btu/h • ft^2 • °F. The overall thermal resistance of the gross area or individual component of the exterior dwelling envelope such as, roof and ceiling, exterior walls, floors, crawl space walls, foundation walls, windows, skylights, doors, and opaque walls, includes the weighted R-values of the component assemblies, including air-film, insulation, drywall, framing, and glazing.

(42) "Thermal transmittance" or "U" means the time rate of heat flow through a body or assembly which is located in between 2 different environments, expressed in Btu/h • $ft.^2$ • °F. The U-value applies to combinations of different materials used in series along the heat flow path and also to single materials that comprise a dwelling section, including cavity air spaces and air films on both sides of a dwelling element.

Note 1: The lower the U-value of a material, the more difficult it is for heat to be transmitted through the material.

Note 2: The thermal transmittance is also referred to as the coefficient of heat transfer or the coefficient of heat transmission.

(43) "Thermal transmittance overall" or "U_O" means the overall, average heat transmission of a gross area of the exterior dwelling envelope expressed as Btu/h • ft^2 • °F. The U_O-value applies to the combined effect of the time rate of heat flow through various paths, such as windows, doors and opaque construction areas, comprising the gross area of one or more exterior dwelling components, such as walls, floors or roof and ceilings.

(44) "Thermally protected type IC " means tested and listed by an independent testing laboratory as being suitable for installation in a cavity where thermal insulation will be in direct contact with the fixture.

(45) "Thermostat" means an automatic control device actuated by temperature and designed to be responsive to temperature.

(46) "Ventilation" means the process of supplying or removing air by natural or mechanical means to or from any space. Such air may or may not have been conditioned.

(47) "Zone" means a space or group of spaces within a dwelling with heating or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

Subchapter IV - Design Criteria

ILHR 22.07 INDOOR AND OUTDOOR TEMPERATURES. The indoor temperatures listed in Table 22.07-1 and the outdoor temperatures listed in Table 22.07-2 shall be used to determine the total dwelling heat loss or heat gain and to select the size of the heating or cooling equipment.

TABLE 22.07-1
INDOOR DESIGN TEMPERATURES

SEASON	LOCATION	DESIGN TEMPERATURE
Winter	All areas except nonhabitable basement areas	70°F
	Unheated, nonhabitable basement areas only	45°F
Summer	All areas	78°F

TABLE 22.07-2
OUTDOOR DESIGN CONDITIONS BASED ON FIGURE 22.07

Zone 1	25° below zero F
Zone 2	20° below zero F
Zone 3	15° below zero F
Zone 4	10° below zero F

Note: See Figure 22.07 for zone boundaries.

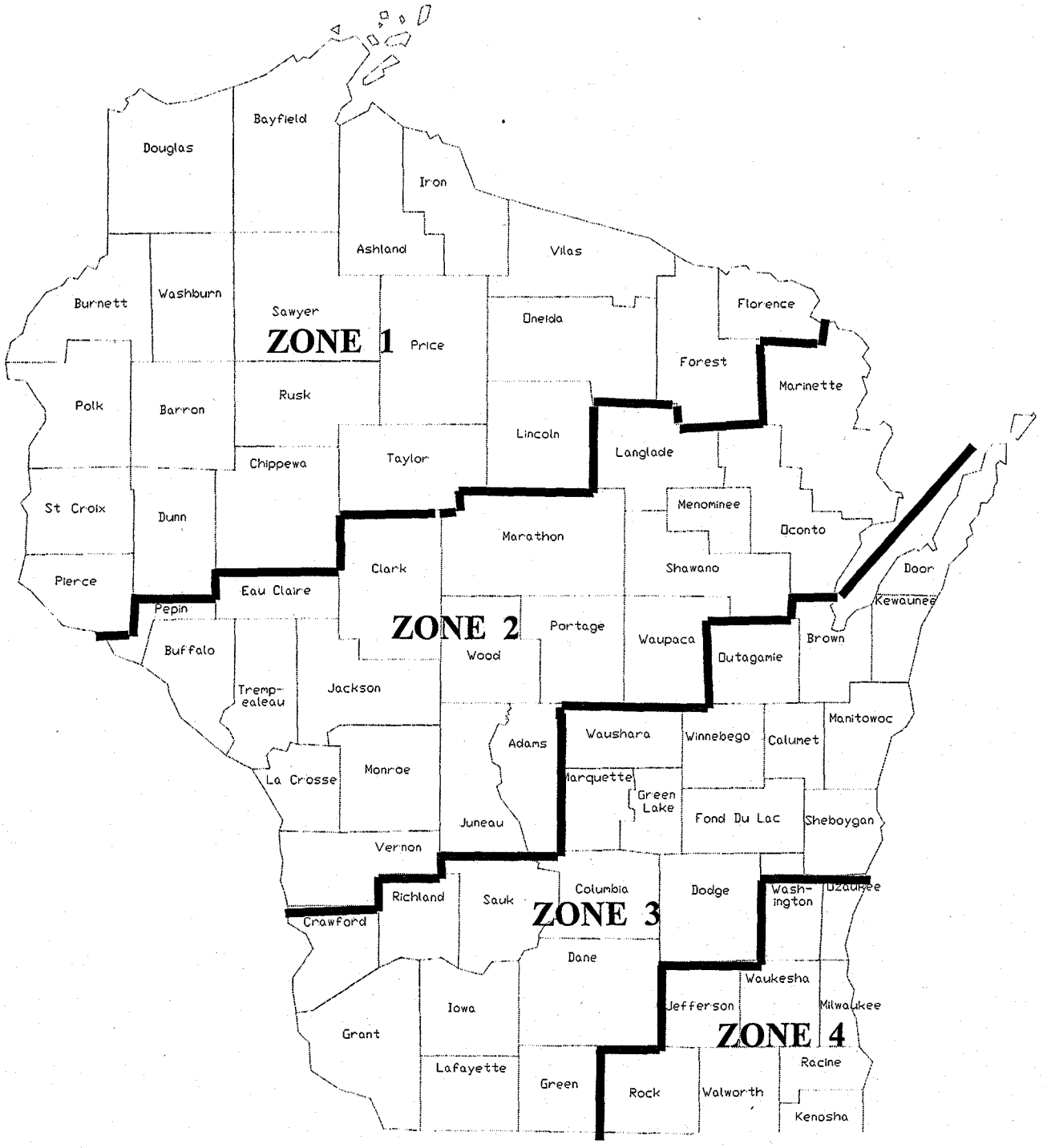

Douglas
Bayfield
Iron
Ashland
Vilas
Florence
Burnett
Washburn
Sawyer
ZONE 1
Price
Oneida
Forest
Marinette
Polk
Barron
Rusk
Lincoln
Langlade
Chippewa
Taylor
St Croix
Dunn
Menominee
Oconto
Marathon
Clark
Shawano
Door
Pierce
Eau Claire
Pepin
ZONE 2
Portage
Waupaca
Brown
Kewaunee
Buffalo
Wood
Outagamie
Trempealeau
Jackson
Manitowoc
Waushara
Winnebago
Calumet
Adams
La Crosse
Monroe
Marquette
Green Lake
Fond Du Lac
Sheboygan
Juneau
Vernon
Columbia
Dodge
Washington
Richland
Sauk
ZONE 3
Crawford
Dane
Waukesha
Iowa
Jefferson
Milwaukee
Grant
ZONE 4
Racine
Lafayette
Green
Rock
Walworth
Kenosha

FIGURE 22.07

ILHR 22.08 VENTILATION AND MOISTURE CONTROL. (1) ATTICS. (a) Ventilation shall be provided above the ceiling or attic insulation. At least 50% of the net free ventilating area shall be distributed at the low sides of the roof. The remainder of the net free ventilating area shall be distributed in the upper one-half of the roof or attic area.

1. If more than 50%, but less than 75% of the net free ventilating area is provided at the low sides of the roof, the total net free ventilating area shall be a minimum of 1/300 of the horizontal area of the ceiling.

2. If 75% or more of the net free ventilating area is provided at the low sides of the roof, the total net free ventilating area shall be at least 1/150 of the horizontal area of the ceiling.

(b) As an exception to par (a), the ventilation space above any non-rigid insulation in a cathedral ceiling assembly shall be at least one inch in height.

(c) Engineered systems that provide equivalent ventilation to that specified in par. (a) may be used.

(2) CRAWL SPACES. Ventilation shall be provided in crawl spaces which are outside the dwelling envelope. The area of ventilation shall be at least 1/1500 of the floor space. At least 50% of the ventilating area shall be provided at opposite sides of the crawl space or as far apart as possible.

(3) CLOTHES DRYERS. If clothes dryers are provided, the dryers shall be vented to the outside of the dwelling. The dryer vents may not terminate in an attic space or crawl space or basement.

Note: See s. ILHR 23.14 for vent material requirements.

Subchapter V - Heating and Air Conditioning Equipment and Systems

ILHR 22.09 SCOPE. This subchapter covers the determination of system heating and cooling loads, design requirements, system and component performance, control requirements, and distribution system construction and insulation.

ILHR 22.10 CALCULATING HEATING AND COOLING LOADS. The design requirements specified in Subchapter IV shall apply for all computations.

ILHR 22.11 CALCULATION PROCEDURES. (1) Heating and cooling design loads including ventilation loads for the purpose of sizing systems shall be determined in accordance with one of the procedures described in Chapter 25 of ASHRAE Handbook of Fundamentals.

(2) Infiltration for heating and cooling design loads shall be calculated based on a maximum of 0.5 air change per hour in the heated or cooled space.

ILHR 22.12 SELECTION OF EQUIPMENT. (1) GENERAL. Except as provided in sub. (2), the output capacity of the mechanical heating equipment shall not exceed the calculated heating load by more than 15%, except to satisfy the manufacturer's next closest nominal size.

(2) WATER HEATERS USED FOR SPACE HEATING. The output capacity of water heaters that are used for simultaneous space heating shall exceed the calculated space heating load by at least 43%, but by no more than 49%. Other sizing methods may be used if approved by the department for water heaters providing simultaneous space and domestic water heating.

Note: Heat exchanger units that are part of the plumbing system shall meet the requirements of Chs. ILHR 81-84.

ILHR 22.13 SUPPLEMENTARY HEATER FOR HEAT PUMPS. (1) If a heat pump is installed, it shall include a control to prevent supplementary heater operation when the operating load can be met by the heat pump alone.

(2) Supplementary heater operation is permitted during transient periods, such as start-up periods, following room thermostat set-point advance, and during defrost periods.

(3) A two-stage thermostat, which controls the supplementary heat on its second stage, shall be accepted as meeting this requirement. The cut-on temperature for the compression heating shall be higher than the cut-on temperature for the supplementary heat. Supplementary heat may be derived from any source including, electric resistance, combustion heating, and solar stored-energy heating.

ILHR 22.14 MECHANICAL VENTILATION. (1) Mechanical ventilation system supply and exhaust shall be equipped with a readily accessible means for shutoff when ventilation is not required.

(2) Automatic or gravity dampers that close when the system is not operating shall be provided for outdoor air intake and exhaust.

ILHR 22.15 TEMPERATURE CONTROL. (1) A readily accessible manual or automatic means shall be provided to restrict or shut off the heating or cooling input to each zone or floor.

(2) Each system shall be provided with an adjustable thermostat for the regulation of temperature. A thermostat shall be capable of being set by adjustment or selection of sensors as follows:

(a) When used to control heating only, the thermostat shall be capable of being set from 55°F to 75°F.

(b) When used to control cooling only, the thermostat shall be capable of being set from 70°F to 85°F.

(c) When used to control both heating and cooling, the thermostat shall be capable of being set from 55°F to 85°F and shall be capable of operating the system heating and cooling in sequence. The thermostat or control system shall have an adjustable deadband of at least 10°F.

ILHR 22.16 HUMIDITY CONTROL. If a system is equipped with a means for adding or removing moisture to maintain a selected relative humidity in spaces or zones, a humidistat shall be provided.

(1) Humidistats of humidifiers shall be capable of being set to prevent new energy from being used to produce a space or zone relative humidity above 30 percent.

(2) Humidistats of dehumidifiers shall be capable of being set to prevent new energy from being used to produce a space or zone relative humidity of less than 60 percent.

Note: This requirement does not restrict the actual operation of the equipment. The only requirement is that the specified setpoints be available to the occupants so that they can minimize energy consumption. The controls are not limited to the specified settings alone.

ILHR 22.17 DUCT SYSTEM INSULATION. (1) Except as provided in sub. (4), heating and cooling duct systems, or portions thereof, that are located on the exterior of walls, floors, ceilings or roofs that are part of the thermal envelope shall be provided with insulation with a thermal resistance of at least R-5.

Note: Where control of condensation is required for compliance with s. ILHR 22.22, additional insulation, vapor retarders, or both, may need to be provided to limit vapor transmission and condensation.

(2) Where exterior walls are used as plenum walls, wall insulation shall be as required by the most restrictive condition of this section or s. ILHR 22.21.

(3) Insulation resistance shall be measured on a horizontal plane in accordance with ASTM standard C 518 at a mean temperature of 75°F at the installed thickness.

(4) Duct insulation, except as required to prevent condensation, is not required on any of the following ducts:

(a) Supply-air or return-air ducts that are installed in basements, cellars or unventilated crawl spaces having insulated walls.

(b) Ducts for which heat gain or loss, without insulation, will not increase the energy requirements of the building.

(c) Ducts located within HVAC equipment.

(d) Exhaust air ducts.

ILHR 22.19 PIPE INSULATION. (1) Except as provided in sub. (2), all heating pipes in unheated spaces and all cooling pipes in uncooled spaces shall be insulated with material providing a minimum thermal resistivity of R-4 as measured on a flat surface in accordance with ASTM standard C 335 at a mean temperature of 75 °F.

(2) Piping insulation is not required in any of the following cases:

(a) Pipes installed within heating and air conditioning equipment, installed in conditioned spaces.

(b) Piping at fluid temperatures between 55°F and 120°F when not required for energy conservation purposes.

(c) When the heat loss or gain of the piping without insulation does not increase the energy requirements of the dwelling.

(d) When piping is installed in basements, cellars or unventilated crawl spaces having insulated walls.

Note: Additional insulation and vapor retarders may be necessary to prevent condensation in accordance with s. ILHR 22.22.

Subchapter VI - Dwelling Envelope Design

ILHR 22.20 GENERAL. The dwelling envelope of all 1- and 2-family dwellings shall comply with this subchapter, unless the requirements of system analysis design of subch. VII are met.

Note: See the appendix for an example of the UDC Energy Worksheet to be used to demonstrate compliance with the dwelling envelope insulation requirements of ss. ILHR 22.21 to 22.28. The worksheet allows the option of using a prescriptive package approach, or trade-off approach. Other forms or software may be used when approved by the department. The U.S. Department of Energy "MECcheck" software, 1995 edition, may be used to demonstrate compliance for non-electrically heated homes.

ILHR 22.21 ENVELOPE REQUIREMENTS. (1) GENERAL. The stated U_O -, U- or R-value of an assembly may be increased, or the stated U_O -, U- or R-value of an assembly may be decreased, provided the total heat gain or loss for the entire dwelling does not exceed the total U_O -, U- or R-value of an assembly resulting from conformance to the values specified in ss. ILHR 22.23 to 22.28.

Note: See the appendix for example copies of the UDC Energy Worksheet to be used for trade-off calculations. Copies of worksheets may be obtained from the Department of Commerce, Safety and Buildings Division P.O. Box 2509 Madison, WI 53701.

(2) APPLICATION OF STANDARDS FOR ELECTRICALLY HEATED DWELLINGS. (a) New dwellings. New dwellings that are electrically heated shall meet the thermal performance standards of this subchapter for electrically heated dwellings.

(b) Additions. If the combined input capacity of permanently installed electrical space heating equipment of the original dwelling and a new addition exceeds 3 kilowatts, either the addition shall meet the thermal performance standards of this subchapter for electrically heated dwellings or the entire dwelling and addition shall meet the thermal performance standards of this subchapter for electrically heated dwellings.

(c) Alterations. If an alteration results in the addition of permanently installed electrical space heating equipment with a combined input capacity of permanently installed electrical space heating equipment of the altered dwelling exceeds 3 kilowatts, either the area served by the new electrical space heating equipment shall meet the thermal performance standards of this subchapter for electrically heated dwellings or the entire dwelling, and the addition shall meet the thermal performance standards of this sub-chapter for electrically heated dwellings.

TABLE 22.21
HEATING AND COOLING CRITERIA g

Component of Dwelling Envelope	Maximum Overall Thermal Transmittance, U_0 or Minimum Thermal Resistance, R Non-electrically Heated	Electrically Heated
Roof and Ceiling[a]	$U_0 = 0.026$	$U_0 = 0.020$
Walls:		
crawl space[c, f]	$U_0 = 0.060$	$U_0 = 0.060$
basement[c, f]	$U_0 = 0.091$	$U_0 = 0.091$
walls[b]	$U_0 = 0.110$	$U_0 = 0.080$
Floors:		
heated slab-on-grade[c, d,f]	R = 8.5	R = 10
over unheated space[e]	$U_0 = 0.050$	$U_0 = 0.050$
unheated slab-on-grade[c, d,f]	R = 6.5	R = 10
over outside air (overhang)	$U_0 = 0.033$	$U_0 = 0.033$

[a] Roof and ceiling assemblies include attic access panels and skylights.
[b] See definition of gross exterior wall area.
[c] Insulation installed below grade shall be suitable for that application.
[d] "Heated slab" means slab-on-grade construction in which the heating elements or hot air distribution system is in contact with or placed within the slab or the subgrade. The required U-value refers to the insulation only.
[e] Includes unheated crawl spaces, basements, garages, and other spaces outside of the dwelling envelope.
[f] The required U-value applies to the floor or wall assembly only, excluding the effect of soil.
[g] The maximum overall heat loss requirement may be increased when an equivalent amount of energy savings is provided by equipment that exceeds the federal efficiency standards of 10 CFR part 230. See Energy Worksheets in the Appendix for how the credit is applied. A more exact calculation of this credit may be submitted to the department for review in accordance with s. ILHR 22.34.

ILHR 22.22 VAPOR RETARDERS. (1) GENERAL. (a) Designs shall prevent deterioration from moisture condensation.

(b) Vapor retarders shall have a rating of 1.0 perm or less when tested in accordance with ASTM standard E 96, Procedure A.

(c) The vapor retarder shall be continuous. All joints in the vapor retarder shall be overlapped and secured or sealed. Rips and punctures in the vapor retarder shall be patched with vapor retarder materials and taped or sealed.

(2) FRAME ASSEMBLIES. In all frame walls, floors and ceilings, the vapor retarder shall be installed on the warm side of the thermal insulation. The vapor retarder shall cover the exposed insulation and the interior face of studs, joists and rafters. No vapor retarder is required in the box sill.

(3) CONCRETE FLOORS. A vapor retarder shall be installed under the slab or under the base course of slabs and basement floors unless the slab is in an unheated attached garage

(4) CONCRETE OR MASONRY BASEMENT WALLS. A vapor retarder is not required in concrete or masonry basement wall below-ground applications.

(5) CRAWL SPACES. A vapor retarder shall be provided over crawl space floors in accordance with s. ILHR 21.05 (4).

(6) WOOD FOUNDATIONS. Vapor retarders for wood foundations shall be in accordance with the standards adopted under s. ILHR 20.24 (2) (b).

ILHR 22.23 WALLS. (1) GENERAL. The combined thermal transmittance value (U_O) of the gross area of exterior walls shall not exceed the value given in Table 22.21. Equation 1 in s. ILHR 22.31 (1) shall be used to determine acceptable combinations to meet this requirement.

(2) METAL STUD FRAMING. When metal stud framing is used, the value of U_W used in Equation 1 in s. ILHR 22.31 (1) shall be recalculated using a series-parallel heat flow path procedure to correct for parallel path thermal bridging. The U_W for purposes of Equation 1 in s. ILHR 22.31 (1), of metal stud walls shall be determined as follows:

$$U_w = \frac{1}{R_1 + \left(R_{ins} \times F_c\right)}$$

where:

R_1 = the total thermal resistance of the elements, in series along the path comprising the wall assembly of heat transfer, excluding the cavity insulation and the metal stud.

R_{ins} = the R-value of the cavity insulation.

F_C = the correction factor listed in Table 22.23.

TABLE 22.23
F_C VALUES FOR WALL SECTIONS WITH METAL STUDS PARALLEL PATH CORRECTION FACTORS

SIZE OF MEMBER	GAGE OF STUD[1]	SPACING OF FRAMING INCHES	CAVITY INSULATION R-VALUE	CORRECTION FACTOR
2 X 4	18 - 16	16 o.c.	R - 11	0.50
			R - 13	0.46
			R - 15	0.43
2 X 4	18 - 16	24 o.c.	R - 11	0.60
			R - 13	0.55
			R - 15	0.52
2 X 6	18 - 16	16 o.c.	R - 19	0.37
			R - 21	0.35
2 X 6	18 - 16	24 o.c.	R - 19	0.45
			R - 21	0.43
2 X 8	18 - 16	16 o.c.	R - 25	0.31
2 X 8	18 - 16	24 o.c.	R - 25	0.38

[1]These factors shall be applied to metal studs of this gage or thinner.

ILHR 22.24 ROOF AND CEILING. The combined thermal transmittance value (U_O) of the gross area of the roof or ceiling assembly shall not exceed the value given in Table 22.21. Equation 2 in s. ILHR 22.31 (1) shall be used to determine acceptable combinations to meet this requirement.

ILHR 22.25 FLOORS OVER UNHEATED SPACES. The combined thermal transmittance value U_O of the gross area of floors that are over unheated spaces and of floors over outdoor air, such as overhangs, and shall not exceed the values given in Table 22.21. Equation 3 in s. ILHR 22.31 (1) shall be used to determine acceptable combinations to meet this requirement.

ILHR 22.26 SLAB-ON-GRADE FLOORS. (1) Where the perimeter edge of a slab-on-grade floor is above grade or less than 12 inches below the finished grade, the thermal resistance of the insulation around the perimeter of the floor shall not be less than the value given in Table 22.21.

(2) Insulation shall be placed on the outside of the foundation or on the inside of a foundation wall. The insulation shall extend downward from the top of the slab for a minimum of 48-inches or downward to at least the bottom of the slab and then horizontally to the interior or exterior for a minimum total distance of 48-inches.

(3) Horizontal insulation extending outside of the foundation shall be covered by pavement or by soil a minimum of 10 inches thick. The top edge of insulation installed between the exterior wall and the edge of the interior slab may be cut at a 45 degree angle away from the exterior wall.

ILHR 22.27 CRAWL SPACE WALLS. (1) If the crawl space does not meet the requirements of s. ILHR 22.25 and does not have ventilation openings which communicate directly with outside air, then the exterior walls of the crawl space shall have a thermal transmittance value not exceeding the value given in Table 22.21.

(2) The vertical wall insulation shall extend from the top of the wall to at least the inside ground surface. Where the vertical wall insulation stops less than 12 inches below the outside finish ground level, crawl space wall insulation shall extend vertically and horizontally a minimum total distance of 24-inches linearly from the outside finish ground level.

ILHR 22.28 BASEMENT WALLS. (1) Except as provided in subs. (3) and (4), the exterior walls of basements below uninsulated floors shall have a transmittance value not exceeding the value given in Table 22.21.

(2) The insulation shall extend to the level of the basement floor.

(3) Where the total gross basement wall area is less than 50 percent below grade, the entire wall area, including the below-grade portion, is included as part of the gross area of exterior walls.

(4) For the purpose of determining compliance with dwelling envelope performance requirements, non-opaque areas, including windows and doors, of all basement walls shall be included in the gross area of exterior walls.

ILHR 22.29 MASONRY VENEER. When insulation is placed on the exterior of a foundation supporting a masonry veneer exterior, the horizontal foundation surface supporting the veneer is not required to be insulated to satisfy the foundation insulation requirement.

ILHR 22.30 AIR LEAKAGE. (1) GENERAL. The requirements of this section apply to those dwelling components that separate interior dwelling conditioned space from the outdoor ambient conditions, or unconditioned spaces such as crawl spaces, and exempted portions of the dwelling from interior spaces that are heated or mechanically cooled. The requirements are not applicable to the separation of interior conditioned spaces from each other.

(2) EXTERIOR DOORS AND WINDOWS. Exterior doors and windows shall be designed to limit air leakage into or from the dwelling envelope. Manufactured doors and windows shall have air infiltration rates of less than 0.3 cfm/sq.ft, determined in accordance with ASTM standard E 283 and AAMA/NWWDA standard 101/I.S.2. Door and window units constructed or fabricated in the field shall be sealed in accordance with sub. (3).

Note: Windows and doors that meet the maximum air infiltration rate specified in the 1997 edition of AAMA/NWWDA standard 101/I.S.2 when tested in accordance with ASTM standard E 283 are acceptable to the department as meeting the 0.3 cfm/sq.ft. infiltration limit.

(3) JOINT AND PENETRATION SEALING. (a) Exterior joints, seams or penetrations in the dwelling envelope, that are sources of air leakage, shall be sealed with durable caulking materials, closed with gasketing systems, taped, or covered with moisture vapor permeable house wrap. Exterior joints to be treated include all of the following:

1. Openings, cracks and joints between wall cavities and window or door frames.

2. Between separate wall assemblies or their sill-plates and foundations.

3. Between walls, roof, ceilings or attic, ceiling seals, and between separate wall panel assemblies.

4. Penetrations of utility services through walls, floor and roof assemblies, and penetrations through the wall cavity of top and bottom plates.

(b) Sealing shall be provided around tubs and showers, at the attic and crawl space panels, at recessed lights and around all plumbing and electrical penetrations, where these openings are located in the dwelling envelope between conditioned space or between the conditioned space and the outside.

ILHR 22.31 CALCULATIONS. The following equations shall be used as specified in this chapter:

(1) EQUATION 1.

$$U_0 = \frac{(U_w A_w) + (U_g A_g) + (U_d A_d)}{A_0}$$

where:

U_O = the overall thermal transmittance of the gross exterior wall area.
A_O = the gross area of the exterior walls.
U_W = the overall thermal transmittance of the various paths of heat transfer through the opaque exterior wall area.
A_W = area of exterior walls that are opaque.
U_g = the thermal transmittance of the windows.
A_g = the area of all windows within the gross wall area.
U_d = the thermal transmittance of the door area.
A_d = door area.

(a) When more than one type of wall, window or door is used, the *U* and *A* terms for those items shall be expanded into sub-elements as:

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

(b) Unless exact areas are calculated, the gross exterior wall area with framing 24 inches on center shall be assumed to be at least 22% framing area, and the gross exterior wall area with framing 16-inches on center shall be assumed to be at least 25% framing area.

(2) EQUATION 2.

$$U_0 = \frac{(U_R A_R) + (U_S A_S)}{A_0}$$

where:

U_O = the overall thermal transmittance of the roof and ceiling gross area.
A_0 = the gross area of the roof and ceiling assembly.
U_R = the thermal transmittance of all elements of the opaque roof and ceiling area.
A_R = the gross area of the opaque roof and ceiling assembly.
U_S = the thermal transmittance of the area of all skylight elements in the roof and ceiling assembly.
A_S = the area, including the frame, of all skylights in the roof and ceiling assembly.

(a) When more than one type of roof or ceiling, skylight or door is used, the *U* and *A* terms for those items shall be expanded into sub-elements as:

$$(U_R\ 1\ A_R\ 1) + (U_R\ 2\ A_R\ 2) + \text{(etc.)}$$

(b) Access doors, hatches, plenums, or other areas in a roof and ceiling assembly shall be included as a sub-element of the roof and ceiling assembly.

(c) Unless exact areas are calculated, wood frame ceilings shall be assumed to be 7% framing area for joists 24-inches on center and 10% framing area for joists 16-inches on center.

(3) EQUATION 3.

$$U_0 = \frac{\left(U_{f1} \times A_{f1}\right) + \left(U_{f2} \times A_{f2}\right) + \left(U_{fn} \times A_{fn}\right)}{A_0}$$

where:

U_O = the overall thermal transmittance of the floor assembly.
A_O = the gross area of the floor assembly.
U_{fn} = the thermal transmittance of the various heat transfer paths through the floor.
A_{fn} = the area associated with the various paths of heat transfer.

Unless exact areas are calculated, wood frame floors shall be assumed to be 7% framing area for joists 24-inches on center and 10% framing area for joists 16-inches on center.

(4) ACCURACY OF CALCULATIONS. The thermal transmittance (U_O) values and dwelling dimensions used in heat gain or loss calculations shall have a minimum decimal accuracy of 3 places rounded to 2, except that the U_O values used for calculating ceiling transmission shall have a minimum decimal accuracy of 4 places rounded to 3.

(5) VALUES. Unless this chapter specifies otherwise, the thermal resistance or thermal transmittance values used in heat gain or loss calculations shall be those given in the ASHRAE Handbook of Fundamentals or shall be substantiated by the submittal of test data from an independent laboratory that verifies the claimed thermal resistance for the specific application of the product or assembly.

Note: See Appendix for a table of R-values reprinted from the ASHRAE Handbook of Fundamentals.

ILHR 22.32 RECESSED LIGHTING FIXTURES. When installed in the dwelling envelope, recessed lighting fixtures shall meet any one of the following requirements:

(1) The fixture shall be inherently or thermally protected type IC and installed inside an air-tight assembly maintaining any clearances required by the listing.

(2) The fixture shall be inherently or thermally protected type IC, manufactured with no penetrations between the inside of the recessed fixture and ceiling cavity, and sealed or gasketed to prevent air leakage into the unconditioned space.

(3) The fixture shall be inherently or thermally protected type IC, and labeled as being tested in accordance with ASTM E 283 at a pressure difference of 75 pascals or 1.57 lb/ft^2 with no more than 2.0 cfm air movement from the conditioned space to the ceiling cavity.

Subchapter VII
Design By Systems Analysis and Design of Dwellings Utilizing Renewable Energy Sources

ILHR 22.33 GENERAL. The requirements of Subchapter V,"Heating and Air Conditioning Equipment and Systems" and the requirements of Subchapter VI, "Dwelling Envelope Design"establish design criteria for energy-consuming and enclosure elements of the dwelling. As an alternative, an energy use analysis may be used to show equivalent compliance. The analysis shall comply with this subchapter or shall be approved by the department.

Note: The department recognizes the use of tradeoffs between higher efficiency furnaces and lower insulation levels. See the appendix for an example of the UDC Energy Worksheet. Other forms or software may be used when approved by the department. The U.S. Department of Energy "MECcheck" software, 1995 edition, may be used to demonstrate compliance for non-electrically heated homes.

ILHR 22.34 ENERGY ANALYSIS. (1) Newly constructed one- and 2-family dwellings designed in accordance with this subchapter comply with Subchapters V and VI if the calculated annual energy consumption is not greater than a similar dwelling, designed as a standard design, whose energy-consuming systems and enclosure elements are designed in accordance with Subchapters V and VI.

Note: In this subchapter, "Standard design" means a dwelling whose enclosure elements and energy-consuming systems are designed in accordance with Subchapters V and VI.

(2) For a proposed alternate dwelling design to be considered similar to a standard design, it shall utilize the same energy sources for the same functions and have equal floor area and the same ratio of dwelling envelope area to floor area, exterior design conditions, climate data, and usage operational schedule.

ILHR 22.35 INPUT VALUES. (1) GENERAL. The input values in this section shall be used in calculating annual energy performance. The requirements of this section specifically indicate which variables shall remain constant between the standard dwelling and proposed dwelling calculations. The standard dwelling shall be a base-version of the design that directly complies with the provisions of this chapter. The proposed dwelling may utilize a design that is demonstrated, through calculations satisfactory to the department, to have equal or lower annual energy use than the standard design.

(2) INPUT VALUES FOR GLAZING AREAS. (a) The orientation of the standard design shall have equal area on the north, south, east, and west exposures.

(b) Shading in the form of draperies, roller shades or blinds shall be assumed to be closed during periods of mechanical air conditioning operation.

(c) Glazed areas shall not be provided with extra exterior shading beyond shading that is provided by typical construction practices such as with tinted glass, outside fixed shading devices and roof overhangs. The energy performance impacts of added exterior shading for glazed areas may be accounted for in the proposed design for a specific dwelling, provided that the actual installation of such systems is approved by the department.

(d) Passive solar designs shall provide documentation acceptable to the department, that fixed external or other acceptable shading is provided to limit excessive summer cooling energy gains to the dwelling interior.

(3) INPUT VALUES FOR HEAT STORAGE AND THERMAL MASS. (a) Internal mass shall be 8 pounds per square foot.

(b) Structural mass shall be 3.5 pounds per square foot.

(c) Passive solar designs shall utilize at least 45 Btu/°F of additional thermal mass, per square foot of added glass area, when south-facing glass exceeds 33 percent of the total glass area in walls.

(4) INPUT VALUES FOR DWELLING ENVELOPE. (a) Surface area and volume. 1. Floors, walls and ceilings of the standard and proposed designs shall have equal areas.

2. The foundations and floor types for both the standard and the proposed designs shall be equal.

3. The glazing area including skylights in the standard design shall not be greater than the glazing area in the proposed design. The *U*- value of the glazing in the standard design shall be selected to permit calculated compliance of the U_O of the wall in the standard design.

4. The standard design of doors shall have at least 40 square feet of door area.

5. Building volume of both the standard and proposed design shall be equal.

(b) HVAC controls. Input values are given in Table 22.35-1.

TABLE 22.35-1
INPUT VALUES FOR HVAC CONTROLS

Parameter		**Value**
Thermostat (constant)	Heating set point	68°F (20°C)
	Cooling set point	78°F (26°C)
	Night set back.	60°F (16°C)
	Set back duration	7 hours
	Number of set back periods	equals the number of dwelling units
	Maximum number of zones	2
	Number of thermostats per zone	1
Internal Sensible Heat Gain (constant)	Btu/hr per dwelling unit	1500 Btu/hr
Domestic Water Heater (calculate, then use as constants)	Temperature set point	120°F
	Daily hot water consumption	Gallons = (30 x the number of dwelling units) + (10 x the number of bedrooms)

(5) SITE WEATHER DATA CONSTANTS. Weather data from the typical meteorological year or its equivalent from the National Oceanic and Atmospheric Administration or an approved equivalent for the closest available location shall be used.

(6) DISTRIBUTION SYSTEM LOSS FACTORS. The heating and cooling systems efficiency shall be proportionally adjusted for those portions of the ductwork located outside or inside the conditioned space using the values shown in the following equations:

Adjusted Efficiency = Equipment Efficiency x Distribution Loss Factor

Total Adjusted System Efficiency = (Equipment Efficiency x Distribution Loss Factor x percent of ducts outside) + (Equipment Efficiency x Distribution Loss Factor x percent of ducts inside).

TABLE 22.35-2
DISTRIBUTION LOSS FACTORS

Mode	Duct Location *	
	Outside	Inside
Heating	0.75	1.00
Cooling	0.80	1.00

* Ducts located in a heated or cooled space are considered as being in an inside location.

(7) AIR INFILTRATION. (a) For the purpose of calculation, air changes per hour for the standard design is 0.50.

(b) If the proposed design takes credit for a reduced air change per hour level, documentation of the measures providing such a reduction or the results of a post-construction blower-door test conducted in accordance with ASTM standard E 779 shall be provided to the department.

ILHR 22.36 DESIGN. The standard design and the proposed alternative design shall be designed on a common basis as specified in this section:

(1) The comparison shall be expressed in Btu input per square foot of gross floor area per year or other time unit, at the dwelling site.

(2) If the proposed alternative design results in an increase in consumption of one energy source and a decrease in another energy source, even though similar sources are used for similar purposes, the difference in each energy source shall be converted to equivalent energy units for purposes of comparing the total energy used.

(3) The different energy sources shall be compared on the basis of energy use at the dwelling site where 1 kWh = 3,413 Btu.

ILHR 22.37 ANALYSIS PROCEDURE. The dwelling heating and cooling load calculation procedures shall be detailed to permit the evaluation factors specified in s. ILHR 22.38 to provide a comparison of energy consumption between the alternative design and the standard design.

ILHR 22.38 CALCULATION PROCEDURE. The calculation procedure shall cover all of the following items that are expected to have a significant impact on the comparison of the energy consumption between the alternate design and the proposed design:

(1) Environmental design requirements as specified in Subchapter IV.

(2) Coincident hourly climatic data for temperatures, solar radiation, wind and humidity of typical days in the year representing seasonal variation.

(3) Dwelling orientation, size, shape, mass and volume.

(4) Air, moisture and heat transfer characteristics.

(5) Operational characteristics of controls for inside air temperature, humidity, ventilation, lighting, and the control mode for occupied and unoccupied hours.

(6) Mechanical equipment design capacity load profile.

(7) Dwelling loads of internal heat generation, lighting, equipment, and the number of occupants during occupied and unoccupied periods.

ILHR 22.39 USE OF APPROVED CALCULATION TOOL. The same calculation tool or method shall be used to estimate the energy usage for space heating and cooling of the standard design and the proposed design. The calculation tool or method and the documentation shall be approved by the department.

ILHR 22.40 DOCUMENTATION. Proposed alternative designs submitted as requests for exception to the standard design criteria, shall be accompanied by an energy analysis comparison report. The report shall provide technical detail on the two dwellings, system designs, and data used in and resulting from the comparative analysis verifying that both analysis designs meet the criteria of of this chapter.

ILHR 22.41 RENEWABLE ENERGY SOURCE ANALYSIS. (1) A proposed dwelling utilizing solar, geothermal, wind or other renewable energy sources for all or part of its energy sources shall meet the requirements of s. ILHR 22.33, except such renewable energy may be excluded from the total annual energy consumption allowed for the proposed dwelling by this subchapter.

(2) To qualify for the exclusion in sub (1), the renewable energy must be derived from a specific collection, storage, and distribution system. The solar energy passing through windows shall also be considered as qualifying if such windows are provided with one of the following:

(a) Operable insulation shutters or other devices which, when drawn or closed, cause the window area to reduce maximum outward heat flows to those in accordance with s. ILHR 22.31 (2), and the windows are shaded from direct solar radiation during periods when mechanical cooling is requested.

(b) The glass is double or triple pane insulated glass with a low-emittant coating on one or both surfaces of the glass, or insulated glass with a low-emittant plastic film suspended in the air space, and the glass areas are shaded from direct solar radiation during periods when mechanical cooling is requested.

(3) Other criteria covered in s. ILHR 22.23 to 22.39 shall apply to the proposed alternative designs utilizing renewable sources of energy.

ILHR 22.42 DOCUMENTATION. (1) Proposed alternative designs submitted as requests for an exception to the standard design criteria, shall be accompanied by an energy analysis, as specified in s. ILHR 22.40. The report shall provide technical detail on the alternative dwelling, system designs, and the data employed in and resulting from the comparative analysis to verify that both the analysis and the designs meet the criteria of this code.

(2) The energy derived from renewable sources and the reduction in conventional energy requirements derived from nocturnal cooling shall be separately identified from the overall dwelling energy use. Supporting documentation on the basis of the performance estimates for the renewable energy sources and nocturnal cooling means specified in this subchapter shall be submitted to the department.

SECTION 34. ILHR 23.02 (1) is repealed and recreated to read:

ILHR 23.02 (1) HEATING AND COOLING SYSTEM DESIGN. (a) Indoor and outdoor design temperatures shall be selected from s. ILHR 22.07.

(b) The heating and cooling systems shall be designed to maintain the indoor design temperature at outdoor design conditions.

(c) When requested, room-by-room heat loss and heat gain calculations shall be furnished.

SECTION 35. ILHR 23.02 (3) (a) is repealed and recreated to read:

ILHR 23.02 (3) VENTILATION (a) General. 1. Mechanical ventilation systems shall be balanced.

2. Infiltration may not be considered make-up air for balancing purposes.

3. All exhaust vents shall terminate outside the structure.

4. Intake air ducts shall be sized to provide a minimum of 40% of the total air that would be exhausted with all exhaust ventilation in the dwelling acting simultaneously.

5. Kitchen range hoods that exhaust air from the kitchen area shall terminate outside the structure and shall be considered as exhaust ventilation for balancing and makeup purposes.

6. Kitchen range hoods that are listed and installed to recirculate air without exhausting it are not required to be balanced.

SECTION 36. s. ILHR 23.065 is created to read:

ILHR 23.065 EQUIPMENT MAINTENANCE INFORMATION. Required regular maintenance actions for equipment shall be clearly stated and incorporated on a readily accessible label. The label may be limited to identifying, by title or publication number, the operation and maintenance manual for that particular model and type of equipment. Maintenance instructions shall be furnished for equipment which requires preventive maintenance for efficient operation. Manufacturer's manuals for all installed heating and cooling equipment and service water heating equipment shall be provided.

SECTION 37. ILHR 23.08 (2) (b) 15. is repealed and recreated to read:

ILHR 23.08 (2) (b) 15. The exterior walls of under-floor spaces shall be insulated in accordance with subch. VI of ch. ILHR 22. The insulation may not be omitted under the provisions of s. ILHR 22.21 or subch. VII of ch. ILHR 22.

SECTION 38. ILHR 23.08 (5) is repealed and recreated to read:

ILHR 23.08 (5) DUCT CONSTRUCTION. Ductwork shall be constructed and installed in accordance with any one of the appropriate following standards:

(a) ASHRAE Handbook HVAC Systems and Equipment.

(b) SMACNA, Residential Comfort System Installation Standards Manual

(c) SMACNA, HVAC Duct Construction Standards-Metal and Flexible.

(d) SMACNA Fibrous Glass Duct Construction Standards.

(e) ASHRAE HVAC Applications Handbook.

(f) NAIMA Fibrous Glass Duct Construction Standards.

SECTION 39. ILHR 23.14 (2) (a) Note is created to read:

Note: s. ILHR 22.08 (3) requires all dryer venting to terminate outside the structure.

SECTION 40. ILHR 23.15 (2) (d) is repealed and recreated to read:

ILHR 23.15 (2) (d) Dampers. 1. Manually operated dampers are prohibited in chimney or vent connectors of all appliances except wood-burning appliances.

2. A listed, automatically operated damper may be used with any heating appliance provided it is installed and used in accordance with the appliance and damper listing.

(END)

* *

EFFECTIVE DATE

Pursuant to s. 227.22 (2) (b), Stats., these rules shall take effect on December 1, 1998.

* *

Wisconsin
Department of Commerce

201 West Washington Avenue
P.O. Box 7970
Madison, Wisconsin 53707
(608) 266-1018

Tommy G. Thompson, Governor
William J. McCoshen, Secretary

August 11, 1998

Gary Poulson
Assistant Revisor of Statutes
Suite 800
131 West Wilson Street
Madison, Wisconsin 53703-3233

Douglas LaFollette
Secretary of State
10th Floor
30 West Mifflin Street
Madison, Wisconsin 53703

Dear Messrs. Poulson and LaFollette:

TRANSMITTAL OF RULE ADOPTION

CLEARINGHOUSE RULE NO.: 97-138

RULE NO.: Chapters ILHR 20-25

RELATING TO: Uniform Dwelling Code

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 also included.

Respectfully submitted,

/s/ William J. McCoshen
William J. McCoshen
Secretary

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AUG 18 1998
REVISOR OF STATUTES
BUREAU

COM-10528 (R.08/97)