# Wisconsin Administrative Code

## Rules of

## INDUSTRIAL COMMISSION

## HEATING, VENTILATION AND AIR CONDITIONING

Cite the rules in this Code as

(for example)

Wis. Adm. Code section Ind 58.01

INDUSTRIAL COMMISSION

State Office Building, Madison 2, Wisconsin

# HEATING, VENTILATION AND AIR CONDITIONING CODE

## INTRODUCTION

### Authority

The Heating, Ventilation and Air Conditioning Code has been adopted by the Industrial Commission in discharge of its duties under Sections 101.01 to 101.28, inclusive, of the Statutes of Wisconsin. The orders of this code were adopted by the Industrial Commission on January 29, 1954 and became effective March 21, 1954 with the exception of the following sections, which became effective March 28, 1954:

Ind–58.10–5
Ind–58.41–3
Ind–58.48–2
Ind–58.66–2(c)
Ind–58.69–6
Ind–58.74–4

### History

Prior to the adoption of the Heating and Ventilation Code by the Industrial Commission on July 6, 1923, the general requirements on ventilation of public buildings and places of employment in Wisconsin were enforced as a part of the Building Code and of the General Orders on Sanitation, issued by the Industrial Commission. The Building Code became effective on October 9, 1914, and the ventilation requirements therein were amended only in minor details prior to July 6, 1923.

The General Orders on Sanitation became effective on February 20, 1913. The ventilation requirements contained therein, Orders 2000 to 2017, inclusive, were amended in 1921, effective July 19, 1921. The

revised general ventilation requirements were contained in Orders 2000, 2010, 2011, 2012 and 2020 to 2025, inclusive, and were in force until March 18, 1932 when they were repealed and superseded by the General Orders on Dusts, Fumes, Vapors and Gases. These orders are now in effect and apply to all places of employment and public buildings.

In the fall of 1922, the Industrial Commission appointed an Advisory Committee to assist in the preparation of a reasonable code of standards of heating and ventilation for public buildings and places of employment in Wisconsin. The personnel of this committee was as follows:

C. E. BRONSON, Kewaunee, Illinois. Representing the American Boiler Manufacturers Association.

DR. H. E. DEARHOLT, Milwaukee, Wisconsin. Representing the Wisconsin Anti-Tuberculosis Association.

G. J. DE GELLEKE, Milwaukee, Wisconsin. Representing the Wisconsin Chapter of American Institute of Architects.

HENRY HOTTON, Milwaukee, Wisconsin. Representing the National Boiler and Radiator Manufacturers Association.

PROF. G. L. LARSON, College of Engineering, University of Wisconsin, Madison, Wisconsin.

SAMUEL R. LEWIS, Consulting Engineer, Chicago, Illinois.

LEN F. SARGENT, Wausau, Wisconsin. National Heating and Ventilating Company.

H. W. SCHMIDT, State Department of Public Instruction, Madison, Wisconsin.

E. WORTHING, President, Bayley Manufacturing Company, Milwaukee, Wisconsin.

R. A. SMALL, Ventilation Engineer, Industrial Commission, Madison, Wisconsin.

W. C. MUEHLSTEIN, Building Engineer, Industrial Commission, Madison, Wisconsin.

The Heating and Ventilation Code prepared by this committee was adopted by the Industrial Commission on July 6, 1923, and became effective on August 19, 1923. In the enforcement of this code following its adoption by the Commission, it became evident that there was some dissatisfaction as to the reasonableness of some of the requirements. Publication was therefore postponed and the code again placed in the hands of the Advisory Committee for further consideration. The revised code as submitted to the Commission with recommendation for adoption, was adopted by the Commission on April 8, 1925, and became effective May 14, 1925.

In 1935, work was commenced on the revision of the original code and the resulting revised code became effective April 11, 1936. On July 25, 1952, the Industrial Commission appointed a new Advisory Committee to review the code and recommend such changes as were necessary to bring the various orders up to date. The personnel of the Committee and the organizations represented are as follows:

DR. JOHN W. BROWN, State Medical Society of Wisconsin, Madison, Wisconsin. (Resigned Dec. 26, 1952)

C. J. CADDELL, Industrial Commission of Wisconsin, Madison, Wisconsin (Secretary for Committee)



JOHN KLATT, Wisconsin State Federation of Labor, Milwaukee, Wisconsin.

PROF. G. L. LARSON, University of Wisconsin, Madison, Wisconsin. (Deceased) The University of Wisconsin was represented on the Committee by Prof. Delmar W. Nelson after the death of Professor Larson.

PAUL E. NYSTROM, Wisconsin Architects Association, Madison, Wisconsin.

C. H. RANDOLPH, Wisconsin Chapter, American Society of Heating and Ventilating Engineers, Milwaukee, Wisconsin.

JOSEPH H. VOLK, Wisconsin Chapter, American Society of Heating and Ventilating Engineers, Milwaukee, Wisconsin. (Chairman)

The Advisory Committee held meetings at regular intervals beginning on Dec. 11, 1952 and concluding on February 11, 1953. The revised code as prepared by this Committee was submitted to the public at hearings conducted by the Industrial Commission at Milwaukee, Green Bay, Madison, Wausau, Superior and Eau Claire.

Many of the suggestions and recommendations received at the public hearings were incorporated in the final draft of the code by the Advisory Committee at meetings held on October 8 and 22, 1953. The revised orders were then submitted to the Industrial Commission and adopted on January 29, 1954.

Publication of the revised orders was made in the official state newspaper on February 19 and February 26, 1954, and the Code became effective March 21 and March 28, 1954.

## Administration

The Heating, Ventilation and Air Conditioning Code is enforced by the Industrial Commission in cooperation with local officials, who are required by law to enforce all orders of the Commission which are germane to their respective duties (Wisconsin Statutes, Section 101.28).

## Appeal

Any person who considers any part of the Heating, Ventilation and Air Conditioning Code, or any interpretation of this code, to be unreasonable may appeal to the Commission to modify or suspend the same (Wisconsin Statutes, Sections 101.15 to 101.17, inclusive).

## Penalty for Violation of An Order

**Section 101.18** of the Wisconsin Statutes provides that "every day during which any person, persons, corporation, or any officer, agent, or employe thereof, shall fail to observe and comply with any order of the Commission, or to perform any duty enjoined by Sections 101.01 to 101.29, inclusive, shall constitute a separate and distinct violation of such order, or of said sections, as the case may be."

**Section 101.28** of the Wisconsin Statutes provides that any employer or other person who violates an order, or fails or refuses to comply with the requirements of a legal order of the Commission shall forfeit and pay into the state treasury the sum of not less than 10 dollars, nor more than 100 dollars, for such violation.

# Chapter Ind 58

# HEATING, VENTILATION AND AIR CONDITIONING



**Ind 58.001 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.

*Cross Reference:* The phrase "place of employment" shall mean and include every place, whether indoors or out or underground and the premises appurtenant thereto where either temporarily or permanently any industry, trade or business is carried on, or where any process or operation, directly or indirectly related to any industry, trade or business, is carried on, and where any person is directly or indirectly, employed by another for direct or indirect gain or profit, but shall not include any place where persons are employed in (a) private domestic service which does not involve the use of mechanical power, or (b) farm labor when the employer is the farmer operating the farm and the labor is such as is customarily performed as a part of farming, and including the transportation of farm products immediately and directly from the farm, and of materials, supplies or equipment directly to the farm for use thereon.

The term "public building" as used in sections 101.01 to 101.29, Wis. Stats., shall mean and include any structure used in whole or in part as a place of resort, assemblage, lodging, trade, traffic, occupancy, or use by the public or by three or more tenants.

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

(3) EXISTING BUILDINGS. The provisions of this code shall apply to all alterations or improvements, including the replacement of any major apparatus or device, in existing buildings, other than existing places of industrial employment.

*Cross Reference:* See general orders on dusts, fumes, vapors and gases for requirements pertaining to existing places of industrial employment.

(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.

**Ind 58.10 Definitions.** (1) "Air supply" is the supply and distribution of the air required for heating, ventilating and air conditioning.

(2) "Ventilation" is the process of supplying or removing air by natural or mechanical means, to or from any space. For the purpose of this code, the minimum quantity and quality of outside and recirculated air introduced into the space shall be in compliance with the requirements stipulated herein.

(3) A "ventilation" system is any combination of building construction, machinery, devices or equipment, so proportioned, arranged, installed, operated and maintained as to secure with normal operation the standard of ventilation required by this code.

(4) 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.

(5) A "gravity system of ventilation," is any ventilation, the practical effectiveness of which depends wholly upon atmospheric conditions, such as relative density, temperature or wind motion. Where outside air is supplied directly to an area by mechanical means, the vent, if surmounted by an approved siphon type roof ventilator, shall be classed as a mechanical exhaust.

(6) A "mechanical system of ventilation" is any ventilation, exhaust or heating system, the effectiveness of which depends upon the operation of power-driven fan equipment.

(7) An "exhaust system of ventilation" is any combination of building construction, machinery, devices or equipment, so proportioned, arranged, maintained and operated, that gases, dusts, fumes, vitiated air, or other materials injurious to health, are effectively withdrawn from the breathing zone of employes and frequenters and disposed of in a proper manner.

(8) The term "air conditioning", for the purpose of this code, shall mean the simultaneous control of temperature, humidity, movement and purity of air.

(9) "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.

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

(11) A "duct" is any pipe, flue or channel used, or intended to be used, for the conveyance of air, gases or entrained materials pertaining to a heating, ventilation or air conditioning system. An underground duct is any duct wholly, or in part, below the surface of the ground adjacent to the duct.

(12) 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.





(13) 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.

(14) "Outdoor openings" are those actual openings in outside walls of the area or room in question which are arranged and equipped in such manner as to be easily operated and accessible for manipulation.

(15) The term "heating surface" as applied to boilers shall include all surfaces exposed to the products of combustion of fuel on one side and water or steam on the other side.

(16) The term "heating surface" as applied to furnaces and jacketed stoves shall include all surfaces exposed to the products of combustion of fuel on one side and the flowing air supply on the other side.

(17) An "occupied area" is any room, area or enclosure, the normal use of which involves actual or intended occupancy by one or more persons.

(18) The term "new building" used in this code shall be understood to mean and include buildings, additions thereto, and alterations thereof, for which complete plans have not been approved by the industrial commission, or construction is not in progress, prior to the effective date of this code.

(19) The term "existing building" used in this code shall be understood to mean and include buildings, additions thereto, and alterations thereof, structurally completed, or for which complete plans have been approved by the industrial commission, or its authorized local representative, and construction is in progress, prior to the effective date of this code.

**Ind 58.20 Plans, specifications and data.** (1) DESIGN AND PREPARATION OF PLANS. All plans and data for heating, ventilation and air conditioning shall be designed and prepared by competent designers and shall bear the name of the designer.

(2) APPROVAL OF PLANS AND SPECIFICATIONS. Complete plans, specifications and data sheets for heating, ventilation and air conditioning of all buildings and occupancies within the scope of this code shall be submitted to the industrial commission for approval. Approval shall be obtained before affected work is commenced and all work shall be executed according to the approved plans and specifications.

(a) In cities where such plans are examined and building permits are issued by a city building official in a manner approved by the industrial commission, additional approval by the industrial commission is not required.

(b) Where an occupied area does not require ventilation under this code and supplementary air cooling or ventilation is desired by the building occupant as an added comfort, plans and specifications need not be submitted to the industrial commission. All such installations shall comply with the requirements of this code and exemption from code compliance shall not be based on openable window area when mechanical cooling, water cooling or dehumidifying equipment is installed.

(3) PLANS AND SPECIFICATIONS REQUIRED IN TRIPLICATE. All plans and specifications for heating, ventilation and air conditioning shall be submitted in triplicate.

*Note:* Extra copies of plans may be filed for approval stamp but they should accompany the triplicate plans.

(4) APPROVAL OF CHANGES IN PLANS. If, after having been approved by the industrial commission, building or heating and ventilation, or air conditioning plans or specifications are changed in any respect covered by this, or any other code, such revised plans shall be submitted to the industrial commission for approval.

(5) APPROVED PLANS KEPT AT BUILDING. A complete set of approved plans and specifications showing identity of approval shall be kept at the building at all times.

(6) INFORMATION REQUIRED ON PLANS AND IN SPECIFICATIONS. The lines, data and information shown on plans for heating, ventilation 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 installation, such as:

(a) Building; name, type, location, on each sheet.
(b) Owner; name, on each sheet.
(c) Architect; name, on title sheet.
(d) Engineer or designer; name, on each sheet.
(e) North points on general plans.
(f) General plans, including attic and roof layouts.
(g) General plan dimensions and height of all rooms.
(h) Intended use of all rooms.
(i) Thickness of walls and type of construction.
(j) Thickness and type of insulation in walls, roofs, ceilings, floors, etc.
(k) Vertical sections and elevations necessary to show profiles of installation.
(l) Size and continuity of all ducts and flues.
(m) Location and type of all principal units of equipment.
(n) Chimney size, shape and height above grate or center line of burner.
(o) Specifications shall be properly identified with and completely supplement the plans.

(7) DATA REQUIRED. All plans or specifications submitted for approval shall be accompanied by data sheets giving the heat loss calculations in B.t.u. per hour calculated in accordance with the heat transmission factors of the current issue of the American Society of Heating and Ventilating Engineers' Guide, the amount of radiation calculated for each room on direct radiation installation, amount of air and delivery temperature calculated for each room for all heating, ventilation and air conditioning systems, amount of indirect radiation, and other data needed to judge the capacity and performance of an installation. There shall also be furnished a statement of sizes and ratings of boilers, furnaces and other heaters, fans and all other equipment.

*Cross reference:* Heat loss calculations may be based on the standards of the Heating, Piping and Air Conditioning Contractors' National Association, or the Standard Code of the National Warm Air Heating and Air Conditioning Association. However, in all cases, the total heat loss calculations shall be shown in B.t.u.

(8) FUNDAMENTAL DATA REQUIRED. When requested, fundamental data pertaining to design and operation of equipment shall be filed for approval with the industrial commission by manufacturers before such equipment is installed or used.





(9) APPROVAL OF MATERIALS AND EQUIPMENT. When requested by the industrial commission, materials, equipment, devices and methods of installation used in connection with this code and not specifically mentioned herein shall not be so used until approved in writing by the industrial commission. The data, tests and other evidence necessary to prove the merits of such material, equipment, devices and methods of installation shall be determined by the industrial commission.

**Ind 58.21 Accident prevention and fire protection.** (1) GUARDS. All mechanical apparatus shall be guarded in compliance with general orders on safety issued by the industrial commission.

(2) FIRE PROTECTION. All installations under this code shall comply with the precautionary requirements of the industrial commission to reduce fire hazards.

*Cross reference:* The following are references to the building code and electrical code which contain general safety and fire protection requirements:

| | |
|---|---|
| Masonry chimneys, construction | section Ind 52.10 |
| Metal smoke stacks, construction | section Ind 52.11 |
| Smoke pipes | section Ind 52.12 |
| Steam and hot water pipes, protection | section Ind 52.13 |
| Ducts, general construction | sections Ind 52.14, Ind 52.15 |
| Heaters, fire protection | sections Ind 52.16, Ind 52.17 |
| Gas vents | section Ind 52.18 |
| Boiler and furnace rooms | sections Ind 54.13, Ind 55.29, Ind 56.15, Ind. 57.20, Ind 57.50 |

Grounding of machinery, Wisconsin state electrical code

**Ind 58.22 Design.** (1) ADEQUACY. All heating, ventilation and air conditioning installations shall be designed and installed to provide the service and results required by this code.

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

(3) BASIS FOR HEATING CALCULATIONS. In the accompanying map, the state has been divided into three zones of coldest weather temperatures recorded for included localities by the U. S. weather bureau during a ten year period. Maximum heat losses for a heating system shall be calculated on the basis of cold weather temperature not more than 10 degrees Fahrenheit warmer than the zone average of the zone in which the installation is located.

(4) PROVISION FOR CLEANLINESS. All parts of installations and equipment which house or handle air used for ventilation purposes shall be designed so as to facilitate sanitary maintenance thereof.

**Ind 58.23 Air supply.** (1) UNCONTAMINATED SOURCE. The outside air shall be taken from a relatively uncontaminated source outside of the building.

(2) MAXIMUM INLET TEMPERATURE. The calculated room inlet temperature of air used for heating and ventilation purposes shall not exceed 140 degrees Fahrenheit.

(3) CONTROL. Controls shall be provided, maintained and operated for all heating, ventilation and air conditioning systems.

*Cross reference:* See section Ind 58.41 for requirements pertaining to the installation of automatic controls.

(4) AIR QUANTITY. The quantity of air used to ventilate a given space during 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 section Ind 58.24)

MAP OF WISCONSIN SHOWING COLDEST TEMPERATURE ZONES


**Zone average of coldest temperature recorded for each zone are as follows:**

| | |
|---|---|
| Zone 1 | 42° Below Zero F. |
| Zone 2 | 34° Below Zero F. |
| Zone 3 | 24° Below Zero F. |





**Ind 58.24 Heating, ventilation and exhaust systems—general.** (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. The following inside temperatures shall be considered as a minimum.

| Type of Building | Deg. Fahr. | Type of Building | Deg. Fahr. |
|---|---|---|---|
| Schools: | | Theaters: | |
| Classrooms | 70 | Seating Space | 68 |
| Assembly Rooms | 68 | Lounge Rooms | 68 |
| Gymnasiums | 55 | | |
| Wardrobe and Locker Rooms | 68 | Hotels: | |
| Kitchens | 66 | Bedrooms and Baths | 70 |
| Dining and Lunch Rooms | 65 | Dining Rooms | 70 |
| Play Rooms | 60 | Kitchens and Laundries | 66 |
| Natatoriums and Bathrooms | 75 | Ballrooms | 65 |
| | | Service Rooms | 68 |
| Hospitals: | | Apartments | 70 |
| Private Rooms | 70 | Offices | 68 |
| Operating Rooms | 75 | Stores | 65 |
| Wards | 68 | Factories and Machine Shops | 60 |
| Kitchens and Laundries | 66 | Foundries and Boiler Shops | 50 |
| Bathrooms | 70 | Toilet and Locker Rooms—General | 68 |
| | | Garages: | |
| | | Repair and Service Areas | 60 |

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

*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 the general orders on dusts, fumes, vapors and gases issued by the industrial commission.

(3) GRAVITY DIRECT-INDIRECT SYSTEMS, PROHIBITED. Gravity direct-indirect systems shall not be considered permissible for installation under this code.

(a) This clause is intended to prohibit the use of so-called direct-indirect radiators whereby the room air supply is supposed to be admitted directly from the outside to the base, and to be delivered at the top, of direct radiators placed in the rooms to be served, without mechanical assistance.

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

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

(5) EXHAUST SYSTEMS REQUIRED. Exhaust systems shall be provided, maintained and operated for all occupied areas where machines, vats, tanks, furnaces, forges, salamanders, and any other equipment and processes in such areas produce or throw off dust or particles sufficiently light to float in the air, or which emit heat, odors, fumes, spray, gas or smoke, in such quantities as to be irritating or injurious to the health.

See the general orders on dusts, fumes, vapors and gases issued by the industrial commission for requirements covering these systems.

(6) EXHAUST SYSTEMS, CLEAN DISCHARGE. Exhaust systems required under the general orders on dusts, fumes, vapors and gases shall include dust collectors, air washers, or other approved machines, devices or methods whereby the discharge from the system will be prevented from contaminating the breathing zone inside the building or re-entering any occupied area.

See the general orders on dusts, fumes, vapors and gases issued by the industrial commission.

(7) TEMPERED AIR SUPPLY. Where ventilation is secured by exhaust methods, a tempered air supply shall be provided to replace the air exhausted from the area, if the volume of air exhausted exceeds the amount that enters the building through infiltration.

(8) NO CONTAMINATION OF ADJACENT AREA. All equipment and systems 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 any other occupied parts of the building.

(9) FINAL TEST REQUIRED. The performance of every heating, ventilation and air conditioning system shall be tested and balanced in place by the installer before being turned over to the owner.

**Ind 58.25 Maintenance and operation.** (1) MAINTENANCE. All heating, ventilation, exhaust and air conditioning systems shall be maintained in good working order and shall be kept clean and sanitary.

(2) OPERATION. All heating, ventilation and exhaust systems shall be operated in accordance with the requirements of this code during all periods of occupancy.

(3) INSTRUCTIONS. Before leaving the job, the installer shall thoroughly instruct the operator of heating, ventilation and air conditioning systems and shall post in a conspicuous place printed instructions for the efficient and practical operation of the system and equipment.

**Ind 58.40 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.

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

(c) Require exhaust.

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





(2) The following table indicates the individual classifications of occupancies within the scope of this code, together with the method to be used in establishing the number of persons for which ventilation is to be provided.

| 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) | 15 sq. ft. per person |
| Assembly halls | (a) | 7 sq. ft. per person |
| Asylums | (a) | Depends on room usage. |
| Banquet halls | (a) | 15 sq. ft. per person |
| Bath and shower rooms | (c) | |
| Barber shop | (b) | 40 sq. ft. per person |
| Beauty parlors | (b) | 20 sq. ft. per person |
| Billiard rooms | (a) | 15 sq. ft. per person |
| Bowling alleys | (a) | Seating capacity, plus 6 persons per alley. |
| Brokerage board rooms | (a) | 7 sq. ft. per person |
| Cafeterias | (a) | 15 sq. ft. per person |
| Churches and other places of worship | (b) | Auditoriums: 7 sq. ft. per person<br>Dining rooms: 15 sq. ft. per person |
| Club rooms | (a) and (b) | Depends on usage. |
| Dance halls | (a) | 15 sq. ft. per person |
| Dining rooms | (a) | 15 sq. ft. per person |
| Dormitories | (b) | 40 sq. ft. per person |
| Factories and machine shops | (b) | See general orders on dusts, fumes, vapors and gases |
| Foundries and boiler shops | (b) | See general orders on dusts, fumes, vapors and gases |
| Funeral homes, public rooms | (b) | 7 sq. ft. per person |
| Garages | (d) | |
| General offices | (b) | 75 sq. ft. per person |
| Gymnasiums and combined gymnasiums and assembly halls | (a) | 6 sq. ft. per person for seated space<br>15 sq. ft. per person for space not seated |
| Hospitals | (a) and (b) | Depends on room usage. |
| Kitchens | (c) | |
| Laboratories | (a) and (c) | 25 sq. ft. per person. See general orders on dusts, fumes, vapors and gases. |
| Laundries | (c) | See general orders 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 |
| Library stack rooms | (c) | |
| Locker rooms | (c) and (d) | |
| Lodge halls | (a) | 6 sq. ft. per person for seated space<br>15 sq. ft. per person for space not seated |

| Use or Occupancy | Classification | Basis of Capacity |
|---|---|---|
| Motion picture booth | (c) | |
| Penal institutions | (a) | Depends on room usage. |
| Places of employment, general | (b) | Depends on room usage. |
| Play rooms | (a) | 23 sq. ft. per person |
| Printing establishments | (b) | See general orders on dusts, fumes, vapors and gases. |
| Restaurants | (a) | 15 sq. ft. per person |
| Retail establishments: | (b) | Basement and 1st floor: |
| (a) Department stores and similar occupancies | | 30 sq. ft. per person. |
| (b) Shops and other retail establishments | | Other floors: 60 sq. ft. per person. |
| | | Basement: 40 sq. ft. per person. |
| | | 1st floor and above: 60 sq. ft. per person. |
| Safety deposit vaults | | See places of employment. |
| School auditoriums | (a) | 7 sq. ft. per person |
| School classrooms | (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 |
| Skating rinks | (a) | 15 sq. ft. per person |
| Swimming pools | (c) | |
| Taverns | (b) | 20 sq. ft. per person |
| Tenement or apartment houses, kitchens and toilets 2 or more families | (c) | |
| 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) | |
| Vocational instruction and research | (a) and (c) | 40 sq. ft. per person. See general orders on dusts, fumes, vapors and gases. |
| Wardrobes, lockers and cloak rooms | (c) | |

**Ind 58.41 General requirements for occupancies under (a) and (b) classifications.** (1) SCOPE. The requirements of this order shall apply to all occupancies listed under (a) and (b) in section Ind 58.40 unless otherwise exempted in 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 in this code.

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

(b) For the purpose of this code, standard air is air that is equivalent to dry air at 70 degrees Fahrenheit and 29.92 inches barometer.

(c) For systems where complete mechanical refrigeration is employed, a primary air circulation of less than 6 air changes per hour





will be permitted. In all such installations, the air circulation shall be based on the heat gain requirements of the area.

(3) OUTSIDE AIR SUPPLY. The outside air supply during occupancy shall not be less than 7½ cubic feet per minute per occupant and an equal amount shall be exhausted unless otherwise exempted in this code. See section Ind 58.40 for method used in determination of capacity.

(4) AIR DISTRIBUTION. All air outlets and returns shall be so located, arranged or equipped as to provide uniform distribution of air and to eliminate drafty conditions within the occupied space.

(5) MECHANICAL SUPPLY SYSTEMS. Mechanical installations are permitted in all occupancies under these classifications.

(6) GRAVITY SUPPLY SYSTEMS. Gravity installations are not permitted in arenas, armories, laboratories, skating rinks and theater auditoriums, lobbies and lounges.

(7) OUTLET AND RETURN LOCATIONS. The locations of all room outlets, returns and exhausts as well as the location of the outside air supply are required to be definitely shown on the plans.

(8) AUTOMATIC TEMPERATURE CONTROL. Automatic temperature control shall be provided for all arenas, armories, assembly halls, banquet halls, gymnasiums, laboratories, lecture halls, library reading and stack rooms, school auditoriums, class lecture, project and study rooms, swimming pools, theater auditoriums, lobbies and lounges and vocational instruction rooms.

(9) AIR CLEANSING DEVICES. Approved air cleansing devices shall be installed in connection with all mechanical heating and ventilation systems except in garages, factories, foundries and similar occupancies. This requirement applies to both outside and recirculated air.

(a) Unit heaters used for heating and recirculation only need not be equipped with air cleansing devices.

(b) Where jet systems or blend-air systems are employed, air cleansing devices need not be provided in the ducts that are installed for the recirculation of air within any occupied space. Air cleansing devices shall be provided in connection with such systems for all outside air and also for all recirculated air that is returned to the unit for general recirculation.

(10) RECIRCULATION. No air contaminated by other than human occupancy shall be used for general recirculation except as otherwise provided herein. Where the total amount of air in circulation in any occupancy is in excess of the quantity required by this code, such excess air may be recirculated.

(a) Where a building used for a retail establishment, shop, or offices is also occupied for a place of abode by 2 or more families living independently or for sleeping and lodging purposes by 3 or more persons not members of the same family is heated by a warm air system, the air from the business area shall not be returned to the unit and used for general recirculation.

**Ind 58.42 Places of assembly.** (1) SCOPE. This classification shall include all occupancies such as arenas, armories, assembly halls, banquet halls, billiard rooms, bowling alleys, cafeterias, club rooms (for

gatherings), dance halls, dining rooms, gymnasiums, lecture halls, lodge halls, playrooms, restaurants, school auditoriums, skating rinks and theaters, where more than 100 persons gather for entertainment, instruction or dining purposes.

(a) The above occupancies which accommodate not more than 100 persons shall conform to the requirements of section Ind 58.51.

(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 58.41 except as specified herein.

(a) For theaters, assembly halls, gymnasiums and similar occupancies having a ceiling height of 15 feet or more, the total air supply shall be based on 6 air changes per hour.

(b) For theaters, assembly halls, gymnasiums, and similar occupancies having a ceiling height of less than 15 feet, the total air supply shall be based on 7½ air changes per hour.

(c) The outside air supply, during occupancy for all theaters, assembly halls, gymnasiums and similar occupancies, shall not be less than 7½ cubic feet per minute per occupant, and an equal amount shall be exhausted.

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

(4) ALTERNATE SERVICE AND CAPACITY. Heating and ventilation 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.

**Ind 58.43 Motion picture booths.** (1) SCOPE. This classification shall include all motion picture booths other than portable booths.

(2) EXHAUST VENTILATION. Fumes, gases and other harmful contamination shall be effectively removed by mechanical exhaust ventilation directly from their source, including projectors, spot lights, stereopticons, and similar equipment and discharged to the outside air. A single exhaust system, including the exhaust unit and connecting ducts, shall be arranged to serve all the sources of harmful contamination in such booth area. The capacity of the exhaust system shall not be less than 15 cubic feet per minute for each arc lamp or other source of contamination. Dampers shall not be installed in such a system and it shall be entirely independent of any other system serving the building.

(3) AIR SUPPLY. In every booth or room which is required to have a mechanical exhaust system, provisions shall be made for a supply of fresh tempered air to replace the air exhausted. The supply of air to a booth or room shall be accomplished in one of, or by a combination of, the following methods:

(a) The ventilation system for the building may be arranged to supply air for the booth or room if the inlet opening is protected with an approved shutter having quick acting fusible links, or other approved heat release devices, which 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 wil be stopped automatically and simultaneously with the closing of the openings in the front of the booth.

(c) Where approved in writing by the industrial commission, the air may be taken through openings in the booth walls, from the auditorium or other space adjoining the booth.

*Cross reference:* For relief outlets in addition to exhaust ventilation, see section Ind 56.45 of the building code issued by the industrial commission.

**Ind 58.44 Places of assembly for worship.** (1) SCOPE. This classification shall include auditoriums, social assembly rooms, Sunday school rooms, and similar areas which are contained in churches or houses of worship. It shall also include chapels used in connection with funeral homes, as well as those in parochial schools, convents and similar occupancies.

(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 58.41, except that no ventilation will be required where the total openable area of the outside windows is greater than 3% of the floor area served, except that in funeral homes the openable area of the outside windows shall be greater than 5% of the floor area served. Such window openings shall preferably be all above grade. No window openings below grade will be considered unless there is a clear space outside of the windows having a width of at least 1½ times the distance below grade at the bottom of the window.

(a) By width is meant the horizontal distance measured at right angles to the plane of the window.

(3) ALTERNATE SERVICE AND CAPACITY. Heating and ventilation 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.

**Ind 58.45 Schools.** (1) SCOPE. This classification shall include class, recitation, study, lecture, project rooms, library reading rooms and similar areas in all school, college and library buildings used for educational purposes. (See section Ind 58.42 for assembly rooms).

(2) AIR MOVEMENT AND SUPPLY. The air movement and supply for all occupancies under this classification shall conform to the requirements of section Ind 58.41. 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.

(3) ALTERNATE SERVICE AND CAPACITY. The capacity of heating and ventilation systems installed in school buildings having not more than 2 classrooms, may be based upon service to classroom floors only; provided that where basement apparatus is used, appropriate arrangement shall be made for alternate service to basement areas if used for occupancy.

(4) PLAYROOMS—RURAL SCHOOLS. Occupancies in this classification where used exclusively as pupils' playrooms need only be provided with a positive exhaust directly from the occupied area.

**Ind 58.46 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) AIR MOVEMENT AND SUPPLY. The air movement and supply for all occupancies under this classification shall conform to the requirements of section Ind 58.41.

(3) SPECIAL VENTILATION. Exhaust ventilation shall be provided in connection with all equipment and processes which create any dusts, fumes, vapors or gases which may be injurious to the health of any frequenter exposed thereto. This exhaust ventilation shall be installed in accordance with the requirements of the general orders on dusts, fumes, vapors and gases, issued by the industrial commission.

(4) SEPARATE EXHAUST SYSTEMS. Exhaust systems serving this class of occupied area shall be separate from, and independent of, all other services and systems in the building.

**Ind 58.47 Wardrobes and locker rooms.** (1) SCOPE. This classification shall include all wardrobe, cloak rooms, lockers, locker rooms and similar areas in all buildings within the scope of this code, except as noted herein.

(2) VENTILATION REQUIRED. Ventilation shall be provided and maintained for all areas of this class. Wherever practicable, such ventilation shall be accomplished by exhaust methods and in any case the effectiveness of the exhaust shall be greater than that of the supply.

(3) MINIMUM AIR MOVEMENT. The air movement provided and maintained for areas of this class shall be not less than 2 cubic feet per minute per square foot of floor area.

(4) WARDROBES AND CLOAK ROOMS IN SCHOOL BUILDINGS. Where necessary in order to insure practical results in wardrobes or cloak rooms adjacent to or connected with occupied areas covered by section Ind 58.45, the required ventilation shall be accomplished by use of inlets admitting air from adjacent classrooms, or corridors, or similar areas, in conjunction with outlets and ducts discharging direct to outside atmosphere. The movement of air in such areas shall be such as to promote thorough aeration of clothing therein.

(5) LOCKER ROOMS IN CONJUNCTION WITH TOILET, BATH AND SWIMMING ROOMS. Occupancies in this classification are required to have a positive tempered air supply only exhausting through the adjoining toilet, shower or swimming room.

(6) LOCKER ROOMS IN PLACES OF EMPLOYMENT. In places of industrial employment where locker rooms are required, a positive tempered air supply shall be provided for locker rooms exhausting through the adjoining toilet or shower room.

(7) REST ROOMS IN PLACES OF EMPLOYMENT. Ventilation shall be provided and maintained for all areas of this class to conform with the





requirements of section Ind 58.41 unless the outside window sash area is greater than 10% of the floor area of the room. One-half of all windows shall be arranged to open.

**Ind 58.48 Toilet, bath and swimming rooms.** (1) SCOPE. This classification shall include all toilet, bath and swimming pool rooms, and other similar occupied areas, in all buildings within the scope of this code.

(2) VENTILATION REQUIRED. Ventilation shall be provided and maintained for all areas of this class. Such ventilation shall be accomplished by exhaust methods with the effectiveness of the exhaust greater than that of the supply. For all swimming pool rooms, a mechanical exhaust shall be provided. For multiple shower installations, a mechanical exhaust shall be provided unless the room has a direct positive air supply, in which case the exhaust may be by gravity.

(a) Every toilet room having more than one fixture (water closets and urinals) and all toilet rooms which do not have an outside window, shall be provided with gravity or mechanical exhaust ventilation. Exhaust ventilation shall not be required for toilet rooms containing one water closet or urinal provided such toilet room has a window or skylight having a glass area of not less than 4 square feet opening directly upon a street, alley or court. The openable area of such window shall not be less than 2 square feet.

(3) MINIMUM AIR MOVEMENT. The air movement provided and maintained in occupied areas of this class shall be not less than 2 cubic feet per minute per square foot of floor area.

(4) SEPARATE EXHAUST SYSTEMS. Exhaust systems serving this class of occupied areas shall be separate from, and independent of, all other services and systems in the building.

**Ind 58.49 Kitchens.** (1) SCOPE. This classification shall include all occupied areas housing the cooking of food in all buildings within the scope of this code, except those classified under vocational instruction.

(2) EXHAUST VENTILATION REQUIRED. Exhaust ventilation shall be provided and maintained for every occupied area of this class.

(3) MINIMUM AIR MOVEMENT. The air movement provided and maintained for areas of this class shall not be less than 4 cubic feet per minute per square foot of floor area except for kitchens in connection with church auditoriums, lodge halls, and schools which are used only occasionally, an air movement of 2 C.F.M. per square foot of floor area will be accepted.

(4) HOODS. Where single hoods are provided for kitchen exhaust, the velocity of air motion over the face area of the hood shall not be less than 60 feet per minute. For double hoods, the velocity over the area between the inner and outer hoods shall not be less than 250 feet per minute, using a 4 inch width of opening as a basis.

(5) SEPARATE EXHAUST SYSTEMS. Exhaust systems serving areas of this classification shall be separate from and independent of all other services and systems in the building. Ducts used in connection with kitchen ranges, etc., where greasy fumes are exhausted, shall be

constructed of not less than 20 gauge galvanized iron or equal and shall be provided with a damper arranged to close automatically in case of fire.

**Ind 58.50 Offices.** (1) SCOPE. This classification shall include all offices and similar occupied areas, wherein the air conditions and nature of occupancy do not involve reasonable inclusion in any other classification in this code.

(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 58.41.

(a) Where the total openable area of the outside windows is less than 3% of the floor area served; or

(b) Where the available floor area is less than 75 square feet for each normal occupant; or

(c) Where heat or odors would otherwise be present in sufficient quantities to be injurious to the health, safety or welfare of the employes and frequenters.

**Ind 58.51 Retail establishments.** (1) SCOPE. This classification shall include barber shops, beauty parlors, brokerage board rooms, taverns and all 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) 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 58.41 unless the total area of outdoor openings is more than 3% of the floor area served, provided such outdoor openings are arranged so as to cause air circulation throughout the respective rooms.

(a) No window or outdoor opening which is below grade will be considered unless there is a clear space outside the window having a width of not less than 1½ times the distance below grade at the bottom of the window.

**Ind 58.52 Garages.** (1) SCOPE. This classification shall include all repair garages and also all storage garages housing 6 or more vehicles driven by internal combustion engines.

(2) VENTILATION REQUIRED. Ventilation shall be provided and maintained for all occupied areas in this classification.

(3) LIVE STORAGE AREA. (a) For the purpose of this order, any area within a garage where self-propelled vehicles are driven in and out under their own power for shelter only, is considered as a live storage area.

(b) All areas used for the live storage of 6 or more motor driven vehicles shall be provided with a tempered supply of outside air of not less than ¾ cubic foot per minute per square foot of floor area, and with the necessary vents for exhausting the same amount of air.

(4) REPAIR AREAS. (a) All areas in which the repairing of motor driven vehicles is done shall be provided with a tempered supply of outside air of not less than ¾ cubic foot per minute per square foot of floor area and with the necessary vents for exhausting the same amount of air.





(b) All repair areas shall also be provided with sufficient flexible hose connections to provide for the full capacity of the vehicles in the repair area. Each hose shall be equipped with a device for connecting it to the exhaust pipe of the vehicle and shall be provided with a shut-off valve which may be closed when not in use. The hoses shall be connected to a main duct leading to an exhaust blower which shall discharge the exhaust air to the outside atmosphere in a location where it will not re-enter any occupied area. All blowers installed in connection with such exhaust systems shall have sufficient capacity for the simultaneous use of all connecting hoses and to exhaust a total volume of not less than 100 cubic feet per minute for each hose connection.

(c) No basement or subbasement garage shall be used for repairing of any kind nor for the storage of volatile inflammable liquids except as provided in sections Ind 8.16 and Ind 8.18 of the flammable liquids code.

(5) SERVICE STATIONS. This section shall include buildings in connection with liquid fuel dispensing stations where one or more vehicles can be driven into the building for washing, greasing, oil changing, tire or battery replacement and similar operations.

(a) All service room or work room areas shall be provided with a tempered supply of outside air of not less than ¾ cubic foot per minute per square foot of floor area and with the necessary vent or vents for exhausting the same amount of air.

(6) GENERAL REQUIREMENTS. Where show rooms or offices are located adjacent to repair or live storage areas, a portion of the outside air supply shall be introduced into the show room or office.

(a) Vent outlets shall not be placed in any show room or office. Where provisions are made for the recirculation of air from the show room or office, the recirculated air shall be discharged into the repair or storage area and returned to the heating unit from that area.

(b) There shall be no recirculation of air from any repair, live storage, or service area during periods of occupancy, except where the total amount of air in circulation is in excess of the quantity required by this order, the excess air may be recirculated.

(c) The air that is exhausted from the repair, live storage, and service areas in a garage shall be removed from the floor line through properly distributed vent ducts located at the points of greatest contamination. Where the exhaust is by gravity, the vent duct or ducts shall extend from the floor line through the roof of the building and shall be capped with an approved siphon type roof ventilator extending at least 2 feet above the high point of the roof or above the top of the parapet wall, whichever is the higher.

(d) The products of combustion from vapors or gases, from fuel or batteries, shall be removed promptly and effectively from the breathing zone of employes and frequenters. The maximum allowable concentration of carbon monoxide shall not exceed 100 parts per million in the breathing zone at any time.

(e) For ventilation where spray coating is done, see general orders on spray coating issued by the industrial commission.

**Ind 58.53 Places of employment.** (1) SCOPE. This classification shall include all places of employment not classified elsewhere in this code.

(2) AIR MOVEMENT, SUPPLY AND DISTRIBUTION. The air movement, supply and distribution for all occupied areas under this classification shall conform to the requirements of section Ind 58.41.

(a) Where the available floor space is less than 75 square feet per normal occupant; or

(b) Where heat, smoke, gas, dust, spray, fumes, vapor, steam, or other contamination would otherwise be present in the air in sufficient quantities to obstruct the vision, or to be irritating or injurious to the health, safety or welfare of employes and frequenters; or

(c) Where industrial poisons are to be used, stored, or handled, or would otherwise be present in the breathing zone.

(d) Where the total area of outdoor openings is less than 3% of the floor area, except warehouses, refrigeration plants, cold storage buildings and processing areas where the nature of the occupancy will not permit.

(3) SPECIAL EXHAUST SYSTEMS REQUIRED. Special exhaust systems shall be provided and operated at all sources of harmful contamination in occupied areas of this class as required by the general orders on dusts, fumes, vapors and gases, issued by the industrial commission.

(a) Where such exhaust system is operated in any area, a tempered air supply shall be provided to replace the air exhausted, if the volume of air exhausted exceeds the amount that enters the building through infiltration.

**Ind 58.54 Dormitories and wards.** (1) SCOPE. This classification shall include rooms in hospitals, dormitory buildings and similar occupancies, equipped with more than two beds.

(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 58.41 unless the window sash area is more than 10% of the floor area and the outdoor openings there through are more than 5% of the floor area.

**Ind 58.55 Penal institutions and places of detention.** (1) SCOPE. This classification shall include areas of compulsory occupancy, corridors and stair halls, in penal institutions, asylums and places of detention.

(2) AIR MOVEMENT, SUPPLY AND DISTRIBUTION. The air movement, supply and distribution for all occupancies under this classification shall be accomplished by mechanical means and shall conform to the requirements of section Ind 58.41. In general, exhaust ventilation shall be through the corridors.

(3) OVERNIGHT LOCK-UPS. Where cells are provided for not more than 6 occupants for purposes of overnight detention only, ventilation will be accepted without a tempered fresh air supply, providing the window sash area direct to the cells is equal to, or greater than, 10% of the floor area.

**Ind 58.60 Outside air intakes.** (1) LOCATION. All outside air intakes shall be located as far as possible from the top of chimneys and vent outlets but this distance shall in no case be less than 20 feet. Fresh air intakes for all gravity heating systems and all gravity ventilation systems shall be located on the side or sides of the building exposed to the prevailing winds.





(2) HEIGHT ABOVE GRADE. All outside air intakes shall be located not less than 2 feet above the outside grade and above roofs and similar areas.

(a) Where an outside air intake is located in an areaway below grade, the top of the areaway shall be at least 2 feet above the grade level at that point.

(3) SCREENS. All outside air intakes shall be protected against the admission of foreign material with a ½ inch wire mesh screen or equal.

(4) WEATHER PROTECTION. All outside air intakes 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 admission of unheated air to the building when the heating unit is not in operation.

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

(6) SIZE AND OPENINGS FOR INTAKES. Consult section Ind 58.69 for allowable velocities to be used in the design of outside air intakes.

(7) OUTSIDE AIR INTAKES FOR COMBUSTION. All boiler rooms or furnace rooms shall be provided with an opening to the outside air. The free area of such opening shall not be less than ½ square foot for each one million B.t.u. per hour fuel consumed, except the minimum area of such opening shall not be less than 1 square foot.

**Ind 58.61 Air cleansing apparatus.** (1) GENERAL. The construction, design and control of all air cleansing apparatus shall be such as to insure consistent maintenance and operation.

(2) AIR WASHERS AND FILTERS. Dirty water shall not be recirculated through sprays affecting air used for ventilation purposes, and not less than 10% of air washer water used shall be renewed during each day of operation exclusive of make-up water; and the reservoir shall be emptied and thoroughly cleaned and refilled with fresh water after each month of operation.

(a) Where filters are provided, they shall be installed on the inlet side of the heating or air conditioning apparatus, except that secondary filters may be installed on the discharge side of fan. All filters shall be so arranged as to be easily accessible for cleaning and inspection service.

**Ind 58.62 Heaters.** (1) ARRANGEMENT. Where more than one heater is required, or provided, for service to the same piping or duct system, or group of systems, they shall be set in battery form and shall be cross connected so that any one may be used alone, or any combination of them may be used simultaneously.

**Ind 58.63 Boilers.** (1) GENERAL. The construction, equipment connections, etc., of all boilers installed hereunder shall comply in every way with the boiler code issued by the industrial commission.

(2) RATING. All low pressure heating boilers shall be of capacities as required by the Net Load Recommendations for Heating Boilers

issued by the Heating, Piping and Air Conditioning Contractors' National Association or The Steel Boiler Institute or the Institute of Boiler and Radiator Manufacturers.

**Ind 58.64 Furnaces.** (1) FAN-FURNACE INSTALLATIONS. Draw through fans, except auxiliary fans, are not permitted in connection with any fan-furnace installation.

(2) GRAVITY SYSTEMS. All 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 inlets to furnace air-ways shall be such as will insure distribution of air to relatively unheated portions of the furnace proper and throughout the furnace air-ways. The top of such inlets shall not be higher than 2 inches below the top of the grates.

**Ind 58.65 Jacketed stoves.** (1) WHERE PERMITTED. The installation of jacketed stoves or cabinet heaters shall be permissible for schools having no basements or other subfloor heater space and also for portable schools. Jacketed stoves or cabinet heaters may be installed in occupancies listed under sections Ind 58.50 and Ind 58.51 where the building has a floor area of less than 1,200 square feet, and also in motels and apartment buildings not more than one story in height.

(2) LOCATION. All jacketed stoves and heaters shall be located in that portion of a schoolroom most exposed to cold weather, usually the northwest portion. They shall be set well clear of any obstruction which may prevent the free and rapid distribution and circulation of heat and air.

(3) SHIELDS. The casings or shields of jacketed stoves or heaters used in schools shall be so constructed as to shield adjacent occupants from undue radiant heat. The clear air space between shield and stove shall average 6 inches and the shields themselves are to extend well above and below all heat radiation surfaces of stoves, but in no case more than 12 inches clear of the floor.

(4) OUTSIDE AIR INTAKE. Every jacketed stove or heater installed in a school building shall have an outside air intake terminating outside the building at a point not less than 2 feet above grade. The outside air intake shall be protected against weather and water with a weather-proof hood or louvers and shall be protected against the admission of foreign material with a ½ inch wire mesh screen or equal. The intake duct shall be joined to the heater casing and airway to prevent cold air from spreading over the floor and to insure contact with the heater surface. Underfloor ducts are not permitted.

(a) The area of the outside air duct shall not be less than 0.25 square inches per square foot of floor area. A damper shall be provided in the outside air supply duct to prevent the admission 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 shall not be 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.

**Ind 58.66 Direct-fired unit heaters, gas-fired space heaters and suspended furnaces.** Direct-fired unit heaters, gas-fired space heaters and suspended furnaces installed in areas specified in this order need not be isolated with a fire-resistive enclosure. All such installations shall comply with the requirements specified herein.

(1) GAS-FIRED UNIT HEATERS. The installation of gas-fired unit heaters shall not be approved for theaters, assembly halls, places of worship, schools, hospitals, hotels, apartment houses, bowling alleys, and similar occupancies.

(a) Gas-fired unit heaters may be installed in retail establishments, manufacturing plants, machine shops, woodworking plants, foundries, offices and similar areas provided such installations comply with the following requirements:

(b) All gas-fired unit heaters shall be of a type that is approved by the Underwriters' Laboratories or the American Gas Association.

(c) Every gas-fired unit heater shall be vented to the outside atmosphere by connecting it to a masonry chimney or an incombustible vent pipe constructed and installed in accordance with the recommendations of the Underwriters' Laboratories for type "B" gas vents, or equal.

(d) Where gas-fired unit heaters are used for tempering outside air, the percentage of outside air to the total air passing through the unit shall be such that the temperature of the air entering the heater shall not be less than 30° F.

(e) All gas-fired unit heaters shall be supported by incombustible brackets or hangers. All heaters, except in garages, shall be located at least 7 feet above the floor and shall be at least 6 inches from any combustible wall or ceiling.

(f) Gas-fired unit heaters installed in garages, motor vehicle service stations, and similar occupancies shall be located at least 8 feet above the garage floor. Gas-fired unit heaters shall not be installed in any basement garage or on the lower floors of a multi-story garage.

(2) GAS-FIRED SPACE HEATERS. The installation of gas-fired space heaters shall be approved for individual apartments, guest rooms in motels, tourist courts, and similar occupancies and also for individual offices. All such installations shall comply with the following requirements:

(a) All gas-fired space heaters shall be of a type that has been tested and approved by the American Gas Association or the Underwriters' Laboratories.

(b) No gas-fired space heaters shall be installed in any normally closed room having a volume of less than 400 cubic feet unless the heater is equipped with an air intake to supply outside air for combustion.

(c) All space heaters shall be vented to the outside atmosphere by connecting them to a masonry chimney or an incombustible vent pipe constructed and installed in accordance with the recommendations of the Underwriters' Laboratories for type "B" gas vents, or equal.

(d) Space heaters shall be equipped with an automatic control which will automatically shut off the gas supply to the burner in case the pilot light is not in operation.

(e) The burner of the heater 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 heater from coming in contact with the flame or with the housing that encloses the burner.

(f) The heater shall be located at least 6 inches from any unprotected combustible wall or partition and shall be securely fastened in place. Space heaters installed on combustible floors shall be mounted on legs at least 6 inches above the floor and such air space shall not be enclosed.

(3) OIL-FIRED SUSPENDED FURNACES. The installation of oil-fired suspended furnaces shall be approved for garages, motor vehicle service stations and similar occupancies. All such installations shall comply with the following requirements:

(a) Every heater shall be located at least 8 feet above the floor and it shall be supported by or suspended from incombustible supports. The heater shall not be supported by or suspended from wood joists or wood beams.

(b) The heater shall be located not less than 6 inches from any combustible wall or ceiling except the side of the heater on which the oil burner is located shall be not less than 48 inches from any wall or partition to provide space for inspection and servicing the unit.

(4) OIL-FIRED UNIT HEATERS AND FURNACES. The installation of direct-fired unit heaters or furnaces and suspended furnaces shall be approved for warehouses, manufacturing plants, foundries, machine shops and similar buildings where the building is of incombustible construction or of mill construction and the materials manufactured, processed or stored therein are primarily of incombustible or slow burning material. In all other buildings under this classification, the heating furnaces or boilers shall be isolated with an enclosure of fire-resistive construction, as required by the state building code.

**Ind 58.67 Chimneys.** (1) HEIGHT AND EFFECTIVE AREA. Chimneys and smoke flues shall be of sufficient effective area and height for the calculated maximum duty as recommended by the Heating, Piping and Air Conditioning Contractors' National Association, the Steel Boiler Institute or the Institute of Boiler and Radiator Manufacturers and shall include additional height to compensate for:

(a) horizontal length of breeching or smoke pipe;
(b) extra internal resistance of heater, or economizer;
(c) smoke flue heat losses, where smoke flues are used for aspirating effect in vent flues;





(d) such further heights as may be necessary to extend above high point of building served and as much higher as may be necessary to attain free wind action at top.

(2) CONSTRUCTION. Chimneys shall be constructed as required by sections Ind 52.10 and Ind 52.11 of the state building code and shall be tight and smooth inside.

(a) Prefabricated chimneys complying with requirements of the Underwriters' Laboratories for type "B" vents may be used in lieu of masonry chimneys if approved by the industrial commission.

(3) SMOKE FLUES IN VENT FLUES. All smoke flues used for the purpose of aspirating effect in vent flues, shall be stayed and supported at the centers of the vent flues, shall be made tight at all joints and shall extend not less than 8 inches above the vent flue. Where such flues are 12 inches or less in diameter, they shall be made of cast iron. Where such flues are more than 12 inches in diameter they may be constructed of steel plate not less than 14 gauge in thickness.

(4) CLEAN-OUTS. All chimneys shall be provided with a readily accessible tight-fitting clean-out door mounted on a metal frame. Clean-out doors shall not be located in a plenum chamber or air-way.

**Ind 58.68 Fans and blowers.** (1) TYPE AND CAPACITY. All fans and blowers shall be of appropriate type and size and shall be selected on a basis of performance against the resistance of the system as installed. All fans shall be rated in accordance with the latest standard test requirements for fans and blowers as adopted by the American Society of Heating and Ventilating Engineers or the National Association of Fan Manufacturers.

(2) QUIET OPERATION. Fans and blowers installed in buildings where noisy operation would be objectionable, shall be located and set, and shall be of such type and outlet velocity in practical use, that reasonably quiet operation is assured.

(a) This order will be understood to prohibit the use of unit heaters and other equipment with a similar degree of noise in occupied areas where such noise would be objectionable.

(3) FAN FURNACE INSTALLATIONS. All fan furnace installations shall be equipped with an automatic fan control from the bonnet temperature so an adequate air supply to the furnace air-ways will be assured.

**Ind 58.69 Ducts.** (1) DESIGN. All ducts shall be designed to promote the unrestricted flow of air, with long sweep elbows or turning vanes. In gravity systems all ducts shall be as direct as possible and heat ducts shall have a rise of not less than one inch per foot in the direction of flow.

(2) AIR VELOCITIES. For the purpose of calculation and design, the velocities in any air-ways shall not in general exceed the following limits; except that for mechanical systems these velocities may be exceeded where properly designed in accordance with the best accepted engineering practice and satisfactory data submitted thereon.

| Part of System | Mechanical System | Gravity System |
|---|---|---|
| 1. Intake Opening | 1,000 F.P.M. | 300 F.P.M. |
| 2. Blast Coils (Total Face Area) | 600 F.P.M. | |
| 3. Trunk Ducts | 1,400 F.P.M. | 300 F.P.M. |
| 4. Branch Ducts | 1,000 F.P.M. | 300 F.P.M. |
| 5. Branch Risers | 800 F.P.M. | 300 F.P.M. |
| 6. Vertical Vent Ducts | 600 F.P.M. | 300 F.P.M. |
| 7. Return Air Ducts | 1,000 F.P.M. | 250 F.P.M. |
| 8. Roof Ventilators | 600 F.P.M. | 300 F.P.M. |
| 9. Inlets and Outlets (Net free area) | | 300 F.P.M. |

(a) Where vent ducts are connected to an exhaust blower, the velocities for branch risers, branch ducts and trunk ducts may be used. The velocities specified for mechanical systems may be exceeded without submitting duct design data provided the friction loss does not exceed .08 inches water gauge per 100 feet, or the equivalent, duct length.

(3) USE. All ducts and air-ways shall be used only for the transmission of air, and shall not be designed or used for any other purpose.

(4) UNDERGROUND AIR SUPPLY DUCTS. Underground ducts constructed to comply with the following requirements may be used for conveying air supply, including return air and outside air.

(a) All underground ducts shall be waterproof.

(b) Underground ducts shall be provided with free drainage to a lower room of the building or to a sump so water will not stand anywhere in the duct. All such ducts shall be constructed without a direct sewer connection.

(c) All room inlets and outlets for underground ducts shall comply with section Ind 58.71 (4) and a water-tight connection shall be provided where the inlet and outlet risers are connected to underground ducts.

(d) Underground ducts used for conveying return air or outside air shall not be less than 12 inches in diameter or 12 inches in the clear, vertically and horizontally, where square or rectangular ducts are used, except that branch underground ducts not more than 16 feet in length may be reduced to not less than 8 inches in diameter or 8 inches in the clear, vertically and horizontally, if the top of the branch duct is flush with the top of the main duct and the branch duct is pitched to drain toward the main duct. All such ducts shall be embedded in concrete and shall be provided with access openings having tight fitting covers for inspection and cleaning service.

(e) Underground ducts used for conveying warm air supply shall be constructed to comply with the following requirements in addition to the requirements of (a), (b) and (c) of this order.

1. Round ducts embedded in concrete shall be used.

2. Where ducts are installed parallel and adjacent to an outside wall, a moisture-proof insulation board not less than 2 inches in thickness or equal shall be provided between the outside wall and the duct.





(5) CONSTRUCTION. All ducts constructed of sheet metal shall be made with locked seams. They shall be constructed and maintained smooth on the inside and shall be air-tight. Ducts or air-ways of wood or other combustible material shall be completely lined on the inside with sheet metal or other approved incombustible material.

(a) No ducts shall be lined with any material which will support combustion or which will present an obstruction to the flow of air.

(6) SHEET METAL PIPING. The following table of U. S. standard metal gauges shall be considered the minimum for ducts and flues constructed of galvanized iron. Ducts constructed of other metal shall be of the equivalent thickness for equal strength. All ducts shall be secured in place and supported to insure permanence.

| Round Ducts Diam. in Inches | Gauge | Rectangular Ducts Width in Inches | Gauge |
|---|---|---|---|
| 1–19 | 26 | 4–18 | 26 |
| 20–29 | 24 | 19–30 | 24 |
| 30–39 | 22 | 31–60 | 22 |
| 40–49 | 20 | 61–96 | 20 |
| 50 and above | 18 | 97 and above | 18 |

For lining purposes, not less than 28 gauge

(a) All rectangular ducts, having one dimension over 18 inches shall be constructed with standing seams, or angles, not more than 33 inches on centers and shall be cross broken diagonally to stiffen the sheets. When this construction cannot be obtained the sheet metal in the ducts or flues shall be at least one gauge heavier than specified in the preceding table.

(b) All ducts with one dimension over 90 inches shall be reinforced with angles of proper sizes.

(c) Plenum chambers and fan-rig housings shall be constructed of not less than 20 gauge galvanized iron or other metal of equivalent strength and shall be reinforced with standing seams or angles.

(7) INSULATION OF DUCTS. Where heat supply ducts are so located or exposed so as to be subject to excessive or undesirable heat losses, they shall be covered with not less than ½ inch of insulating material.

(8) SEPARATE VENT DUCTS. Vent ducts from different rooms shall not be combined anywhere and shall be continuous from the room vent opening to a gathering chamber or outside atmosphere unless direct-connected to an exhaust fan. Gravity vent ducts serving similar occupancy classifications may be combined immediately below the point of final delivery to the outside atmosphere such as the base of a roof ventilator.

(a) This order prohibits the use of open pipe spaces as a substitute for a continuous duct.

(9) TERMINATION OF VENT DUCTS. Vent ducts used in connection with mechanical ventilation supply systems may terminate in air-tight incombustible gathering chambers in the attic if the floor is of

smoothly finished fire resistive construction. 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. 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.

(a) Where dampers are installed in gravity vent ducts, automatic back draft dampers shall be used. Hand operated dampers shall not be installed in vent ducts that are connected to a siphon type roof ventilator.

(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.

**Ind 58.70 Volume dampers and deflectors.** Necessary volume dampers, splitters and deflectors, shall be provided for all ducts to permit accurate balancing of the system, and such dampers, splitters and deflectors shall be set according to air measurements of the system and shall then be locked in place.

**Ind 58.71 Outlets and returns.** (1) NUMBER AND ARRANGEMENTS. The capacity, number and arrangement of outlets, returns and exhausts shall be such as to insure a uniform distribution of air throughout the areas served during all periods of occupancy.

(2) ELEVATOR SHAFTS AND STAIR WELLS. Elevator and stair shafts shall not be considered or used for ventilation purposes nor shall they be allowed to interfere with the effectiveness of installation hereunder.

*Cross reference:* See also elevator code issued by the industrial commission.

(3) OUTLETS AND RETURNS FOR GRAVITY SYSTEMS. Gravity outlets and returns shall be arranged in room walls in such a manner as to use every possible natural advantage to provide proper and effective air movement and distribution.

(a) Where foot warmers are installed in the main heat flue wall, they shall be provided with dampers which shall not obstruct more than ⅔ of the free area of the heat flue when fully open.

(4) GRILLES OR DIFFUSERS REQUIRED. All air supply outlets shall be equipped with grilles or devices which will provide a uniform distribution of air. Floor registers or grilles are not permitted under any conditions.

(5) CORRIDOR VENTILATION. Air from occupied areas uncontaminated by other than human occupancy may be discharged into corridors and recirculated or vented through auxiliary spaces, such as built-in lockers, toilet rooms, kitchens, or similar areas. Where the vent capacity of such auxiliary spaces is insufficient, additional direct vent flues shall be provided.





(a) Where lockers are installed in recessed walls and used for venting purposes, they shall have a net free inlet and outlet area each, of not less than 15 square inches per lineal foot of locker width.

**Ind 58.72 Radiation.** (1) RADIATION, RECESSED OR ELEVATED. Heating and ventilation units or radiation installed in gymnasiums, play rooms and similar occupied areas shall be fully recessed and protected or elevated not less than 7 feet above the floor. Radiators in aisles, passageways and corridors shall not project into minimum width required by the building code.

(2) SHIELDS REQUIRED. Direct radiators installed within 2½ feet of fixed seats shall be provided with insulated shields constructed and arranged to affect convective air currents and to protect the adjacent occupants from direct radiant heat.

**Ind 58.74 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. They shall be adequately shown on plans submitted for approval.

(2) EXPANSION AND CONTRACTION. Appropriate anchors, expansion swings or joints, supports and similar trade essentials shall be provided in every piping system.

(3) PIPE INSULATION. Where steam and hot water supply, and return piping pass through occupied areas where their heat emission might be objectionable or where such piping is subjected to the danger of freezing, it shall be properly covered with not less than one inch of insulating material.

See the building code issued by the industrial commission for additional requirements.

**Ind 58.75 Refrigerants.** (1) SCOPE. This order covers the use of refrigerants in heat transfer apparatus for temperature reduction or dehumidification as a function of air conditioning of occupied areas.

*Cross reference:* For regulations covering refrigerating machinery, condensers, pressure tests, etc., see the refrigerating plant code issued by the industrial commission. The construction of the machinery room shall comply with the structural and fire protection requirements of the building code.

(2) CLASSIFICATION OF REFRIGERANTS. Refrigerants used in connection with this code shall be classified as follows:

(a) *Class I.* Non-toxic and non-inflammable refrigerants. Included in this list are:

| | *Chemical Formula* |
|---|---|
| Water or water vapor | $H_2O$ |
| Carbon Dioxide | $C O_2$ |
| Dichlorodifluoromethane (Freon 12) | $C CL_2F_2$ |
| Dichlorotetrafluoroethane (Freon 114) | $C_2CL_2F_4$ |
| Monochlorodifluoromethane (Freon 22) | $CHCLF_2$ |
| Dichlorodifluoromethane, 73.8% | $C CL_2F_2$ |
| and Ehthylidene Fluoride, 26.2% (Carrene #7) | $CH_3CHF_2$ |
| Dichloromonofluoromethane (Freon 21) | $CH CL_2F$ |

(b) *Class II.* Relatively non-toxic and non-inflammable refrigerants, having a sufficiently high boiling point to prevent rapid evaporation in event of release. Included in this list are:

| | |
|---|---|
| Dichloroethylene | $C_2H_2CL_2$ |
| Dichloromethane—Methylene chloride (Carrene #1) | $CH_2CL_2$ |
| Trichloromonofluoromethane (Freon 11) | $CCL_3F$ |
| Trichlorotrifluoroethane (Freon 113) | $C_2CL_3F_3$ |

(c) *Class III.* Irritant and inflammable refrigerants. Included in this list are:

| | |
|---|---|
| Ammonia | $NH_3$ |
| Methyl chloride | $CH_3CL$ |
| Ethyl bromide | $C_2H_5Br$ |

(3) USES, WHERE PERMITTED. Only the refrigerants included in class I may be used for cooling air by direct expansion or circulation in coils or extended surface cooling apparatus.

(a) Refrigerants included in classes I and II may be used for the purpose of cooling water to be circulated through air washers.

(b) Refrigerants included in classes I, II and III may be used for the purpose of cooling brine or water in a closed system where such brine or water is not circulated directly through the air to be conditioned.

*Cross reference:* Refrigerants not included in class I shall be classified and may be used in accordance with the requirements of the American Standard Association Safety Code for Mechanical Refrigeration B9.1–1953.

(4) REFRIGERANTS PROHIBITED. The following toxic and inflammable refrigerants shall not be used for air conditioning purposes:

| | |
|---|---|
| Butane | $C_4H_{10}$ |
| Isobutane | $(CH_3)_3CH$ |
| Propane | $C_3H_8$ |
| Ethane | $C_2H_6$ |
| Ethyl Chloride | $C_2H_5CL$ |
| Methyl Bromide | $CH_3Br$ |
| Methyl Formate | $HCOOCH_3$ |
| Sulphur Dioxide | $SO_2$ |





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