cooling or net heat output for heating to the rate of total energy input, expressed in consistent units and under standard rating conditions.

(2) COOLING LOAD. Cooling load is the rate at which heat must be removed from the space to maintain a selected indoor air temperature.

(3) ENERGY. Energy is the capacity for doing work; taking a number of forms which may be transformed from one into another, such as thermal (heat), mechanical (work), electrical, and chemical; in customary units, measured in kilowatt hours (kwh) or British thermal units (Btu).

(4) ENERGY EFFICIENCY RATIO (EER). The energy efficiency ratio is the ratio of net cooling capacity in Btu per hour to total rate of electric input in watts under designated operating conditions.

(5) NONDEPLETABLE ENERGY SOURCES. Nondepletable energy sources are sources of energy (excluding minerals) derived from incoming solar radiation, including photosynthetic processes; from phenomena resulting therefrom, including wind, waves and tides, lake or pond thermal differences; and energy derived from the internal heat of the earth, including nocturnal thermal exchanges.

(6) RECOVERED ENERGY. Recovered energy is the energy utilized which would otherwise be wasted from an energy utilization system.

(7) SERVICE WATER HEATING. Service water heating is the supply of hot water for domestic or commercial purposes other than comfort heating and processing.

(8) THERMAL PERFORMANCE. Thermal performance is the design heat loss, excluding infiltration and ventilation, through above-grade gross walls and roofs facing heated interiors.

(9) ZONE. A zone is a space or group of spaces within a building with heating or cooling requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device. As a minimum, each floor of a building shall be considered as a separate zone.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78; am. (2), Register, January, 1980, No. 289, eff. 2-1-80.

PART III—DESIGN CONDITIONS

Ind 63.10 Scope. The criteria of this part establish the minimum requirements for the thermal design of the exterior envelope of buildings and establish criteria for the design of the heating, ventilating and air-conditioning systems and their parts.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78.

Ind 63.11 General requirements. (1) BUILDING USE. When a building houses more than one use, each portion of the building shall conform to the requirements for the use housed therein.

(2) MOISTURE CONDENSATION. The design of buildings for energy conservation shall not create conditions of accelerated deterioration from moisture condensation.

Note: The designer should consider the use of vapor barriers and ventilation to control condensation.

(3) INFILTRATION. *All exterior windows and doors.* All exterior windows and doors shall be designed to limit air leakage into or from the building and shall be caulked, gasketed, weatherstripped or otherwise sealed.

(b) *Factory manufactured exterior windows and doors.* Factory manufactured exterior windows and doors shall be designed and manufactured to have a rate of infiltration equal to or less than the rates specified in Table 63.11-A.

TABLE 63.11-A

AIR INFILTRATION RATES FOR FACTORY MANUFACTURED EXTERIOR WINDOWS AND DOORS

Component	Infiltration Rate (Expressed in CFM/lineal foot of perimeter crack of operable sash, unless otherwise specified)	
Operable windows, prime		
Residential*	.30	
All other occupancies	.15	
Prehung, swing-type doors	.50	
Glazed, sliding (patio type) doors	.50	CFM/square foot of door area

*Residential occupancies include apartments, row houses, town houses, condominiums, convents and monasteries.

1. Compliance with the air infiltration rates specified in Table 63.11-A shall be certified by an independent testing laboratory or a Wisconsin registered architect or professional engineer using the criteria for air leakage specified in ASTM E-283, "Standard Method of Test for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Door" (Ind 51.25 (55)) at a pressure differential of 1.567 pounds per square foot (equivalent to effect of 25 miles per hour wind).

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

(4) DESIGN TEMPERATURE DIFFERENTIALS. (a) *Winter.* The winter design temperature differential shall be determined using the indoor design temperature as given in Table 1 of chapter Ind 64 and the outdoor design temperature as given in the following Figure 1.

(b) *Summer.* The summer design temperature differential shall be determined using an indoor design temperature of 78° F and the outdoor design temperature as given in the following Figure 1.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78; r. and recr. (3), Register, May, 1980, No. 293, 6-1-80.

Ind 63.12 Design criteria. (1) THERMAL PERFORMANCE. (a) The thermal performance values for the exterior envelope of buildings, other than residential buildings (i.e., apartments, row houses, town houses, condominiums, convents and monasteries) of 2 stories or less in height, shall not exceed the values specified in Table 63.12-A.

TABLE 63.12-A

THERMAL PERFORMANCE VALUES

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

*Expressed in Btu/hour/square foot of above-grade exterior envelope.

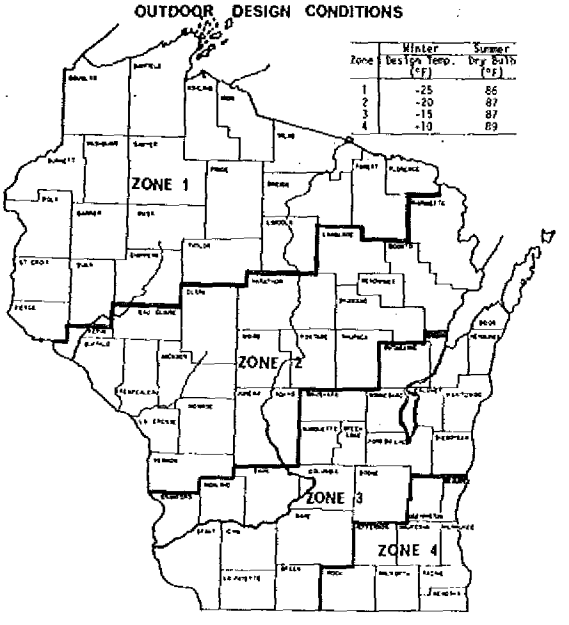
(b) The thermal performance values for the exterior envelope of residential buildings (i.e., apartments, row houses, town houses, condominiums, convents and monasteries) of 2 stories or less in height shall not exceed 9 Btu/hour/square foot of above-grade exterior envelope.

(c) *Exception.* The thermal performance values specified in (a) or (b) may be increased provided the U-value for floors over unheated spaces is decreased so that the total heat gain or loss for the entire building envelope and floor area does not exceed the total heat gain or loss resulting from conformance to the values specified in (1) and (2) of this section.

Note: To determine the thermal performance value of a building, the designer may use a static or dynamic method of calculation provided such calculation method is acceptable to the department.

FIGURE 1

OUTDOOR DESIGN CONDITIONS



(2) FLOORS OVER UNCONDITIONED SPACES. The overall heat transmission coefficient (U-value) for floors of heated or mechanically cooled spaces over unconditioned spaces shall not exceed 0.08 Btu/H-Ft²-F°.

(3) SLAB-ON-GRADE PERIMETER INSULATION. For slab-on-grade floors, the thermal resistance of the insulation around the perimeter of the floor shall not be less than the values shown in Table 63.12-B. The insulation shall extend downward from the top of the slab for a minimum distance of 24 inches, or downward to the bottom of the slab then horizontally beneath the slab for a minimum total distance of 24 inches.

TABLE 63.12-B

PERIMETER INSULATION REQUIREMENTS

Slab-on-grade Perimeter Insulation	Zone 1	Zone 2	Zone 3	Zone 4
R = °F Ft² Hour / Btu	6.7	6.2	5.9	5.2

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78; am. (1) (intro.), Register, January, 1980, No. 289, eff. 2-1-80; r. and recr. (1), Register, May, 1980, No. 293, eff. 6-1-80.

PART IV—HEATING AND AIR-CONDITIONING EQUIPMENT AND SYSTEMS

Ind 63.20 Equipment efficiencies. (1) ELECTRICAL EQUIPMENT. All electrical heating and cooling equipment shall comply with the minimum coefficients of performance (COP) or energy efficiency ratios (EER) established in this section.

(a) *Air-conditioning equipment.* Air-conditioning equipment shall have minimum EER and COP values as indicated in Table 63.20-A.

(b) *Heat pumps.* Heat pumps in the cooling mode shall have EER and COP values as indicated in Table 63.20-A based on the standard rating conditions specified in Table 63.20-B. Heat pumps in the heating mode shall be rated at the standard rating conditions and have a minimum COP as shown in Table 63.20-C.

(a) Heated swimming pools shall be equipped with controls to limit heating water temperatures to no more than 80° F, except for pools used for therapeutic purposes.

(b) Unenclosed heated pools shall be controlled so that the electric resistance or fossil-fueled pool water heating systems are inoperative from September 15 to May 15.

Note: The requirements of (3) of this section will be enforced by the department of health and social services. The same rules will be included in Wis. Adm. Code chapter H 72—Users of Indoor or Outdoor Artificial Swimming Pools.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78; am. (1) and (2), Register, January, 1980, No. 289, eff. 2-1-80.

Ind 63.33 Insulation. (1) STORAGE TANKS. Heat loss from unfired hot water storage tanks shall be limited to 15 Btu per hour per square foot of external tank surface area. The design ambient temperature shall be no higher than 65° F.

(2) PIPING. Piping heat loss for recirculation systems shall be limited to a maximum of 25 Btu per hour per square foot of external pipe surface for above-ground piping and a maximum of 35 Btu per hour per square foot of external pipe surface for underground piping. Maximum heat loss shall be determined at a ΔT equal to the maximum water temperature minus a design ambient temperature no higher than 65° F.

(a) *Exception.* Conformance to the minimum pipe insulation requirements specified in Table 63.22 shall be deemed as complying with the requirements of this section.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78; cr. (2) (a), Register, May, 1980, No. 293, eff. 6-1-80.

PART VI—ILLUMINATION AND ELECTRICAL SYSTEMS

Ind 63.40 Distribution. (1) POWER FACTOR. Building service utilization equipment rated greater than 1,000 watts and lighting equipment greater than 30 watts, with an inductive reactance load component, shall have a power factor of not less than 85% under rated load conditions. Building service utilization equipment with a power factor of less than 85% shall be corrected to at least 90% under rated load conditions.

(2) LIGHTING SWITCHING. Switching shall be provided for each lighting circuit, or for portions of each circuit, so that the partial lighting required for custodial or for effective complementary use with natural lighting may be operated selectively.

Note: For purposes of energy conservation, the department recommends separate metering for energy usage for each tenant in any multi-tenant residential building. Where local codes and regulatory agencies permit, tenants should be financially responsible for the energy they use. This recommendation does not include college dormitories, hotels and other transient facilities.

History: Cr. Register, May, 1978, No. 269, 7-1-78; am. (1), Register, January, 1980, No. 289, eff. 2-1-80.

Ind 63.41 Lighting. The building lighting shall be designed in accordance with one of the following methods:

(1) LIGHTING POWER BUDGET. For purposes of establishing a budget, the power allowed for the lighting load shall not exceed the value for the

space use as indicated in Table 63.41. Each area of space shall be multiplied by its maximum lighting load respective value as indicated in Table 63.41. This calculation shall be made for all areas of the building and these values shall be summed to yield a total allowable lighting wattage. This total allowable lighting wattage is the maximum amount of lighting power for the building, which may then be allocated as desired provided this value is not exceeded.

(a) *Exception.* The following areas or classes of lighting equipment may be exempt from the criteria of (1) of this section:

1. Local task lighting fixtures applied to an individual location with switching under the user's immediate control, such as, but not limited to, a portable desk lamp, a work light on a machine, or a hospital examination light.

2. Lighting for special applications where the lighting is an essential technical element for the function performed, such as theatrical performances and spectator sports.

(2) ILLUMINATION BUDGET. If the total allowable lighting wattage value determined by the calculations outlined in (1) above is exceeded, then the illumination shall be determined by a method acceptable to the department.

Note #1: The department will accept calculations in accordance with chapter 9 of the ASHRAE 90-75 standard.

Note #2: The material in this section is not intended to be used as a lighting design procedure. The purpose of this section is solely to outline a procedure for determining the maximum power limit for the lighting. It is recommended that lamps of the highest efficacy be used, except where areas or tasks require good to high color rendition.

TABLE 63.41

LIGHTING POWER VALUES

Area/Use	Maximum Connected Lighting Load
Offices	3.0 watts/sq. ft.
Factories, mercantile buildings, classrooms, day care centers and other chapter 54 and 56 occupancies not listed elsewhere in this table	2.5 watts/sq. ft.
Conference rooms, toilet rooms, theaters and other places of assembly (i.e., entertainment, recreation, worship, or dining areas)	2.0 watts/sq. ft.
Corridors, bulk manufacturing buildings, places of abode or detention, lobby areas, and other chapter 57 and 61 occupancies	1.0 watt/sq. ft.
Dead storage areas	0.5 watts/sq. ft.
Indoor parking structures and other hazardous occupancies	0.25 watts/sq. ft.
Outdoor parking areas	0.05 watts/sq. ft.
Building perimeter, facade	5.0 watts/lin. ft.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78.

Ind 63.42 Controls. Circuiting and switching or dimming shall be provided so that lighting can be turned off when a space is empty and

not used or so that lighting can be reduced or turned off (manually or automatically) where daylight is adequate and can be used effectively.

Note: The department recommends that switching, circuiting or dimming be provided for lighting in task areas larger than 150 square feet to reduce the lighting level by at least one-half when the task is not being performed or is relocated.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78.

PART VII—NONDEPLETABLE ENERGY SOURCE

Ind 63.50 Buildings utilizing solar, geothermal, wind or other nondepletable energy source. Any building, or portion thereof, utilizing any nondepletable energy source shall meet all the requirements of this chapter. An energy credit will be given to the building envelope in the amount of the net nondepletable energy collected. The nondepletable energy must be derived from a specific collection, storage and distribution system, which may include active and passive systems.

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

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78.

Ind 63.51 Documentation. Proposed alternative designs, submitted as variations to the standard design criteria, shall be accompanied by an energy analysis. This department will accept alternative systems designed according to the requirements of nationally recognized agencies.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78.

PART VIII—SYSTEM ANALYSIS DESIGN

Ind 63.60 Annual energy consumption. A building designed in accordance with this part will be deemed as complying with this chapter if the calculated annual energy consumption is not greater than a similar building with enclosure elements and energy consuming systems designed in accordance with parts I through VI of this chapter. If the proposed alternative design results in an increase in consumption of one energy source and a decrease in another energy source, the difference in each energy source shall be converted to equivalent energy units for purposes of comparing the total energy used.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78.

Ind 63.61 Simulation. The calculation procedure used to simulate the operation of the building and its service systems through a full year operating period shall be detailed to permit the evaluation of the effect of system design, climatic factors, operational characteristics, and mechanical equipment on annual energy usage. Manufacturer's data or comparable field test data shall be used when available in the simulation of all systems and equipment. The calculation procedure shall be based upon 8,760 hours of operation of the building and its service systems and shall utilize the following input:

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

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

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

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

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

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78.

Ind 63.62 Documentation. Proposed alternative designs, submitted as requests for exception to the standard design criteria, shall be accompanied by an energy analysis comparison report. The report shall provide technical detail on the building and system design and on the data used.

History: Cr. Register, May, 1978, No. 269, eff. 7-1-78.