

Chapter Ind 59

HEATING, VENTILATING AND AIR CONDITIONING

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History: Chapter Ind 58 as it existed on January 31, 1965 was repealed and a new chapter Ind 59 was created effective February 1, 1965.

Ind 59.01 Scope of code. (1) PUBLIC BUILDINGS AND PLACES OF EMPLOYMENT. The provisions of this code shall apply to all buildings used, or to be used, as places of employment or as public buildings, as defined by statutes.

Note: For a definition of "public buildings" and "places of employment" see section 101.01 (1), Wis. Stats. For a definition of "farming" see section 102.04 (3), Wis. Stats.

(2) NEW BUILDINGS. The provisions of this code shall apply to the heating, ventilating and air conditioning of all new buildings.

(3) EXISTING INSTALLATIONS. The provisions of this code shall apply to the addition of or replacement of any major apparatus in existing buildings.

(4) CHANGE IN USE. The provisions of this code shall apply to every building, or portion of a building, devoted to new use for which the requirements under this code are in any way more stringent than the requirements covering the previous use.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.10 Definitions. (1) "Air conditioning" is the process of treating air to control simultaneously its temperature, humidity, cleanliness and distribution to meet the requirements of the conditioned space.

(2) "Combustible" refers to a material or structure made of or surfaced with wood, compressed paper, plant fibers or other material that will ignite and burn.

(3) A "duct" is any pipe, flue, or tunnel used to convey air, gases and entrained materials. An underground duct is any part of a duct that is below the surface of the ground.

(4) A "duct furnace" is a suspended direct-fired heating appliance normally installed in air ducts. Air circulation is provided by a blower not furnished as part of the appliance.

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

(6) "Existing buildings" shall include buildings, structurally completed, or for which drawings have been approved prior to April 11, 1936. Buildings constructed after April 11, 1936 shall comply with requirements of the code in effect at the time the drawings were approved or construction was completed.

(7) A "furnace" is completely self-contained direct-fired, automatically controlled, vented appliance for heating air by transfer of heat of combustion through metal to the air and designed to supply heated air through ducts to spaces remote from the appliance location.

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

(9) "Hazardous piping" is any service piping conveying oxygen, flammable liquids, flammable gases or toxic gases.

(10) A "heating system" is any combination of building construction, machinery, devices or equipment, so proportioned, arranged, installed, operated, and maintained as to produce and deliver in place the required amount and character of heating service.

(11) A "jacketed stove" is a vented, self-contained free standing, non-recessed heating appliance, using solid, liquid or gas fuels. The effective heating is dependent on a gravity flow of air circulation over the heat exchanger.

Note: See definition for "space heaters".

(12) "Major apparatus" shall be defined as central air-handling equipment supplying more than one occupancy or rooms and heat-producing equipment generating heat for the heating and ventilating system.

(13) "Mechanical ventilation" is the process of supplying or removing air by power-driven fans or blowers.

(14) The term "new building" includes buildings, additions thereto, and alterations thereof, for which complete drawings have not been approved by the department of industry, labor and human relations, or construction is not in progress, prior to February 1, 1965.

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

(16) The "outside air intake" includes the ducts and outdoor openings through which outside air is admitted to a ventilating, air conditioning or heating system.

(17) An "occupied area" is any room, area or enclosure used by one or more persons.

(18) "Outdoor openings" may be doors, windows or skylights located in outside walls or roof and can be opened to provide natural ventilation to the occupied space. Natural ventilation is permitted through window openings arranged in conformance with Wis. Adm. Code section Ind 52.02.

(19) An "outlet" or supply opening is an opening, the sole purpose of which is to deliver air into any space to provide heating, ventilation or air conditioning.

(20) A "return" or exhaust opening is any opening the sole purpose of which is to remove air from any space being heated, ventilated or air conditioned.

(21) A (gravity or circulating type) "space heater" is a vented, self-contained free standing or wall recessed heating appliance using liquid or gas fuels.

Note: See definition for "jacketed stove".

(22) "Tempered outside air". Outside air heated before distribution.

(23) "Tempered air". Air transferred from heated area of building.

(24) A "unit heater". (Direct-fired low and high static type).

(a) Low static type is a direct-fired suspended, self-contained automatically controlled, vented heating appliance, having integral means for circulation of air by means of a propellor fan or fans.

(b) High static pressure type is a direct-fired suspended or floor standing, self-contained, automatically controlled and vented, heating appliance having an integral means for circulation of air against 0.2 inch or greater static pressure.

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

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.20 Drawings, specifications and data. (1) DESIGN AND PREPARATION OF DRAWINGS. All drawings and data for the installation of heating, ventilating and air conditioning equipment shall be designed and prepared to satisfy the requirements of this code.

Note: See section 101.31 Wis. Stats. the provision of which regulates the practice of engineering and architecture in Wisconsin.

Designers are hereby notified that beginning on August 1, 1968, all drawings and design data to be submitted for review and approval under the provision of this code for buildings greater than 50,000 cubic feet shall be sealed or stamped by an engineer or architect registered in accordance with the laws of Wisconsin.

(2) APPROVAL OF DRAWINGS AND SPECIFICATIONS. Where heating, ventilation and air conditioning equipment is required, complete drawings, specifications, and data sheets shall be submitted to the department of industry, labor and human relations for approval. Approval shall be obtained before affected work is commenced and all work shall be executed according to the approved drawings and specifications.

Note: To expedite approval of drawings the heating and ventilation drawings should be submitted for approval with the building drawings.

Note: Approval is not required for the installation of air cooling equipment when added to an approved heating and ventilating system.

(a) Drawings for installations within the city limits of Milwaukee shall be submitted to the Inspector of Buildings, Milwaukee for examination and approval.

(b) The replacement of major apparatus is subject to department of industry, labor and human relations approval.

(c) A statement in triplicate, showing capacities of old and new equipment may be submitted instead of data required in subsection (7).

(3) NUMBER OF DRAWINGS AND SPECIFICATIONS. One copy of specifications and 3 complete sets of drawings shall be submitted for approval.

Note: Extra copies of drawings may be filed for an approval and shall be submitted with the original submittal.

(4) APPROVAL OF CHANGES ON DRAWINGS. When it is necessary to change approved heating and ventilating drawings or specifications, revised drawings shall be approved before installation is commenced.

(5) APPROVED DRAWINGS KEPT AT BUILDING. A complete set of approved drawings shall be kept available at the job site.

(6) INFORMATION REQUIRED ON DRAWINGS AND IN SPECIFICATIONS. The lines, data and information shown on drawings for heating, ventilating and air conditioning systems submitted for approval shall be permanent, clear, legible and complete, and shall include all details and data necessary for review of the proposed installation, such as:

(a) Name of the owner of the building.

(b) Complete address of the building.

(c) Architect, engineer or designer's name shall appear on the title sheet.

(d) A floor plan for each floor where equipment is installed shall be furnished as part of the set of drawings.

(e) A room schedule, indicating the intended use of all rooms.

(f) Description of the construction for walls, floor, ceiling, and roof.

(g) Elevation and sectional plans to illustrate and clarify equipment arrangements.

(h) Location, size and type of all principal units of equipment.

(i) Size and continuity of all ducts and vents.

(j) Description and location of chimney

(k) Specifications shall be properly identified with and completely supplement the drawings.

(7) DATA REQUIRED. All drawings submitted for approval shall be accompanied by sufficient data and information for the department of industry, labor and human relations to judge if the capacity of the equipment and the performance of the system will meet the requirements of this code. The following data shall be submitted:

(a) Heat loss calculated in BTU per hour.

(b) Calculated air volume at design temperature for each occupied area.

(c) Calculated direct and indirect radiation required for each occupied area.

(d) Calculations for ventilation requirements.

(e) Summation of total heating and ventilation requirements.

Note: Cross reference: The department of industry, labor and human relations will accept the method and standards recommended by the Mechanical Contractors' Association of America, American Society of Heating, Refrigeration and Air Conditioning Engineers, National Warm Air Heating and Air Conditioning Association and Institute of Boiler and Radiator Manufacturers as the basis for calculations and design data.

(8) **FUNDAMENTAL DATA REQUIRED.** When requested, additional data pertaining to design and operation of a heating and ventilating system shall be filed for approval with the department of industry, labor and human relations by the architect, engineer, designer or manufacturer before such equipment is installed or used.

(9) **APPROVAL OF MATERIAL AND EQUIPMENT.** The use of materials, equipment, devices and methods of installation not mentioned in this code is subject to approval in writing by the department of industry, labor and human relations. Sufficient test data and descriptive information shall be submitted to prove its use.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65; am. (1), Register, May, 1966, No. 125, eff. 6-1-66; am. (1), Register, October, 1967, No. 142, eff. 11-1-67.

Ind 59.21 Accident prevention and fire protection. (1) GUARDS. All mechanical apparatus shall be guarded to comply with Wis. Adm. Code, chapter Ind 1.

(2) **FIRE PROTECTION.** All installations under this code shall comply with the precautionary requirements of the department of industry, labor and human relations to reduce fire hazards.

Note: Refer to the building code and electrical code for additional safety and fire protection requirements:

Masonry chimneys, construction---Wis. Adm. Code section Ind 52.10
Metal smoke stacks, construction---Wis. Adm. Code section Ind 52.11
Smoke pipes-----Wis. Adm. Code section Ind 52.12
Steam and hot water pipes,
protection-----Wis. Adm. Code section Ind 52.13
Vertical duct shaft, construction---Wis. Adm. Code section Ind 52.14
Boiler and furnace rooms-----Wis. Adm. Code sections Ind 54.13,
Ind 55.29, 56.15, 57.20, 57.50
Heating and ventilating equipment and
wiring-----Wis. Adm. Code section E 1-E 900

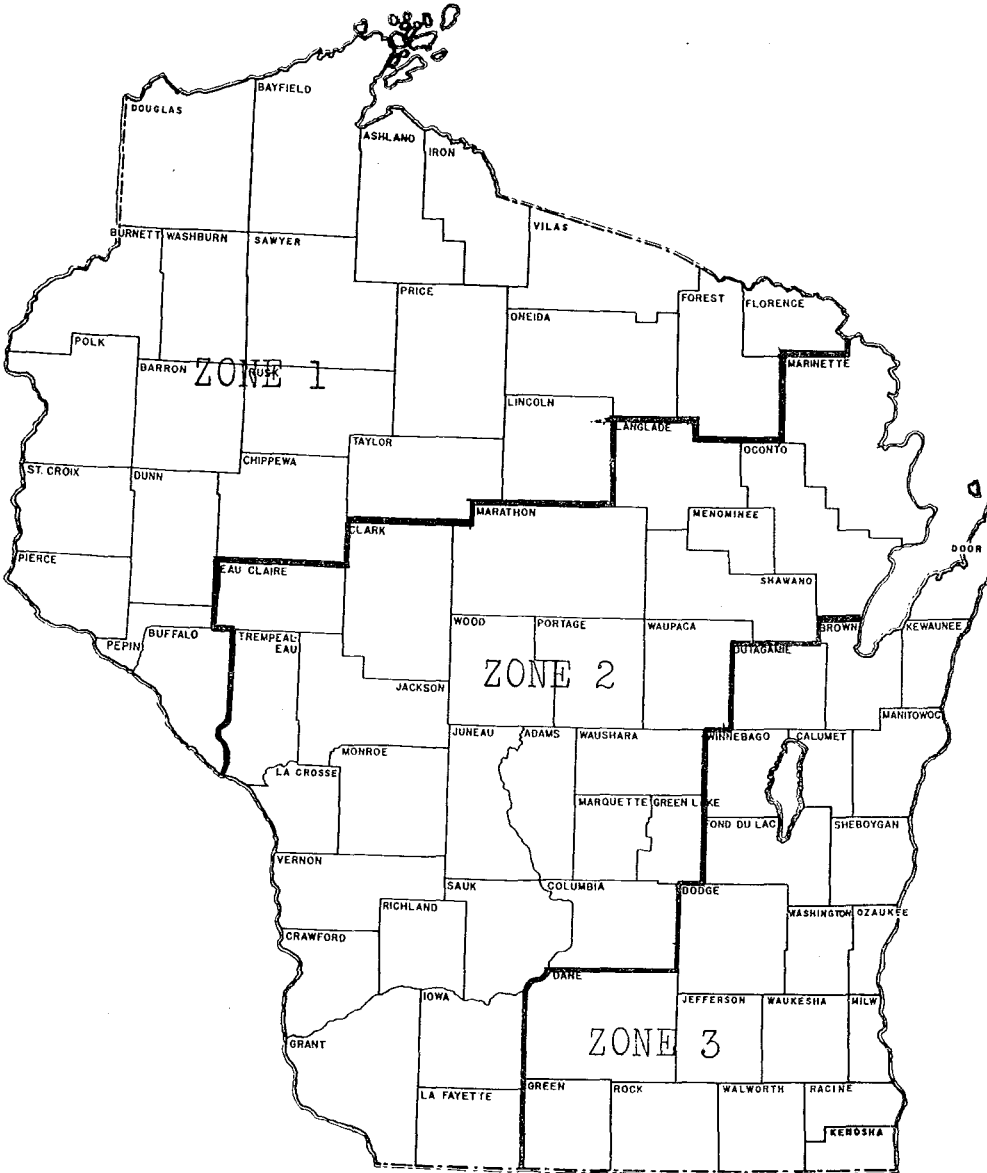
Ind 59.22 Design. (1) INSTALLATION OF EQUIPMENT. All heating, ventilating and air conditioning installations shall be designed and installed to provide the service and results required by this code.

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

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

(3) **OUTSIDE TEMPERATURE DESIGN CONDITIONS.** In the accompanying map, the state of Wisconsin has been divided into 3 zones. The maximum heat losses for a heating system shall be calculated on the basis of the temperatures indicated in Table 1 with reference to location of the project in each respective zone.

TABLE 1
MAP OF WISCONSIN SHOWING DESIGN TEMPERATURE ZONES



Zone 1 - - - - - 30° Below Zero F.
 Zone 2 - - - - - 25° Below Zero F.
 Zone 3 - - - - - 15° Below Zero F.

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(4) **INSIDE TEMPERATURE DESIGN CONDITIONS.** The heating system shall be designed to maintain a temperature of not less than that shown in Table 2.

TABLE 2

Type of Buildings	Deg. Fahr.	Type of Buildings	Deg. Fahr.
Barber Shops and Beauty Parlors.....	75	Hotels:	
Schools:		Bedrooms and Baths.....	70
Classrooms.....	70	Dining Rooms.....	70
Assembly Rooms.....	68	Kitchens and Laundries.....	66
Gymnasiums.....	65	Ballrooms.....	65
Wardrobe and Locker Rooms.....	70	Service Rooms.....	68
Kitchens.....	66	Apartments.....	70
Dining and Lunch Rooms.....	65	Offices.....	68
Play Rooms.....	60	Stores.....	65
Natatoriums and Bathrooms.....	75	Factories and Machine Shops.....	60
Toilet Rooms.....	70	Foundries and Boiler Shops.....	50
Hospitals:		Toilet and Locker Rooms—	
Private Rooms.....	70	General.....	70
Operating Rooms.....	75	Garages:	
Wards.....	68	Repair and Service Areas.....	60
Kitchens and Laundries.....	66		
Bathrooms.....	75		
Toilet Rooms.....	75		
Theaters:			
Seating Space.....	68		
Lounge Rooms.....	68		

(5) **AIR-CLEANSING APPARATUS.** (a) Air-cleansing apparatus shall be designed and installed to permit access to the equipment for maintenance and to insure proper operation of the heating and ventilating system.

(6) **SUPPLY AIR TEMPERATURE.** The design condition of the supply air temperature shall not exceed 140° Fahrenheit.

(7) **CONTROLS.** Where ventilation is required by this code, controls shall be provided so that minimum air circulation, supply and exhaust shall be maintained continuously during periods of occupancy.

(8) **AIR QUANTITY.** The quantity of air used to ventilate a given space during period of occupancy shall always be sufficient to maintain the standards of air temperature, air quality, air motion and air distribution as required by this code. (See Wis. Adm. Code section Ind 59.24).

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.24 General requirements for heating, ventilating and exhaust systems. (1) **HEATING SYSTEMS REQUIRED.** Heating systems complying with the requirements of this code shall be provided, maintained and operated for all occupied areas within the scope of this code.

(2) **VENTILATING SYSTEMS REQUIRED.** Ventilating systems shall be provided, maintained and operated to accomplish required ventilation service for all occupied areas within the scope of this code.

Note: Cross reference: For requirements pertaining to all places of employment or occupancy where smoke, gas, dust, fumes, steam, vapor, industrial poisons, or other detrimental materials are used, stored, handled, or are present in the air in sufficient quantities to obstruct the vision, or to be irritating, or to be injurious to the health, safety or welfare of the employes or frequenters, see Wis. Adm. Code Ch. 20, Dusts, Fumes, Vapors and Gases issued by the department of industry, labor and human relations.

(3) **GRAVITY DIRECT-INDIRECT SYSTEMS.** The installation of gravity direct-indirect systems is prohibited.

Note: This rule is intended to prohibit the use of direct-indirect radiation whereby the outside air supply is admitted to the base and delivered at the top without mechanical assistance.

(4) **HOT WATER HEATING AND VENTILATING SYSTEMS.** Hot water systems installed in areas where ventilation is required under this code shall comply with the following requirements:

(a) The system hot water shall be circulated continuously by mechanical means.

(5) **EXHAUST SYSTEM AIR DISCHARGE.** Exhaust systems shall be designed to prevent contaminated air re-entering the building.

Note: See Wis. Adm. Code, Ch. Ind 20.

(6) **TEMPERED AIR SUPPLY.** (a) Where ventilation is affected by exhaust methods, an outside tempered air supply shall be provided to replace the air exhausted from the area if the volume of air exhausted exceeds one air change per hour.

(b) Where heat gain from kitchen equipment or a process of manufacture is adequate to equal all or part of the ventilation load, the air may be recirculated and supplied mechanically within the immediate area and mixed with a quantity of outside air to temper the air supply, provided that dampers and temperature controls are installed in the system to maintain a discharge temperature of not less than 55° Fahrenheit.

(c) A tempered air supply depending on a negative pressure within the space is prohibited except in foundries, steel fabricating shops and similar areas.

(7) **CONTAMINATION OF ADJACENT AREA.** All equipment and system service rooms, which house sources of odors, fumes, noxious gases, smoke, steam, dust, spray, or other contamination, shall be such as to prevent spreading of any such contamination to other parts of the building occupied by people.

(8) **FINAL TEST REQUIRED.** Every heating, ventilating and air conditioning system shall be tested and balanced in place by the designer or installer.

(9) **INSTRUCTIONS.** The designer or installer shall provide the owner with written instructions for the operation and maintenance of the system and equipment.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.25 Maintenance and operation. (1) **MAINTENANCE.** All heating, ventilating, exhaust and air conditioning systems shall be maintained in good working order and shall be kept clean and sanitary.

(2) **OPERATION.** All heating, ventilating and exhaust systems shall be operated to satisfy the requirements of this code during periods the building is occupied unless otherwise exempted by this code.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.40 Occupancy classification. (1) The various occupancies to which the provisions of this code apply shall be classified as follows:

(a) Require ventilation on an occupancy basis.

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(b) Require ventilation on an occupancy basis unless otherwise exempted.

(c) Require exhaust.

(d) Require ventilation on the basis of floor area.

(2) Table 3 is a list of occupancies to determine ventilation requirements and number of persons.

TABLE 3

Use or Occupancy	Classification	Basis of Capacity
Arenas and field houses.....	(a)	4 sq. ft. per person. Use seated area only.
Armories (drill halls).....	(a)	30 sq. ft. per person.
Assembly halls.....	(a) or (b)	7 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Banquet halls.....	(a) or (b)	15 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Bath and shower rooms.....	(c)	See Wis. Adm. Code section Ind 59.48.
Barber shops.....	(b)	20 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Beauty parlors.....	(b)	20 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Billiard rooms.....	(a) or (b)	15 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Bowling alleys.....	(a) or (b)	Seating capacity, plus 6 persons per alley. Terminate occupied area at foul line. See Wis. Adm. Code section Ind 59.51.
Brokerage board rooms.....	(a) or (b)	7 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Cafeterias.....	(a) or (b)	15 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Churches and places of worship..	(a) or (b)	See Wis. Adm. Code section Ind 59.44.
Chapel.....	(a) or (b)	7 sq. ft. per person.
Dining and social rooms.....	(a) or (b)	15 sq. ft. per person.
Nave or auditorium.....	(a) or (b)	7 sq. ft. per person.
Club rooms.....	(a) or (b)	Depends on usage.
Dance halls.....	(a) or (b)	15 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Dining rooms.....	(a) or (b)	15 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Factories and machine shops....	(b)	See Wis. Adm. Code section Ind 59.53. Also see rules of Wis. Adm. Code on Dusts, Fumes, Vapors and Gases.
First aid rest rooms.....	(a) or (b)	15 sq. ft. per person. See Wis. Adm. Code section Ind 59.53.
Foundries and boiler shops....	(b)	See Wis. Adm. Code section Ind 59.53. Also see rules of Wis. Adm. Code on Dusts, Fumes, Vapors and Gases.
Funeral homes.....		See Wis. Adm. Code section Ind 59.44.
Chapel.....	(a) or (b)	7 sq. ft. per person.
Garages and service stations....	(d)	See Wis. Adm. Code section Ind 59.52.
General offices.....	(a) or (b)	See Wis. Adm. Code section Ind 59.50.
Gymnasiums and combined gymnasiums and assembly halls..	(a)	6 sq. ft. per person for seated space. 15 sq. ft. per person for space not seated. See Wis. Adm. Code section Ind 59.56.
Hospitals.....	(a) or (b)	See Wis. Adm. Code section Ind 57.17 and Ind 57.19.
Hospitals (Mental).....		See Wis. Adm. Code section Ind 59.55.
Day Rooms.....	(b)	See Wis. Adm. Code section Ind 57.19.
Dormitory.....	(b)	See Wis. Adm. Code section Ind 57.17 and Ind 57.19.
Janitor closets.....	(c)	See Wis. Adm. Code section Ind 59.48 and Ind 59.56.
Kitchens.....	(c)	See Wis. Adm. Code section Ind 59.49.
Laboratories.....	(a) or (c)	25 sq. ft. per person. See rules of Wis. Adm. Code on Dusts, Fumes, Vapors and Gases.
Laundries.....	(c)	See rules of Wis. Adm. Code on Dusts, Fumes, Vapors and Gases.
Lecture halls.....	(a)	7 sq. ft. per person. Use seated area only.
Library reading rooms.....	(a)	20 sq. ft. per person.

Use or Occupancy	Classification	Basis of Capacity
Locker rooms.....	(c) or (d)	See Wis. Adm. Code section Ind 59.48 and Ind 59.53.
Lodge halls.....	(a) or (b)	6 sq. ft. per person for seated space, 15 sq. ft. per person for space not seated—See Wis. Adm. Code section Ind 59.51.
Mental hospitals.....		See Wis. Adm. Code section Ind 59.55.
Day rooms.....	(b)	See Wis. Adm. Code section Ind 57.19.
Dormitory.....	(b)	See Wis. Adm. Code section Ind 57.19.
Motion picture booth.....	(a) or (c)	See Wis. Adm. Code section Ind 59.43.
Penal Institutions.....		See Wis. Adm. Code section Ind 57.17 and Ind 57.19.
Jail cell (over-night lock-up).....	(b) & (c)	6 air changes per hour.
Places of employment.....	(b)	75 sq. ft. per person. See Wis. Adm. Code section Ind 59.53.
Play room (unfinished areas).....	(c)	23 sq. ft. per person.
Printing establishments.....	(b)	See Wis. Adm. Code section Ind 59.53. Also rules of Wis. Adm. Code on Dusts, Fumes, Vapors and Gases.
Restaurants.....	(a) or (b)	15 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Retail establishments.....	(a) or (b)	Basement: 40 sq. ft. per person. Other floors: 60 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
School all-purpose, dining and recreation rooms.....	(a)	15 sq. ft. per person.
School auditoriums.....	(a)	7 sq. ft. per person.
School classrooms.....	(a)	23 sq. ft. per person.
School kindergarten rooms.....	(a)	23 sq. ft. per person.
School lecture rooms.....	(a)	7 sq. ft. per person. Use seated area only.
School project rooms.....	(a)	23 sq. ft. per person.
School study rooms.....	(a)	16 sq. ft. per person.
Security vaults (occupied).....	(d)	2 CFM per sq. ft.
Skating rinks.....	(a) or (b)	15 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Sunday School.....	(b)	15 sq. ft. per person.
Swimming pools.....	(c)	See Wis. Adm. Code section Ind 59.48.
Taverns.....	(a) or (b)	20 sq. ft. per person. See Wis. Adm. Code section Ind 59.51.
Theaters.....	(a)	7 sq. ft. per person.
Theater lobbies.....	(a)	15 sq. ft. per person.
Theater lounge rooms.....	(a)	15 sq. ft. per person.
Toilet rooms.....	(c)	See Wis. Adm. Code section Ind 59.48.
Vocational instruction and research.....	(a) or (c)	40 sq. ft. per person. See rules of Wis. Adm. Code on Dusts, Fumes, Vapors and Gases. 2 CFM per sq. ft. floor area.
Wardrobes, lockers and cloak rooms.....		See Wis. Adm. Code section Ind 59.48 and Ind 59.53.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.41 General requirements for occupancies under (a) and (b) classifications. (1) **SCOPE.** The requirements of this rule shall apply to all occupancies listed in Wis. Adm. Code section Ind 59.40 (1) (a) and (b) unless otherwise exempted by this code.

(2) **AIR MOVEMENT.** The total air circulated for all occupancies in this classification shall not be less than 6 air changes per hour unless otherwise provided by this code.

(a) The air delivery capacity of all equipment supplying air for heating, ventilating and air conditioning purposes shall be based on standard air ratings.

Note: Standard air is substantially equivalent to dry air at 70° Fahrenheit and 29.92 inches (H₂) barometric pressure.

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(b) An air movement of less than 6 air changes per hour is permitted where mechanical cooling (air conditioning) is provided and the heat gain requirement for the space has been satisfied.

(3) **OUTSIDE SUPPLY.** The outside air supply maintained during occupancy of a given space shall not be less than $7\frac{1}{2}$ cubic feet per minute per occupant. Exhaust ventilation in equal volume shall be maintained simultaneously.

Note: See Wis. Adm. Code section Ind 59.40 (Table 3) for method of determining number of occupants.

(4) **AIR DISTRIBUTION.** All air outlets and returns shall be so located, arranged or equipped as to provide a uniform distribution of air.

(5) **RECIRCULATION.** No air contaminated by other than human occupancy shall be used for recirculation, except within the same occupancy classification.

(6) **AUTOMATIC CONTROLS.** Automatic controls shall be provided to maintain temperature and controlled ventilation to satisfy the following conditions during periods the area is occupied.

(a) Provide a continuous air movement of not less than the minimum required by this code.

(b) Provide a continuous supply of tempered outside air as determined by the number of occupants of not less than $7\frac{1}{2}$ cubic feet of air per minute per person.

(c) Maintain design temperature.

(7) **AIR CLEANSING DEVICES.** Approved air cleansing devices shall be installed in a manner to filter the outside air and recirculated air used with mechanical heating and ventilating systems except as follows:

(a) Filters are not required in garages, factories, foundries and similar occupancies.

(b) Filters are not required for use with unit heaters designed for heating and recirculation.

(c) Where jet systems or blend-air systems are approved, air filters are not required in the ducts that are installed for the recirculation of air within the same occupied space.

Note: The department of industry, labor and human relations recognizes as approved, filters listed in Building Materials List published by the Underwriters' Laboratories, Inc. and test data of any other recognized testing agency for the purpose for which it is used.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.42 Places of assembly. (1) **SCOPE.** This classification shall include arenas, armories, assembly halls, banquet halls, billiard rooms, bowling alleys, cafeterias, club rooms, dance halls, dining rooms, gymnasiums, lecture halls, lodge halls, playrooms, restaurants, school auditoriums, skating rinks and theaters, that will accommodate more than 100 persons.

Note: For areas that will accommodate less than 100 persons, see Wis. Adm. Code section Ind 59.51.

(2) **AIR MOVEMENT, SUPPLY AND DISTRIBUTION.** The air movement, supply and distribution for all occupancies under this classification shall conform to the requirements of section Ind 59.41.

(3) **STAGES.** The stage in any theater or assembly hall, for which a fire curtain is required, shall be supplied with sufficient air or other means to equalize the pressure to avoid deflecting the curtain.

(4) **ALTERNATE SERVICE AND CAPACITY.** Heating and ventilating systems installed in so-called community buildings and lodge halls may be arranged for selective delivery of the entire service to either the first floor area or to the basement floor area provided these areas are not used simultaneously.

History: Cr. Register, January, 1965, No. 109, *eff.* 2-1-65.

Ind 59.43 Motion picture booth. (1) **SCOPE.** This classification shall include all motion picture booths housing projection equipment using carbon arc lamps.

(2) **EXHAUST VENTILATION.** Hazardous fumes and gases shall be mechanically exhausted to the outside atmosphere from projectors, spotlights, stereopticons, and similar equipment. One exhaust system shall be used to remove all contaminated air. The volume of air exhausted shall be not less than 15 cubic feet per minute for each arc lamp or other source of contamination. Dampers are prohibited in the system. The system shall not be used for any other service.

(3) **AIR SUPPLY.** Where a mechanical exhaust system is required, a volume of tempered air shall be supplied to equal the volume of air exhausted. Air shall be supplied by one or a combination of the following methods:

(a) Tempered air may be supplied to the booth from other ventilating systems in the building if the inlet opening is protected with an approved shutter having quick acting fusible links, or other approved heat release devices that will automatically and quickly close the inlet opening simultaneously with the openings in the front of the booth.

(b) A separate supply system, such as a unit ventilator, if the equipment is arranged so that the air supply will be stopped automatically and simultaneously with the closing of the openings in front of the booth.

Note: When approved in writing by the department of industry, labor and human relations, the air may be taken through openings in the booth walls from the auditorium or other space adjoining the booth. For relief outlets in addition to exhaust ventilation, see Wis. Adm. Code section Ind 55.45.

History: Cr. Register, January, 1965, No. 109, *eff.* 2-1-65.

Ind 59.44 Places of assembly for worship. (1) **SCOPE.** This classification shall include auditoriums, social assembly rooms, and Sunday School rooms, in churches or houses of worship. It shall also include chapels in funeral homes, parochial schools and convents.

(2) **VENTILATION REQUIRED.** The air movement supply and distribution for occupancies in this class shall conform to the requirements of Wis. Adm. Code section Ind 59.40 and Ind 59.41. Mechanical ventilation will not be required where the total openable area of outside doors and windows is greater than 3% of the floor area served, except in funeral homes the openable area shall be greater than 5%. Window openings below grade will not be accepted unless there is a "clear

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space" outside of the window having a width not less than 1½ times the distance below grade at the bottom of the window.

Note. Width of "clear space" is the horizontal distance measured at right angles to the plane of the window.

(3) **ALTERNATE SERVICE AND CAPACITY.** Heating and ventilating systems installed in occupied areas of this class may be arranged for selective delivery of the entire service to either the auditorium floor area or to the basement floor area provided these areas are not used simultaneously.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.45 Schools. (1) **SCOPE.** This classification shall include all class, study, recitation, lecture, project rooms, kindergartens, library reading rooms and similar areas in all school, college and library buildings used for educational purposes. (See Wis. Adm. Code section Ind 59.42 for assembly rooms).

(2) **VENTILATION REQUIRED.** (a) *General.* The air movement and supply for all occupancies in this class shall conform to the requirements of sections Ind 59.40, 59.41 and 59.42.

(b) *Air movement and supply.* The air movement and supply for all occupancies under this classification shall conform to the requirements of section Ind 59.41. For corridors and halls used in conjunction with occupied areas of this class, the air movement shall not be less than 10 cubic feet per minute per lineal foot of corridor or hall. This air supply shall be accomplished by means of air inlets admitting air from adjacent classrooms or by a direct tempered air supply.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.46 Places for vocational instruction and research. (1) **SCOPE.** This classification shall include all places for vocational instruction and research, such as laboratories, school shops, domestic science rooms and similar occupied areas.

(2) **VENTILATION REQUIRED.** The air movement and supply for areas in this class shall conform to the requirements of sections Ind 59.41 and 59.52.

(3) **EQUIPMENT AND PROCESS EXHAUST.** (a) An exhaust system shall be provided for all equipment and processes that create dusts, fumes, vapors or gases injurious to health.

Note: See Wis. Adm. Code, Ch. Ind 20.

(b) Exhaust systems shall be separate from and independent of all other services and systems in a building.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.48 General sanitation and service areas. (1) **SCOPE.** This classification shall include toilet rooms, locker rooms, natatoriums and shower rooms.

Note 1: For exhaust ventilation requirements in hospital service areas, see Wis. Adm. Code section Ind 59.56 (2).

Note 2: For exhaust ventilation requirements in places of employment, see Wis. Adm. Code section Ind 59.53.

(2) **VENTILATION REQUIRED.** (a) Exhaust ventilation shall be provided for all areas of this class unless otherwise exempted. The volume of air exhausted shall not be less than 2 cubic feet per minute per square foot of floor area.

(b) The effectiveness of the exhaust shall be greater than the supply.

(c) Exhaust ventilation shall be installed in toilet rooms having more than one fixture (water-closets and urinals).

Note: Exhaust ventilation is not required from toilet rooms having one water-closet or one urinal when the window area is greater than 4 square feet and more than 2 square feet is openable.

(d) The air movement in the natatorium shall be not less than 6 air changes per hour and the volume of tempered outside air supplied and exhausted shall be not less than 2 cubic feet per minute per square foot of pool surface.

(e) Locker rooms used with natatoriums, baths and toilet rooms, shall be supplied with tempered air.

Note: The air supplied may be exhausted through baths or toilet rooms.

(3) **EXHAUST VENTILATING SYSTEMS.** Exhaust ventilating systems serving this class of occupancy shall not be used for any other service.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.49 Kitchens. (1) **SCOPE.** This classification includes all areas where food is prepared, except places of vocational instruction and single unit apartments in apartment buildings, hotels and motels.

(2) **VENTILATION REQUIRED.** (a) *Exhaust.* The exhaust ventilation required for every occupied area of this class shall not be less than 4 cubic feet per minute per square foot of floor area. For kitchens in churches, auditoriums, lodge halls and schools, the exhaust ventilation shall be not less than 2 cubic feet per minute per square foot of floor area.

(b) *Exhaust ventilating system.* Exhaust ventilating systems serving this class of occupancy shall not be used for any other services.

(3) **RANGE HOODS.** (a) The air velocity over the face area of a single wall hood shall be not less than 100 feet per minute or 350 feet per minute through the slot opening of a double wall hood.

(b) The electrical wiring and fixtures shall be of a type approved for use in damp locations.

Note: See Wisconsin State Electrical Code, Volume 2.

(4) **DUCTS.** (a) Ducts or vents connected to range hoods and passing through any other area of the building shall be protected with not less than 2-hour fire-resistive construction. Where 2-hour fire-resistive construction cannot be provided, a manufactured or masonry chimney shall be used. The manufactured chimney shall be tested and approved for use at a flue gas temperature of not less than 1000° Fahrenheit.

Note: See Wis. Adm. Code section Ind 51.05 for various building materials having a 2-hour rating.

(b) Accessible clean-out openings shall be installed in the area of the duct not requiring a 2-hour fire-resistive construction.

(c) The air discharge shall be directed away from combustible materials.

(d) Sheet metal ducts shall be constructed of not less than 20 U.S. gauge sheet steel.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.50 Offices. (1) **SCOPE.** This classification shall include areas where clerical and administrative work is the chief usage.

(2) **VENTILATION REQUIRED.** The air movement supply and distribution for this classification shall conform to the requirements of Wis. Adm. Code section Ind 59.41 unless each of the following requirements has been satisfied:

(a) The total area of outdoor openings is not less than 3% of the floor area served.

(b) The available floor space for each occupant is not less than 75 square feet per person.

(c) Heat or odors are not present in sufficient quantities to be injurious to the health, safety or welfare of the occupants.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.51 Retail establishment. (1) **SCOPE.** This classification shall include barber shops, beauty parlors, brokerage board rooms, taverns, bowling alleys, retail establishments where goods and commodities are bought and sold and places where not more than 100 persons assemble for recreation, entertainment or dining purposes.

(2) **VENTILATION REQUIRED.** The air movement, supply and distribution for all occupancies of this class shall conform to the requirement of section Ind 59.41 unless the total area of "outdoor openings" is more than 3% of the floor area served. Window openings below grade will not be accepted unless there is a "clear space" outside of the window having a width of not less than 1½ times the distance below grade at the bottom of the window.

Note: Width of "clear space" means the horizontal distance measured at right angles to the plane of the window.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.52 Garages and service stations. (1) **SCOPE.** Ventilation shall be provided for all repair garages, service stations, body shops or all live storage garages housing 6 or more vehicles driven by internal combustion engines.

Note: A live storage area is any area within a building used for the storage of fire trucks, tractors, automobiles, trucks and other self-propelled vehicles driven in and out under their own power.

(2) **VENTILATION REQUIRED.** The supply and exhaust ventilation shall be provided for areas of this class, whenever open to the public or to employees.

(3) **STORAGE AREAS.** (a) *Heated live storage area.* Areas used for the storage of 6 or more motor-driven vehicles shall be provided with a tempered outside air supply of not less than ½ cubic foot per minute per square foot of floor area. Exhaust ventilation shall equal the volume of air supplied.

(b) *Unheated live storage area.* Areas used for the storage of 6 or more motor-driven vehicles and where heat is not required, shall be provided with exhaust ventilation equal to $\frac{1}{2}$ cubic foot of air per minute per square foot of floor area unless the following requirements have been satisfied:

1. The floor is at or above grade level.

2. A permanent open wall of the included area is not less than 30% of the total wall area and arranged to cause air circulation throughout the respective area.

(4) **REPAIR AREAS.** (a) All areas in which motor-driven vehicles are repaired shall be supplied with a volume of tempered outside air not less than $\frac{3}{4}$ cubic foot per minute per square foot of floor area. An equal volume of exhaust ventilation shall be provided and maintained. Exhaust air shall be drawn from a line not more than 18 inches above the floor.

(b) Provide a mechanical exhaust system in the repair area to remove the exhaust fumes from internal combustion engines. The duct system shall be designed with sufficient outlets to accommodate the total number of vehicles in the repair area. Provide flexible hose equipped with a device for connecting it to the exhaust pipe of the vehicle and to the exhaust system. Each outlet shall be provided with a shut-off valve that can be closed when not in use. The blower capacity shall be sufficient to exhaust a volume of air not less than 100 cubic feet per minute for each opening.

Note: In a repair area of a garage where the repair area can accommodate not more than 2 vehicles, an incombustible flexible tube or hose not more than 10 feet long connected to the engine exhaust (tail pipe) and terminating outside of the building may be used in lieu of a mechanical exhaust system.

(5) **SERVICE STATIONS.** Buildings of this classification shall include liquid fuel dispensing stations where vehicles can be driven into the building for washing, greasing, oil change, tire or battery replacement and similar operations.

(a) All service room or work room areas shall be supplied with a volume of tempered outside air not less than $\frac{1}{2}$ cubic foot per minute per square foot of floor area. Provide an exhaust ventilation system having an equal capacity. Exhaust air shall be drawn from a line not more than 18 inches above the floor.

(6) **GENERAL REQUIREMENTS.** (a) A separate ventilating system shall be provided for show rooms or offices, except in service stations, where such occupancies are adjacent to repair or live storage areas.

Note: Ventilation is not required if openable area is provided to conform with Wis. Adm. Code sections Ind 59.50 (2) (a) and 59.51 (2).

(b) Air shall not be recirculated from any repair, live storage or service area, unless the total volume of air in circulation is in excess of the ventilation required. Excess air may be recirculated.

(c) The air exhausted from the repair, live storage and service areas shall be removed from a line not more than 18 inches above the floor through vent ducts located in areas of greatest contamination. Where gravity exhaust ventilation is provided, the vent ducts shall

extend not less than 2 feet above the high point of the roof or parapet and shall be capped with an approved siphon type roof ventilator.

Note: For ventilation requirements where spray coating is done, see Wis. Adm. Code Ch. Ind 21.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.53 Places of employment. (1) **SCOPE.** This classification shall include all places of employment not classified elsewhere in this code.

(2) **VENTILATION REQUIRED.** (a) The air movement supply and distribution for all areas in this class shall conform to the requirements of Wis. Adm. Code section Ind 59.41 unless all of the following requirements have been satisfied:

1. The available floor space for each occupancy shall be at least 75 square feet per person.

2. Heat, smoke, gas, dust, spray, hazardous fumes, vapors, steam or other contamination shall not be present in sufficient quantities to obstruct the vision, or be irritating, or injurious to the health or safety of employes and frequenters.

3. The total area of outdoor openings shall be not less than 3% of floor area served, except in refrigeration plants, warehouses, cold storage buildings and processing areas where the nature of the occupancy does not permit outdoor openings.

(3) **INDUSTRIAL EXHAUST SYSTEMS REQUIRED.** (a) Industrial exhaust systems shall be installed and operated to remove harmful contaminants in conformance with Wis. Adm. Code, Ch. Ind 20.

(b) Supply a volume of tempered outside air to replace the air exhausted if the volume of air exhausted exceeds an infiltration rate of 3 air changes per hour.

(4) **LOCKER ROOMS.** Locker rooms used in places of industrial employment shall be provided with a tempered air supply.

Note 1: See Wis. Adm. Code section Ind 59.48.

Note 2: Exhaust air from locker rooms may be directed through the adjoining toilet or shower room.

(5) **FIRST AID REST ROOMS IN PLACES OF EMPLOYMENT.** Ventilation shall be provided for all areas of this class to conform to the requirements of Wis. Adm. Code section Ind 59.41. Ventilation is not required where the total sash area is greater than 10% of the floor area and the openable area is greater than 5%.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.55 Penal institutions and places of detention. (1) **SCOPE.** This classification shall include corridors and areas of compulsory occupancy in penal institutions, mental hospitals and other places of detention.

(2) **VENTILATION REQUIRED.** The air movement supply and distribution for all areas of this class shall be accomplished by mechanical means and shall conform to the requirements of sections Ind 59.40 and 59.41. The air movement through the corridors shall be not less than 10 cubic feet per minute per lineal foot of corridor.

(3) **OVERNIGHT LOCK-UPS.** Where cells are provided for not more than 6 occupants for the purpose of overnight detention only, exhaust ventilation shall be provided on the basis of 6 air changes per hour for the occupied area.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.56 Hospitals. (1) **SCOPE.** This classification shall include hospitals, nursing homes, public health centers, and treatment centers where medical services are provided for treatment and care of "bedfast patients".

Note 1: A "bedfast patient" is a person who is normally confined to a bed or chair.

Note 2: Refer to the State Board of Health, Hospital and Related Services, for additional requirements.

(2) **VENTILATION REQUIRED.** (a) Exhaust ventilation shall be provided from bedpan rooms, baths, janitor closets, sterilizing rooms, laboratories, soiled utility rooms, and soiled linen rooms on the basis of 2 cubic feet per minute for each square foot of floor area.

(b) Enclosed nursing stations, drug storage rooms, clean utility rooms, treatment rooms, dark rooms and X-ray rooms shall have a minimum air movement of 6 air changes per hour unless the operable window area is 3% of the floor area served. Such ventilation shall be accomplished by exhaust methods where the volume of air exhausted shall be greater than the volume of air supplied.

(c) The operating rooms, anesthesia rooms, recovery rooms, labor rooms, delivery rooms and nursery shall have a minimum air movement of not less than 6 air changes per hour. Tempered outside air shall be provided and the system shall be designed to maintain a room temperature of 75 degrees Fahrenheit. The recirculation of air is not permitted except in a nursery where part of the air may be recirculated from the area supplied. Provide mechanical exhaust ventilation equal to the volume of air supplied. Relative humidity in the anesthetizing locations shall be maintained at not less than 50%.

(d) Private, semi-private wards and day rooms shall be ventilated in accordance with the requirements of Wis. Adm. Code section Ind 56.41 unless operable sash area has been provided and the content of the space is in excess of 400 cubic feet per occupant.

Note: See Wis. Adm. Code sections Ind 57.17 and 57.19.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.60 Outside ventilating air intakes. (1) **LOCATION.** (a) Outside air intake openings shall be located a distance of at least 20 feet horizontally or 10 feet vertically from vents and chimney outlets.

(b) Where vents and intakes are located on adjacent walls of outside corners, the horizontal distance may be reduced to 10 feet.

(c) Outside air intake openings located in exterior walls shall be located at least 10 feet (measured in any direction) from any exhaust vent or chimney outlet.

(2) **MOUNTING HEIGHT.** (a) Outside air intake openings shall be located at least 12 inches above the outside grade or above roof.

(b) Where outside air intake openings are located in any areaway below grade, the top of the areaway shall be not less than 12 inches above the grade level.

(3) **SCREENS.** All outside air intake openings shall be provided with a device to prevent intake of foreign material of $\frac{1}{2}$ inch size or larger.

Note: See Wis. Adm. Code section Ind 59.69 (Table 4) for allowable velocities in the design of outside air intake openings.

(4) **WEATHER PROTECTION.** All outside air intake openings shall be protected against weather and water with a weatherproof hood or louvers. All outside air intakes except intakes for combustion air shall be equipped with a damper to prevent the intake of unheated air to the building when the heating unit is not in operation.

(5) **ACCESSIBILITY AND CLEANLINESS.** All outside air intakes shall be easily accessible for cleaning, and shall be kept clean and sanitary in use throughout the circuit to the heater.

(6) **COMBUSTION AIR INTAKES. (GRAVITY)** (a) All boiler rooms and furnace rooms shall have an opening to the outside air. The free area of such opening shall be not less than 1 square inch for each 5,000 BTU per hour of fuel consumed. The minimum free area of such opening shall be not less than 100 square inches.

(b) Manually operated dampers are prohibited.

(c) Motorized dampers are acceptable when interconnected with the burner of direct-fired equipment. Flue dampers shall be open when the burner is in operation.

Note: Mechanical supply fans may be used to supply combustion air when complete design data is submitted for approval.

History: Cr. Register, January, 1965, No. 109, *eff.* 2-1-65.

Ind 59.61 Air cleansing apparatus. (1) Contaminated water shall not be recirculated through sprays affecting air used for ventilating purposes.

Note: See note following Wis. Adm. Code, section Ind 59.41 (7) for approved materials used in cleansing devices.

History: Cr. Register, January, 1965, No. 109, *eff.* 2-1-65.

Ind 59.63 Boilers. (1) **GENERAL.** The boiler, safety devices and other auxiliary equipment shall be of a type approved by the department of industry, labor and human relations.

Note: See Wis. Adm. Code, Ch. Ind 41.

(2) **RATING.** All boilers not rated by a recognized testing laboratory shall have a net rating equal to 60% of fuel input.

Note: The department of industry, labor and human relations accepts net ratings as listed by Mechanical Contractors Association of America, Inc., Steel Boiler Institute, Inc. and Institute of Boiler and Radiator Manufacturers.

(3) **CONTROLS.** The boiler shall be equipped with automatic controls that will shut off fuel supply to the burner and pilot in case of ignition failure.

History: Cr. Register, January, 1965, No. 109, *eff.* 2-1-65.

Ind 59.65 Jacketed stoves. (1) **SCOPE.** Jacketed stoves are acceptable in the following occupancies:

(a) One-room schools and portable schools having no basement or other subfloor heater space.

(b) One-story office buildings, where total floor area is less than 1500 square feet.

(c) One-story motels and apartment buildings.

(2) **LOCATION.** Jacketed stoves in a schoolroom shall be located in the coldest area.

(3) **SHIELDS.** The casings or shields of jacketed stoves in schools shall be so constructed as to shield adjacent occupants from radiant heat. The clear air space between shield and stove shall average 6 inches and the shields themselves shall extend above and below all heat radiating surfaces, but not more than 12 inches clear of the floor.

(4) **OUTSIDE AIR INTAKE.** Jacketed stoves installed in school buildings shall have an outside air intake terminating outside the building at a line not less than 12 inches above grade. The outside air intake shall be protected with a weatherproof hood or louvers and a $\frac{1}{2}$ inch wire mesh screen. The intake duct shall be joined to the heater casing and airway in a manner that will prevent cold air from spreading over the floor and insure contact with the heater surface. Underfloor ducts are prohibited.

(a) The area of the outside air duct shall not be less than 0.25 square inch per square foot of floor area. A damper shall be provided in the outside air supply duct to prevent the intake of unheated outside air to the building during periods when the heater is not in operation.

(5) **VENTS.** Vent outlets in rooms served by jacketed stoves and heaters shall be located at the floor line and not less than 6 feet from the heater casing.

(a) The area of auxiliary metal vent flues used in connection with smoke pipes shall not be less than 150 square inches.

(b) Where effective devices for mixing smoke and vented air are used, the smoke flue and outlet duct may be combined, provided that the free area of the vent duct is not less than 144 square inches.

(6) **OIL BURNING HEATERS.** Every oil burning jacketed stove or room heater shall be supplied directly from an oil supply tank having a capacity of not less than 250 gallons.

(a) The fuel oil tank shall be equipped with a fill pipe, vent pipe and an oil gauge.

Note: See Wis. Adm. Code, chapter Ind 8.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.66 Space heating equipment. (1) FURNACES. (a) *Fan-furnace installations.* Forced air heating systems shall be designed to prevent a negative pressure on the heat exchanger, except where systems are designed to supply 100% tempered make-up air to replace a volume equal to that exhausted.

(b) *Gravity furnaces.* Gravity furnaces shall be located so that the air supply circuits leading to and from them will be as short and direct as practicable. The outside air inlet to gravity furnace airways shall be such as will insure distribution of air to relatively unheated portions of the furnace proper and throughout the furnace airways. The top of such inlet shall not be higher than 2 inches below the top of the grates.

(c) *Rating.* All furnaces not rated by a recognized testing laboratory shall have a net rating equal to 60% of fuel input.

(d) *Fire-resistive enclosure.* The furnace shall be isolated in a fire-resistive enclosure constructed in conformity to the applicable provisions of the Wis. Adm. Code, chapters Ind 50-59, building and heating, ventilating and air conditioning code.

Note: See Wis. Adm. Code, section Ind 59.21 (2)

(e) *Approved type.* A furnace shall be a type approved by the department of industry, labor and human relations.

(f) *Venting.* Furnaces shall be connected to an approved stack, vent or chimney. (See Wis. Adm. Code section Ind 59.67.)

Note: The department of industry, labor and human relations recognizes equipment listed by Underwriters' Laboratories, American Gas Association or other nationally recognized testing laboratories.

(g) *Controls.* The furnace shall be equipped with automatic controls that will shut off fuel supply to the burner and pilot in case of ignition failure.

(2) UNIT HEATERS, SUSPENDED FURNACES AND DUCT FURNACES. (a) Direct-fired appliances of this class are prohibited in theaters, assembly halls, places of worship, schools, hospitals, hotels, apartment houses, and similar places where more than 100 persons assemble for recreation, entertainment or dining purposes, except where the appliance is enclosed in a fire-resistive enclosure constructed in conformity to applicable provisions of the Wis. Adm. Code, chapters Ind 50-59, building, heating, ventilating and air conditioning code.

(b) Direct-fired appliances of this class in retail establishments, manufacturing plants, garages, service stations, machine shops, wood-working plants, foundries, offices, and similar areas shall comply with the following requirements:

1. The appliance shall be suspended in an occupied space.
 2. The heating appliance shall be of an approved type.
 3. The heating appliance shall be vented to the outside atmosphere by connection to a masonry chimney, an approved vent pipe, or to a metal smoke stack. (See Wis. Adm. Code section Ind 59.67—approved chimneys.)
 4. The heating appliance shall be supported by incombustible brackets or hangers. All units shall be located at least 7 feet above the floor and at least 6 inches away from any combustible wall or ceiling.
 5. The oil-fired unit shall not be suspended over combustible material.
 6. The appliance shall be equipped with automatic controls that will shut off fuel supply to the burner and pilot in case of ignition failure.
- (c) Where the entering air to the heat exchanger of all gas-fired equipment is 30 degrees Fahrenheit or lower, the heat exchanger and burners shall be constructed of corrosion-resistive materials.
- (d) Floor-standing direct-fired unit heaters, furnaces and boilers in metal fabricating plants, foundries, and machine shops shall be isolated in a fire-resistive enclosure unless the building and contents are incombustible.

(e) Direct-fired gas appliances designed to supply 100% outside air (where the products of combustion are mixed with the comfort

air stream), may be installed in metal fabricating plants, foundries, machine shops and factories provided:

1. The volume of air supplied to the occupied space is exhausted mechanically.

2. The heater is equipped with automatic controls that will shut off fuel supply to the burner in case of ignition failure.

Note: The department of industry, labor and human relations recognizes as approved, equipment listed by the American Gas Association, Underwriters' Laboratories, Inc. and test data of any other recognized testing laboratories.

(f) Supply duct connections are prohibited with "low static" direct-fired unit heaters.

(g) Unit heaters, suspended furnaces and duct furnaces not rated by a recognized testing laboratory shall have a net rating equal to 60% of fuel input.

(3) **SPACE HEATERS.** (a) Space heaters are prohibited in hazardous occupancies. Space heaters may be used in motel guest rooms, individual apartments, individual offices and retail establishments, subject to the following provisions:

1. A space heater may be used in retail establishments provided the floor area of any story does not exceed 1500 square feet.

2. Space heaters used in a retail establishment shall be provided with outside combustion air supplied directly to the burner.

3. Space heaters may be used in offices located within a factory or warehouse building providing the total floor area of the office space or spaces does not exceed 500 square feet.

4. The rated input capacity shall not exceed 70,000 BTU per hour for each appliance.

5. Space heaters shall be a type approved by the department of industry, labor and human relations.

6. Space heaters shall not be installed in any enclosed space having a volume less than 1000 cubic feet unless the combustion air supply is taken from the outside directly to the appliance.

7. Space heaters shall be vented to the outside atmosphere by connection to a masonry chimney, an approved vent, vent pipe or metal smoke stack. (See Wis. Adm. Code section Ind 59.67—approved chimneys.)

8. Space heaters shall be equipped with automatic pilot of the complete shut-off type for gas burners and automatic valve in oil supply line for oil burners that will close in case of ignition failure.

9. Oil-fired space heaters shall be equipped with mechanical pressure atomizing burner.

10. The burner of the appliance shall be enclosed with a metal housing so constructed that there will be no open flame and the burner housing shall be effectively guarded against personal contact. The arrangement shall be such that the shield will prevent any combustible material in the vicinity of the appliance from coming in contact with the flame or with the housing that encloses the burner.

11. Space heaters shall be located at least 6 inches from any unprotected combustible wall or partition, unless approved by the

department of industry, labor and human relations. Space heaters standing on a combustible floor shall be supported on legs securely fastened to the floor. The space under the unit shall not be enclosed.

12. Every oil-burning space heater shall be supplied directly from an oil supply tank having a capacity of not less than 250 gallons. The fuel oil tank shall be equipped with an oil gauge, vent and fill pipe. The vent and fill pipe openings shall terminate outside of the building.

Note: For fuel oil storage location and piping requirements, see Wis. Adm. Code, Ch. 8.

13. Space heaters shall not be equipped with duct extensions beyond the vertical and horizontal limits of the metal enclosure.

14. Space heaters not rated by a recognized testing laboratory shall have a net rating equal to 80% of fuel input.

Note: The department of industry, labor and human relations recognizes equipment listed by American Gas Association, Underwriters' Laboratories, Inc. and test data of any other nationally recognized testing laboratory.

(4) **INFRA-RED GAS-FIRED RADIANT HEATERS.** (a) Heating appliances of this class installed in machine shops, foundries, manufacturing plants, warehouses, garages and aircraft hangars shall conform to the following:

1. The heaters shall be a type approved by the department of industry, labor and human relations.

2. The heater shall be equipped with automatic pilot of the complete shut-off type.

3. Ventilation shall be provided to supply combustion air and dilute the products of combustion.

4. The heaters shall be supported by incombustible brackets or hangers.

5. Not less than the minimum clearances shall be maintained between the heater and combustible materials determined in accordance with test procedures and standards approved by the department of industry, labor and human relations. The heater shall be suspended above the floor not less than a height equal to 7 feet plus the approved minimum clearance from face of heater to combustible materials.

6. Infra-red gas-fired radiant heaters, vented or unvented, not rated by a recognized testing laboratory shall have a net rating equal to 80% of fuel input.

Note: The department of industry, labor and human relations recognizes as approved, equipment listed by the American Gas Association, Underwriters' Laboratories, Inc. and test data of any other nationally recognized testing laboratory.

(5) **ELECTRIC SPACE HEATING EQUIPMENT.** (Electric furnaces, space heaters, unit heaters, cable heating devices, infra-red radiant heaters, and heat pump systems.) Where electric space heating equipment is used, it shall conform to the following requirements:

(a) It shall be a type approved by the department of industry, labor and human relations.

(b) It shall be equipped with safety and temperature controls.

(c) Not less than the minimum clearances shall be maintained between the electric space heating equipment and combustible mate-

rial determined in accordance with test procedures and standards approved by the department of industry, labor and human relations.

(d) Electric space heating equipment shall not be installed in hazardous occupancies unless it is approved for such use. (See Wis. Adm. Code, Electrical code, volume 2.) The open type resistance heating element is prohibited in hazardous occupancies.

(e) Electric space heating equipment shall be rated on the energy input to the heating element, expressed in BTU per hour.

Note: The department of industry, labor and human relations recognizes as approved equipment listed by Underwriters' Laboratories, Inc.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.67 Chimneys, gas vents, mechanical draft and venting devices.

(1) **GENERAL REQUIREMENTS.** Heating appliances using solid, liquid or gas fuels shall be vented to the outside. A natural draft chimney or other venting device shall have the height and area to remove the products of combustion.

(2) **TYPES.** (a) *Masonry chimney.* The design and construction of the chimney shall conform to the provisions of Wis. Adm. Code, section Ind 52.10, (Building and heating, ventilating and air conditioning code).

(b) *Metal smoke stacks.* The design and construction of a metal smoke stack shall conform to the provisions of Wis. Adm. Code, section Ind 52.11.

(c) *Factory-built chimneys.* Where a factory-built chimney or a gas vent is used instead of a masonry chimney or a metal smoke stack, it shall be an approved type.

1. Type "A". An approved type "A" chimney may be used with solid, liquid or gas-fired heating appliances, where the flue gas temperature does not exceed 1000 degrees Fahrenheit continuously and does not exceed 1400 degrees Fahrenheit for infrequent brief periods of forced firing.

2. Type "B". An approved type "B" gas vent may be used with gas-fired appliances where the flue gas temperature does not exceed 550 degrees Fahrenheit at the outlet of the draft hood.

3. Type "BW". An approved type "BW" gas vent may be used with a vented recessed heater.

4. Type "C". A type "C" gas vent may be used with gas-fired low heat appliances (low pressure boiler, furnaces and space heaters). The vent shall be not less than No. 20 standard gauge galvanized iron or other approved corrosion-resistant material. The installation shall conform to the requirements of Wis. Adm. Code, section Ind 52.12.

Note: The department of industry, labor and human relations recognizes as approved chimneys designated as types "A", "B", "BW", and "C" and listed by American Gas Association and Underwriters' Laboratories, Inc.

(3) **SPECIAL REQUIREMENTS.** (a) All chimneys or gas vents shall be supported from incombustible construction unless otherwise approved.

(b) All chimneys or gas vents depending on a gravity principle for the removal of the products of combustion shall terminate not less than 3 feet above the highest point where they pass through the roof of the building, and at least 2 feet higher than any ridge, peak or wall within 10 feet of the chimney.

(c) The height and cross-sectional area may be reduced for chimneys employing mechanical draft equipment when approved by the department of industry, labor and human relations.

(4) SMOKE PIPES. The construction and installation of smoke pipes shall conform with the requirements of the Wis. Adm. Code, section Ind 52.12.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.68 Fans and Blowers. (1) **TYPE AND CAPACITY.** Fans and blowers shall be of a type and size that will satisfy the design conditions of the heating and ventilating system. Fans and blowers shall be rated in accordance with an approved test procedure.

Note: The department of industry, labor and human relations accepts certified ratings listed by Air Moving and Conditioning Association, Inc.

(2) **QUIET OPERATION.** The sound generated by various fans and blowers shall not be objectionable.

(3) **CONTROLS FOR FAN-FURNACE INSTALLATIONS.** All fan-furnace installations shall be equipped with controls to shut off the heat generating equipment whenever the bonnet air temperature exceeds a safe limit and to maintain air circulation through furnace airways whenever required to distribute the heat generated. The fan shall be of a capacity adequate to provide the required ventilation.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.69 Ducts. (1) **DESIGN.** All ducts shall be designed to promote the unrestricted flow of air with long sweep elbows or turning vanes. All ducts of a gravity system shall be as direct as possible and shall have a rise of not less than one inch per foot in the direction of flow.

(2) **AIR VELOCITIES.** The air velocity in vent ducts shall not exceed the limits established in Table 4.

TABLE 4

	Maximum Allowable Velocities	
	Mechanical System	Gravity System
Intake openings using propellor fans.....	600 F.P.M.	300 F.P.M.
Vertical vent ducts.....	600 F.P.M.	300 F.P.M.
Roof siphon ventilators.....	600 F.P.M.	300 F.P.M.

Note: The allowable velocity may be increased to 600 feet per minute for gravity vent ducts equipped with siphon ventilators and the tempered outside air is supplied by mechanical means.

Note: For supply and return air duct velocities, reference may be made to the standards of the American Society of Heating, Refrigerating and Air Conditioning Engineers Guide and Data Book, which are acceptable.

(3) **USE.** No duct designed for the transmission of air shall be used for any other purpose.

Note: See Wis. Adm. Code section Ind 59.69 (4) (g) for exception.

(4) **UNDERGROUND DUCT CONSTRUCTION AND INSTALLATION.** (a) All underground duct systems using cement tile, glazed clay tile and other tile having a composition of cement and minerals shall be waterproof

and shall have sufficient strength to prevent failure of duct at time of installation and while in service. All fittings shall be designed with bell and spigot or slip joint connections. All joints shall be waterproof.

(b) Metal and other approved materials not specified in (a) may be used for underground systems if encased in not less than 2 inches of concrete. The ducts shall be round, water-proof, incombustible, smooth, and of sufficient strength to prevent collapse.

(c) Supply air ducts installed parallel and adjacent to an outside wall shall be insulated with a moisture proof material (thermal conductance factor of .19 BTU per hour per square foot per degree Fahrenheit) placed between the duct and outside wall. The insulation shall extend from bottom of floor to 2 feet below finished grade.

(d) Underground ducts shall be provided with drainage to a lower room of the building or to a sump. No duct shall be connected to a sewer.

(e) All room inlets and outlets for underground ducts shall comply with Wis. Adm. Code, subsection Ind 59.71 (4). A water-tight connection shall be provided where the inlet and outlet risers are connected to underground ducts.

(f) In addition to the requirements of subsections (4) (a), (b), (c), (d), and (e), the trunk duct shall not be less than 12 inches high and 12 inches wide and branch ducts not more than 16 feet long may be 8 inches high and 8 inches wide. All ducts shall be provided with inspection and clean-out openings equipped with tight fitting incombustible covers.

(g) In addition to the requirements in subsections (4) (a), (b), (c), (d) and (e) warm air supply ducts shall be designed in compliance with allowable air velocities in Table 4. Where supply air ducts are installed parallel and adjacent to an outside wall, a moisture-proof insulating material (thermal conductance factor of .19 BTU per hour per square foot per degree Fahrenheit) shall be placed between the duct and outside wall. The insulation shall extend from bottom of floor to 2 feet below finished grade.

(h) Non-hazardous piping may be installed in underground ducts if it does not restrict the air flow and the inside dimensions of the duct are greater than 4 feet wide and 4 feet high.

(5) CONSTRUCTION. (a) All sheet metal ducts and fittings shall be constructed in compliance with standards approved by the department of industry, labor and human relations. All ducts or airways of wood or other combustible material shall be lined on the inside with sheet metal or other approved incombustible material.

Note: For acceptable standards, see ASHRAE Guide and Data Book, published by the American Society of Heating, Refrigeration and Air-Conditioning Engineers or as illustrated in the Duct Manual published by the Sheet Metal and Air Conditioning Contractors National Association, Inc.

(b) Ducts constructed of other than metal need not conform to subsection (5) (a), provided:

1. They are approved for such use and the method for fabricating, installing and supporting is approved by the department of industry, labor and human relations.

Note: The department of industry, labor and human relations accepts Class 1 air ducts tested (Standards for Safety U.L. 181) and listed by Underwriters' Laboratories, Inc.

2. They resist puncture, deformation or collapse.
3. They are not used where the air temperature exceeds 250 degrees Fahrenheit.
4. They do not pass through required fire-resistive construction.
5. They are not connected to a furnace, duct heater or similar heat-producing appliance unless a connecting duct of steel, having a length of not less than 6 feet is used to separate them from the appliance.

(c) Flexible duct connectors between duct systems and air outlets or air outlet units need not conform to subsections (5) (a) and (b), provided:

1. The duct material is approved for such use.

Note: Flame-retarded fabric of metal or mineral listed in Building Materials List published by Underwriters' Laboratories, Inc. are acceptable.

2. The construction is approved by the department of industry, labor and human relations.
3. The connector is not subject to deterioration from mildew or moisture.
4. The connector does not pass through required fire-resistive construction.

(d) The vibration isolation connectors at the joint between the duct and fan or heat-producing equipment shall conform to the following:

1. The connector shall be a type approved for such use.

Note: The department of industry, labor and human relations accepts the use of flame-proofed fabric of metal or mineral and listed in Building Materials List published by Underwriters' Laboratories, Inc.

2. The connector shall be not more than 10 inches wide.
3. The connector shall not be used where the air temperature is in excess of 250 degrees Fahrenheit.

(e) Spirally wound metal ducts shall be constructed to provide structural strength equal to rectangular ducts. The metal may be one standard gauge lighter than required for round ducts.

(6) **SUSPENDED CEILING PLENUM.** The plenum above suspended ceilings shall be of incombustible construction. The installation of hazardous piping is prohibited. Openings into the plenum that would affect the fire-resistive rating of the roof and ceiling are prohibited.

(7) **INSULATION.** Heating supply ducts shall be covered with not less than ½ inch of insulation unless an allowance is made for temperature drop in the system.

(8) **GRAVITY VENT DUCTS.** (a) Separate vent ducts from each area of similar occupancy shall extend to a plenum at the base of a siphon ventilator.

(b) The use of open pipe space for a gravity vent duct is prohibited.

(9) **TERMINATION OF VENT DUCTS.** Vent ducts used with mechanical ventilation supply systems shall not terminate in attic space, unless the space is air tight, of incombustible construction and the attic floor is smooth. All such gathering chambers shall be connected to an approved siphon type roof ventilator or to an exhaust fan discharging outside the building.

(10) VENT DUCTS, HORIZONTAL RUN. (a) Horizontal runs in vent ducts connected to siphon type roof ventilators shall be avoided wherever possible and the maximum practicable inclination shall be provided in all cases. In no case shall the horizontal run exceed 30% of the vertical run unless the room has a direct mechanical supply or the vent duct is connected to an exhaust fan.

(b) Dampers are prohibited in gravity vent ducts, unless automatic back draft dampers are installed.

(11) VENT DUCTS ABOVE ROOF. Final delivery of all vent circuits shall be protected from weather, and shall be so located and constructed as to prevent contamination of air supply for or in any occupied area. Gravity vent ducts shall extend not less than 2 feet above the high portion of the roof or parapet wall, and shall be surmounted with an approved type of siphon roof ventilator.

(12) RELIEF VENTS. (a) The use of barometric relief vents is prohibited where exhaust ventilation is required for occupancies classified as (c) and (d) in Table 3.

(b) Barometric relief vents may be used to exhaust an air volume equal to the mechanical ventilation supplied for occupancies classified as (a) and (b) in Table 3.

(c) Where barometric relief vents are installed on the roof, the discharge opening shall not be less than 2 feet above the roof.

(13) FIRE DAMPERS. (a) Heating and ventilating ducts shall not pass through fire walls, fire partitions, floors and air shaft walls requiring fire-resistive construction of 2-hour or better rating unless approved fire dampers or doors are installed in the opening.

Note: The department of industry, labor and human relations accepts fire damper and door test data from a nationally recognized testing laboratory, fire dampers and doors complying with specifications in duct manual published by Sheet Metal, Air Conditioning Contractors National Association, Inc. or complying with specifications in National Board of Fire Underwriters' Bulletin No. 90A.

(b) Fire dampers are prohibited in kitchen hood exhaust ducts.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.70 Volume dampers and deflectors. Necessary volume dampers, splitters and deflectors shall be provided in all ducts to permit accurate balancing of the system. The dampers, splitters and deflectors shall be adjusted to satisfy the heating and ventilating requirements of the conditioned space and locked in place.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.71 Outlets and returns. (1) NUMBER AND ARRANGEMENTS. The capacity, number and arrangement of outlets, returns and exhausts shall insure a uniform distribution of air.

(2) ELEVATOR SHAFTS AND STAIRWELLS. Air shall not be transferred through elevator shafts and stairwells where doors are required at any floor level.

(3) GRILLES OR DIFFUSERS REQUIRED. All air supply outlets and returns shall be equipped with grilles or devices which will provide a uniform distribution of air. Floor registers and grilles are prohibited.

(4) **CORRIDOR VENTILATION.** Air in a volume equal to the outside air required from a room may be discharged and recirculated through a corridor and exhausted through lockers, toilet rooms, kitchens, janitor closets and similar areas. Additional exhaust ventilation shall be provided where the volume of air exhausted from the corridor is less than the volume of air supplied.

Note: See Wis. Adm. Code sections Ind 59.24 (8), 59.48 (4), 59.49 (3) (b), and 59.56 (2).

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.72 Equipment location and protection required. Heating and ventilating equipment in gymnasiums, play rooms and similar occupied areas shall be fully recessed, and protected, or located not less than 7 feet above the floor. Heating and ventilating equipment shall not block any part of the required aisles, passageways and corridors.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.74 Piping. (1) PIPE SIZES AND ARRANGEMENT. All steam and hot water supply and return piping, air-line piping and auxiliary equipment shall be of appropriate sizes, elevations and arrangements in accordance with standard engineering practice to accomplish the calculated services in practical operation, without undue noise, stress or other detriment.

(2) **EXPANSION AND CONTRACTION.** The piping for heating system shall be equipped with anchors, expansion swings or joints, supports and similar devices to relieve stress and strains caused by temperature change of the pipe material.

(3) **PIPE INSULATION.** Steam, hot water supply and return piping in occupied areas shall be covered with not less than $\frac{1}{2}$ inch insulating material, where the heat emission is objectionable or where piping is subject to freezing.

Note: For additional requirements see Wis. Adm. Code section Ind 52.13.

History: Cr. Register, January, 1965, No. 109, eff. 2-1-65.

Ind 59.75 Refrigerants. The rules covering the use of refrigerants as a function of air conditioning systems shall conform with Wis. Adm. Code chapter Ind 45 (Mechanical Refrigeration).

