# Chapter Ind 51

# DEFINITIONS AND STANDARDS

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**Ind 51.01 Definitions.** (1) ACCESSORY ROOM. Any room or enclosed floor space used for eating, cooking, bathrooms, water closet compartments, laundries, pantries, foyers, hallways, and other similar floor spaces. Rooms designated as recreation, study, den, family room, office, etc., in addition to habitable rooms, are considered accessory rooms.

(1a) AIR CONDITIONING. The process of treating air to control simultaneously its temperature, humidity, cleanliness and distribution to meet the requirements of the conditioned space.

(2) ALLEY. Any legally established public thoroughfare less than 30 feet in width but not less than 10 feet in width whether designated by name or number.

(3) APPROVED. Approval granted by the department under the regulations stated in this code.

(4) AREA (GROSS). The maximum horizontal projected area within the perimeter of the outside surface of walls or supports of the building or structure. Exterior cantilever open balconies are not included.

(5) AREA (NET). The occupied or usable floor area in a building but not including space occupied by columns, walls, partitions, mechanical shafts or ducts.

(5a) AREAWAY. Exterior area whose grade is below the grade (at building) and having at least one side consisting of the exterior wall of a building.

(6) ATTIC. The space not used for human occupancy located between the ceiling of uppermost story and the roof.

* See Appendix A for further explanatory material.

(7) AUTOMATIC. Automatic as applied to a fire protective device, is one which functions without human intervention and is actuated as a result of the predetermined temperature rise, rate of rise of temperature, combustion products or smoke density such as an automatic sprinkler system, automatic fire door, automatic fire shutter, or automatic fire vent.

(8) BALCONY (EXTERIOR). An elevated platform attached to a building and enclosed on one or more sides by railings.

(9) BALCONY (INTERIOR). An open intermediate level or stepped floor. Also see "Stories, Number of."

(10) BASEMENT. A basement floor is that level below the first or ground floor level with its entire floor below exit discharge grade.

(11) BEARING WALL. See "Wall (bearing)."

(12) BUILDING.* A structure for support, shelter or enclosure of persons or property.

(13) BUILDING HEIGHT. See "Height (building)."

(14) BUTTRESS. A structural projection which is an integral part of a wall, primarily to provide resistance to lateral forces.

(15) CAVITY WALL. See "Wall (cavity)."

(16) CEILING PROTECTION. The fire protection membrane suspended beneath the floor or ceiling construction which, when included with the construction, develops the fire-resistive rating for the overall assembly.

(17) CLOSING DEVICE (FIRE DOOR). A closing device is one which will close the door and be adequate to latch and/or hold hinged or sliding door in a closed position.

(a) *Automatic.* An automatic closing device is one which functions without human intervention and is actuated as a result of the predetermined temperature rise, rate of rise of temperature, combustion products or smoke density.

(b) *Self-closing.* A self-closing device is one which will maintain the door in a closed position.

(18) COMBUSTIBLE CONSTRUCTION. An assembly such as a wall, floor or roof having components of combustible material.

(19) COMBUSTIBLE MATERIAL. All materials not classified as "noncombustible" are considered combustible. This property of a material does not relate to its ability to structurally perform under fire exposure. The degree of combustibility is not defined by standard fire test procedures.

(20) CONCRETE. See "Types of Concrete," section Ind 51.045 (1) (a).

(21) CONSTRUCTION. Includes all labor and materials used in the framing or assembling of component parts in the erection, installation, enlargement, alteration, repair, moving, conversion, razing, demolition or removal of any appliance, device, building, structure or equipment.

* See Appendix A for further explanatory material.

(22) CORRIDOR. An enclosed passageway in a building for public ingress and egress to and from dwelling units, rooms or other areas and leading to a lobby, foyer or exit discharge.

(22a) CORRIDOR (REQUIRED EXIT). A fire-rated enclosure beginning at the end point of maximum allowable exit distance and continuing to the exit discharge door.

**Note:** See line 20 of Table 51.03-A.

(23) COURT (EXIT). An exterior court providing a pathway for public egress from an exit to a public thoroughfare.

(24) COURT (INNER). An open air shaft or court surrounded on all sides by walls.

(25) COURT (INNER LOT LINE). A court bounded on 3 sides by walls and on the remaining side by a lot line or property line.

(26) COURT (OUTER). A court bounded on 3 sides with walls and on the remaining side by a street, alley or other open space not less than 15 feet wide.

(27) COURT (OUTER LOT LINE). A court with one side on a lot line or property line and opening to a street or open space not less than 15 feet wide.

(28) CURTAIN WALL. See "Wall (curtain)."

(29) DEPARTMENT. Means the department of industry, labor and human relations.

(30) DIVISION WALL. See "Wall (division)."

(31) DUCT. 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.

(32) DUCT FURNACE. See "Furnace (duct)."

(33) ELEVATOR. See Wis. Adm. Code, chapter Ind 4.

(34) EQUIPMENT. Self-contained systems and apparatus attached to or built into the building and used for mechanical or electrical processing, comfort, safety, sanitation, communication or transportation within a building.

(35) EXHAUST VENTILATING SYSTEM. See "Ventilating System (exhaust)."

(36) EXISTING. A building, structure, or equipment completed or in the course of construction or use or occupied prior to the effective date of applicable rules of this code.

(37) EXIT COURT. See "Court (exit)."

(38) EXIT DISCHARGE GRADE. See "Grade (exit discharge)."

(39) EXIT (VERTICAL). See "Vertical Exit."

(40) EXTERIOR BALCONY. See "Balcony (exterior)."

(41) EXTERIOR WALL. See "Wall (exterior)."

(42) FAMILY.* Means 2 or more individuals who are related to

* See Appendix A for further explanatory material.

each other by blood, marriage, adoption or legal guardianship. For purposes of this code a group of not more than 4 persons not necessarily related by blood or marriage, living together in a single living unit will be considered equivalent to a single family.

(43) FIRE DOOR. A door so constructed as to give protection against the passage of fire.

(44) FIRE DOOR ASSEMBLY. The assembly of fire door and its accessories, including all hardware, frames, closing devices and their anchors, so constructed as to give protection against the passage of fire.

(45) FIRE DOOR CLOSING DEVICE. See "Closing Device (fire door)."

(46) FIRE RESISTANCE AND FIRE-RESISTIVE MATERIAL. Having the property to withstand fire or give protection from it. As applied to elements of building, it is characterized by the ability to confine a fire or to continue to perform a given structural function, or both.

(47) FIRE-RESISTIVE CLASSIFICATION. Fire-resistive classification is the time in hours during which a material or assembly continues to exhibit fire resistance under conditions of tests and performance as specified in ASTM E-119, ASTM E-152 and ASTM E-163.

(48) FIRE-RESISTIVE PROTECTION. An insulating material applied directly, attached to, or suspended from a structural assembly, to maintain the structural integrity of a member or system for the specified time rating.

(49) FIRE-RESISTIVE PROTECTION, DIRECTLY APPLIED. A coating material applied directly to the structural element for the purpose of fire protection.

(50) FIRE-RESISTIVE RATING. Refer to fire-resistive classification.

(51) FIRE-RETARDANT ROOF COVERINGS. Roof coverings shall be classified on the basis of protection provided against fire originating outside the building or structure on which they have been installed.

(a) Class A roof coverings are those which are effective against severe fire exposures (meeting the 3 methods for fire tests of class A roof coverings [ASTM Standard E-108]) and possess no flying brand hazard.

(b) Class B roof coverings are those which are effective against moderate fire exposures (meeting the 3 methods for fire tests of class B roof coverings [ASTM Standard E-108]) and possess no flying brand hazard.

(c) Class C roof coverings are those which are effective against light fire exposures (meeting the 3 methods for fire tests of class C roof coverings [ASTM Standard E-108]) and possess no flying brand hazard.

(52) FIRE RETARDANT—TREATED WOOD. Fire-retardant wood includes lumber or plywood that has been treated with a fire-retardant chemical to provide classifications (flame-spread [FSC] and fuel contributed [FCC]) of 25 or less by ASTM method E-84, shows no progressive combustion during 30 minutes of fire exposure by this

* See Appendix A for further explanatory material.

method, and is so labeled. Fire-retardant wood for decorative and interior finish purposes provides reduced flame-spread classification (FSC) by ASTM method E-84 as specified by the code for materials used in the particular applications.

(53) FIRE WINDOW ASSEMBLY. A fire window includes glass, frame, hardware and anchors constructed and glazed to give protection against the passage of flame.

(54) FIRST FLOOR. The first floor is the primary floor used in determining the number of stories of a building.

(55) FLAME-SPREAD CLASSIFICATION. Flame-spread classification (FSC) is a comparative rating of the measure of flame-spread on a surface of a material or assembly as determined under conditions of tests and performance as specified in ASTM E-84.

(56) FLAME-SPREAD RATING. Refer to flame-spread classification.

(56a) FLOOR. The bottom or lower part of an enclosed space including any portions raised or depressed by not more than 3 feet from the designated principal level where the raised or depressed portion is treated architecturally as a part of the same principal level.

(57) FLOOR AREA. See "Area (net)."

(57a) FLOOR LEVEL. The upper surface of a floor treated architecturally as the designated principal floor at a given elevation.

(58) FOYER. An enclosed space and passageway into which aisles, corridors, stairways, or elevators may exit and from which the public has access to exits.

(59) FRONT YARD. See "Yard (front)."

(60) FUEL CONTRIBUTED CLASSIFICATION. Fuel contributed classification (FCC) is a comparative measure of the fuel contribution of a material or an assembly in the flame-spread test per ASTM E-84.

(61) FURNACE. A 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.

(62) FURNACE (DUCT). 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.

(63) GRADE (AT BUILDING). Elevation of surface of paved or unpaved ground adjacent to wall of a building.

(64) GRADE (EXIT DISCHARGE). The elevation of finished exterior surface of paved or unpaved ground at any exit discharge doorsill.

(65) GRAVITY EXHAUST VENTILATION. See "Ventilation (gravity exhaust)."

(66) GROSS AREA. See "Area (gross)."

(67) GROUND FLOOR. A ground floor is that level of a building on a sloping or multilevel site which has its floor line at or not more than

* See Appendix A for further explanatory material.

3 feet above exit discharge grade for at least one-half of the required exit discharges.

(67a) HABITABLE ROOM.* Any room or enclosed floor space arranged for living and/or sleeping purposes.

(68) HAZARDOUS PIPING. See "Piping (hazardous)."

(69) HEATING SYSTEM. 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.

(70) HEIGHT (BUILDING). Height of a building is measured from the average of the exit discharge grade elevation of all required first story exits to the top of a level roof or to a point ½ of the distance between the intersection of the exterior wall surface (extended) with the roof surface, and the highest part of the roof but not to include penthouses.

NOTE: For exceptions to penthouses see definition "Stories, Number of."

(71) HOLLOW BONDED WALL. See "Wall (hollow bonded)."

(72) INNER COURT. See "Court (inner)."

(73) INNER LOT LINE COURT. See "Court (inner lot line)."

(74) INTAKE (OUTSIDE AIR). See "Outside Air Intake."

(75) INTERIOR BALCONY. See "Balcony (interior)."

(76) JACKETED STOVE. See "Stove (jacketed)."

(76a) LIVING UNIT. Any enclosed floor space consisting of one or more habitable rooms (with or without accessory rooms) used by a person(s) or family.

(77) LOBBY. An enclosed space into which aisles, corridors, stairways, elevators or foyer may exit and provides access to exits.

(78) LOT LINE. A legally established line dividing one lot, plot of land or parcel of land from an adjoining lot or plot of land or parcel of land.

(79) MAJOR APPARATUS. Central air-handling equipment supplying more than one occupancy or rooms and heat-producing equipment generating heat for the heating and ventilating system.

(80) MASONRY. A construction composed of separate units such as brick, block, hollow tile, stone or approved similar units or a combination thereof, laid up or built unit by unit and bonded by approved manner.

(81) MECHANICAL VENTILATION. See "Ventilation (mechanical)."

(82) MEZZANINE OR MEZZANINE FLOOR. An intermediate floor, either open or enclosed. Also see "Stories, Number of."

(83) NET AREA. See "Area (net)."

(84) NONBEARING WALL. Refer to "Wall (exterior)" or "Partition."

* See Appendix A for further explanatory material.

(85) NONCOMBUSTIBLE CONSTRUCTION. An assembly such as a wall, floor or roof having components of noncombustible material.

(86) NONCOMBUSTIBLE MATERIAL. A noncombustible material is one which, in the form in which it is used, meets one of the requirements (a), (b) or (c) listed below. Materials used adjacent to or in contact with heat-producing appliances, warm air ducts, plenums and chimneys shall be classified as noncombustible only on the basis of requirement (a). Non-combustible does not apply to the flame-spread characteristics of interior finish or trim materials. No material shall be classed as noncombustible building construction material which is subject to increase in combustibility or flame-spread classification (FSC) beyond the limits herein established through the effects of age, moisture or other atmospheric conditions.

(a) Materials which pass the test procedure of ASTM E-136 for defining noncombustibility of elementary materials when exposed to a furnace temperature of 1,382 degrees F. for a minimum period of 5 minutes, and do not cause a temperature rise of the surface or interior thermocouples in excess of 54 degrees F. above the furnace air temperature at the beginning of the test and which do not flame after an exposure of 30 seconds.

(b) Materials having a structural base of noncombustible material as defined in paragraph (a), with a surfacing not more than ⅛ inch thick which has a flame-spread classification (FSC) not greater than 50 when tested in accordance with the method of test for surface burning characteristics of building materials (ASTM E-84).

(c) Materials other than defined in paragraphs (a) and (b), having a flame-spread classification (FSC) not greater than 25 without evidence of continued progressive combustion, and of such composition that surfaces that would be exposed by cutting through the material in any way would not have a flame-spread classification (FSC) greater than 25 when tested in accordance with the method of test for surface burning characteristics of building materials (ASTM E-84).

(87) OCCUPANCY OR USE. The purpose for which a building, structure, equipment, materials, or premises, or part thereof, is used or intended to be used as regulated in this code.

(88) OCCUPIED. Refers to any room or enclosure used by one or more persons for other than incidental maintenance.

(89) OPEN SPACES. Front (setback), rear and side yards, exit courts, outer courts, and outer lot line courts on the same property with a building as regulated by this code.

(90) 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.

(91) OUTER COURT. See "Court (outer)."

(92) OUTER LOT LINE COURT. See "Court (outer lot line)."

(93) OUTLET (SUPPLY OPENING). An opening, the sole purpose of which is to deliver air into any space to provide heating, ventilating or air conditioning.

* See Appendix A for further explanatory material.

(94) OUTSIDE AIR. 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.

(95) OUTSIDE AIR INTAKE. Includes the ducts and outdoor openings through which outside air is admitted to a ventilating, air conditioning or heating system.

(96) PANEL WALL. See "Wall (panel)."

(97) PARTITION. An interior nonbearing vertical element serving to enclose or divide an area, room or space.

(98) PARTY WALL. See "Wall (party)."

(99) PENTHOUSE. An enclosed or partially enclosed structure extending above the main roof of a building or structure and/or enclosing a stairway, tank, elevator, machinery, mechanical equipment or other apparatus and not used for human occupancy.

(100) PIER. An isolated column of masonry or concrete. A section of bearing wall not bonded on the sides into adjoining masonry shall be considered to be a pier when its horizontal dimension measured at right angles to the thickness does not exceed 4 times the thickness.

(101) PILASTER. A projection of masonry for the purpose of bearing concentrated loads, or to compensate for reduction of wall section by chases, openings or recesses, or for the purpose of stiffening the wall against lateral forces. (See also "Buttress.")

(102) PIPING (HAZARDOUS). Any service piping conveying oxygen, flammable liquids, flammable gases or toxic gases.

(102a) PLACE OF EMPLOYMENT. The term "place of employment" includes 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 does not include any place where persons are employed in (a) private domestic service which does not involve the use of mechanical power or (b) farming.

(103) PORCH. An unenclosed exterior structure at or near grade attached or adjacent to the exterior wall of any building, and having a roof and floor. (See also "Terrace" and "Balcony.")

(104) PROPERTY LINE. A legally established line dividing one lot, plot of land or parcel of land under one ownership from an adjoining lot or plot of land or parcel of land under another ownership.

(104a) PUBLIC BUILDING. The term "public building" means an includes any structure, including exterior parts of such building, such as a porch, exterior platform or steps providing means of ingress or egress, used in whole or in part as a place of resort, assemblage, lodging, trade, traffic, occupancy, or use by the public or by 3 or more tenants.

* See Appendix A for further explanatory material.

(105) PUBLIC THOROUGHFARE. Any legally established street or alley as defined herein.

(105a) REMODELING. To remodel and/or alter means to change any building or structure which affects the structural strength, fire hazard, internal circulation, or exits of the existing building or structure. This definition does not apply to maintenance, reroofing, or alterations to the heating and ventilating or electrical systems.

(106) REQUIRED. A term for mandatory use under the provisions of this code.

(106a) REQUIRED EXIT CORRIDOR. See "Corridor (Required Exit)."

(107) RESTRAINED SUPPORT. A flexural member where the supports and/or the adjacent construction provides complete or partial restraint against rotation of the ends of the member and/or partial restraint against horizontal displacement when subject to a gravity load and/or temperature change.

(108) RETAINING WALL. See "Wall (retaining)."

(109) RETURN (OR EXHAUST OPENING). Any opening, the sole purpose of which is to remove air from any space being heated, ventilated or air conditioned.

(110) ROADWAY. That portion of a public thoroughfare devoted to vehicular traffic, or that part included between curbs.

(111) ROOF. The structural cover of a building with a slope range bearing from horizontal to a maximum of 60 degrees to the horizontal.

(112) ROOF COVERING. Refers to the covering applied over the roof construction for the purpose of weather or fire resistance.

(113) ROOF COVERINGS (FIRE-RETARDANT). See "Fire-Retardant Roof Coverings."

(114) ROOM. A space within a building completely enclosed with walls, partitions, floor and ceiling, except for openings for light, ventilation, ingress and egress.

(115) SETBACK.* Refers to the open space between the property line or public thoroughfare and the nearest part of the building. Unenclosed terraces, slabs, or stoops without roofs or walls may project into this open space or setback.

(116) SHAFT. A vertical opening in a building extending through one or more stories and/or roof, other than an inner court.

(117) SHALL. A term for mandatory use under the provisions of this code.

(118) SIGNS. A structure that is intended, designed, or used for advertising, display, identification, announcements, or related purposes; this includes signs, screens, billboards, and other advertising devices of any type.

(119) SIMPLE SUPPORT. A flexural member where the supports and/or the adjacent construction allows free rotation of the ends of the member and horizontal displacement when subject to a gravity load and/or a temperature change.

* See Appendix A for further explanatory material.

(120) SPACE HEATER (GRAVITY OR CIRCULATING TYPE). A vented, self-contained free standing or wall recessed heating appliance using liquid or gas fuels. (Also see definition for "Stove (jacketed).")

(121) STORIES, NUMBER OF.* The number of stories of a multistory building includes all stories except the basement(s), ground floor(s), attic or interior balcony(ies) and/or mezzanine floor(s). Also see Ind 51.02 (14).

(122) STORY. The space in a building between the surfaces of any floor and the floor next above or below, or roof next above, or any space not defined as basement, ground floor, mezzanine, balcony, penthouse or attic. (Also see "Stories, Number of.")

(123) STOVE (JACKETED). 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. (Also see definition for "Space Heater.")

(124) STREET. Any legally established public thoroughfare 30 feet or more in width whether designated or not by name or number such as avenue, boulevard, circle, court, drive, lane, place, road or way. All-weather hard-surfaced areas 30 feet or more in width and extending at least 50% of the length of that side of building and accessible to fire-fighting equipment will be acceptable in lieu of streets.

(125) STRUCTURE. An assembly of materials forming a construction for occupancy or use (including, among others, buildings, stadiums, gospel or circus tents, reviewing stands, platforms, stagings, observation towers, radio and television towers, water tanks, trestles, piers, wharves, open sheds, coal bins, shelters, fences, and display signs).

(126) SUPPORT (RESTRAINED). See "Restrained Support."

(127) SUPPORT (SIMPLE). See "Simple Support."

(128) TEMPERED AIR. Air transferred from heated area of building.

(129) TEMPERED OUTSIDE AIR. Outside air heated before distribution.

(130) TERRACE. An unenclosed exterior structure at or near grade having a paved, floored, or planted platform area adjacent to an entrance or to the exterior walls for a building or structure and having no roof.

(131) TREATED WOOD (FIRE-RETARDANT). See "Fire Retardant—Treated Wood."

(132) UNIT HEATER (HIGH STATIC PRESSURE TYPE). 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.

(133) UNIT HEATER (LOW STATIC TYPE). 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.

(134) VENEERED WALL. See "Wall (veneered)."

(135) VENTILATING SYSTEM (EXHAUST). Any combination of build-

* See Appendix A for further explanatory material.

ing 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.

(136) VENTILATION. The process of supplying or removing air by natural or mechanical means, to or from any space.

(137) VENTILATION (GRAVITY EXHAUST). 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.

(138) VENTILATION (MECHANICAL). The process of supplying or removing air by power-driven fans or blowers.

(139) VERTICAL EXIT. A means of egress used for ascension or descension between 2 or more floors, or other levels, and shall include approved exterior stairways, automatic (moving) stairways, fire escapes, ramps, stairways, and smokeproof stair towers.

(140) WALL. A structural element which is vertical or within 30 degrees of vertical, serving to enclose space, form a division, or support superimposed weight.

(141) WALL (BEARING). Any wall which supports a load in addition to its own weight.

(142) WALL (CAVITY). A wall built of masonry units or of plain concrete, or a combination of these materials, so arranged to provide an air space within the wall, and in which the facing and backing (inner and outer parts) of the wall are tied together with metal ties.

(143) WALL (CURTAIN). An exterior nonbearing wall.

(144) WALL (DIVISION).*

(a) *Building division.* A wall used for separation between 2 buildings on the same property identical in construction to a party wall.

(b) *Fire division.* A wall extending from the lowest floor level to or through the roof to restrict the spread of fire.

(145) WALL (EXTERIOR). Any outer enclosing wall of a building or structure.

(146) WALL (FRAMING). Wall framing shall include columns, studs, beams, girders, lintels and girts.

(147) WALL (HOLLOW BONDED). Wall built of masonry units with or without any air space within the wall, and in which the facing and backing of the wall are bonded together with masonry units.

(148) WALL (NONBEARING EXTERIOR). Wall which supports no vertical load other than its own weight.

(148a) WALL (NONBEARING INTERIOR). See "Partition."

(149) WALL (PANEL). An exterior nonbearing wall in skeleton construction.

(150) WALL (PARAPET). That part of a wall entirely above the roof line.

* See Appendix A for further explanatory material.

(151) WALL (PARTY).* Walls used for separation between 2 buildings on the property line between adjoining properties.

(152) WALL (RETAINING). Wall used to resist laterally imposed pressures.

(153) WALL (VENEERED). Wall having facing which is attached to the backing but not so bonded as to exert common action under load.

(154) YARD (FRONT). An open, unoccupied space unobstructed to the sky, extending across the full width of a lot, or plot of land between the street line and the base of a front building wall. Unenclosed terraces, slabs or stoops without roofs or walls may project into this open space.

**History:** Cr. Register, June, 1972, No. 198, eff. 1–1–73; renum. (1) to be (1a), r. and recr. (10), (54), (67) and (121), cr. (1), (5a), (22a), (56a), (57a), (67a), (76a), (106a) and (148a), Register, September, 1973, No. 213, eff. 10–1–73; cr. (102a), (104a) and (105a), Register, December, 1974, No. 228, eff. 1–1–75.

## Standards for Classes of Construction

**Ind 51.015 Scope.** This section covers minimum standards for common types of building designs currently being constructed. This section does not specifically include classification for uncommon building designs such as shells, domes, space frames, inflatable and similar types of designs. The standards contained herein shall be used as a guide for such uncommon building designs to achieve the degree of safety intended by these standards.

**History:** Cr. Register, June, 1972, No. 198, eff. 1–1–73; renum. Register, September, 1973, No. 213, eff. 10–1–73.

**Ind 51.02 General requirements.** (1) The fire-resistive ratings shown in "Classes of Construction" table 51.03-A are to satisfy the structural integrity end point for the time specified. For heat transmission end point requirements see subsection Ind 51.042 (5).

(2) Substitution of a building element fire-resistive rating will be permitted in any class of construction providing it is equal to or better than the required fire-resistive rating as specified in table 51.03-A.

(a) Construction requiring the use of noncombustible material shall not be replaced by combustible construction regardless of fire-resistive rating unless mentioned specifically under classes of construction standards.

(b) Noncombustible construction may be substituted for combustible construction provided the fire-resistive rating indicated in table 51.03-A is equal to or better than that noted for combustible construction.

(3) FLOOR FRAMING. (a) All floor framing shall satisfy the requirements of Table 51.03-A, whether floor system is considered part of a story or not, unless more restrictive requirements are noted under the occupancy chapters of this code.

(4) Exterior wall construction:

* See Appendix A for further explanatory material.

(a) All exterior walls which are in contact with the soil shall be of masonry or concrete.

(b) Exposed exterior walls between the first floor structural system and grade shall be of masonry or concrete except as follows:

1. Walls may be constructed of material other than masonry or concrete providing the following conditions are satisfied:

a. The construction shall meet the requirements of table 51.03-A for specified class of construction.

b. Any portion of exposed wall above grade and below the first floor structural system, when other than masonry or concrete, shall be counted as a story, and is also considered when determining height of wall.

(5) INTERIOR WALL CONSTRUCTION. (a) Openings in partitions and interior bearing walls shall be protected if such walls serve as required building division, fire division or fire separation walls.

1. Openings shall be protected by approved fire door or fire window assemblies as specified in section Ind 51.047, or fire damper or fire door assemblies as specified in section Ind 59.69.

**Note: Openings in walls other than those specified above need not be protected except to satisfy structural integrity end point for the time specified.**

(6) Roof coverings, skylights and skydomes:

(a) There shall be no restriction in use of glass or other noncombustible material when satisfying minimum requirements for roof coverings.

(b) Where combustible plastic is used in roof openings it shall not exceed an area greater than 20% of the roof area except as permitted under occupancy sections.

1. No individual dome or group of domes or skylights shall exceed 100 square feet.

a. Domes or groups of domes or skylights shall be separated from each other by at least 8 feet laterally and 10 feet along the slope of the roof.

(7) Building locations:

(a) When the distance between buildings located on the same property is less than 10 feet, the following shall apply:

1. Where the combined gross area for these buildings is less than that allowable for one building the exterior wall shall satisfy minimum requirements listed for class of construction in table 51.03-A.

a. Buildings classified as wood frame under subsections Ind 51.03 (7) or (8) shall have exterior walls with a fire-resistive rating of not less than that required for these buildings when satisfying the 10 feet to 30 feet distance to property line shown in table 51.03-A.

2. Where the combined gross area for these buildings is greater than that allowable for one building, one of the opposing walls shall be not less than a 4-hour fire-resistive rated fire division wall or building division wall, whichever applies. Where buildings are of different classes of construction, the lesser allowable gross area shall apply.

* See Appendix A for further explanatory material.

(8) Interior balcony or mezzanine. Interior balconies or mezzanine floors shall have fire-resistive ratings as required for the story in which it is located.

(9) No pipes, wires, cables, ducts or other service equipment shall be imbedded lengthwise in the required fire-resistive protection of any structural member except as allowed in approved fire rated assemblies.

(10) Exposed exterior structural columns and framing. The required fire-resistive hourly rating may be omitted on noncombustible columns and framing when the building does not exceed 2 stories and the fire separation to the center of a street, or to the property line or buildings on the same property, is greater than 30 feet.

(11) Stairways, elevators and vertical shafts which serve 3 or more floor levels shall be enclosed with fire-resistive rated construction equal to or better than requirements specified in Table 51.03-A, except as exempted below:

(a) In buildings with 3 floor levels, the stairways in the upper 2 levels may be left open provided all stairways leading to the lowest level are separated from the upper levels with fire-resistive rated construction as specified in Table 51.03-A or better.

(b) Conditions specified in subsections Ind 55.09 (1) (a) and (b) as applied to a place of worship are acceptable.

(c) A building having 3 or more floor levels may have an open interior stairway or floor opening connecting any 2 adjacent floors providing:

1. The floors above and below said openings serve to cut off the openings at these floor levels.

a. The fire-resistive ratings of floors shall satisfy those specified in Table 51.03–A, but in no case shall the rating be less than one-hour combustible or noncombustible, whichever applies.

2. The open stairway between 2 floors is in addition to the required stairways and exit passageways specified in the occupancy chapters of this code.

3. The openings are not prohibited by the occupancy chapters of this code.

(12) PARAPET WALLS. (a) Parapet walls shall be provided on exterior walls closer than 10 feet to a property line or to other buildings on the same property except as exempted under Ind 51.02 (12) (a) 4, Wis. Adm. Code. Parapet walls shall satisfy the following requirements:

1. Parapets shall not be less than 2 feet in height.

2. The minimum thickness of masonry parapets shall be 8 inches.

3. Parapets shall have fire-resistive ratings as specified for exterior walls in Table 51.03-A.

4. Parapets are not required on exterior walls which front streets and alleys or where exterior walls connect with roofs of noncombustible construction.

(b) All parapet walls shall be properly coped with noncombustible weatherproof material.

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* See Appendix A for further explanatory material.

## CLASSES OF CONSTRUCTION TABLE 51.03-A FIRE RESISTIVE RATINGS IN HOURS (OR FRACTIONS THEREOF)

| | BUILDING ELEMENT | MODIFYING CONDITIONS | | | TYPES OF CONSTRUCTION | | | | | | | | APPLICABLE NOTES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NUMBER OF STORIES | SEE NOTES (f)(g) BLDG SETBACK DIS. TO P/L OR TO OTHER BLDG ON SAME PROP. | BEARING OR NON-BEARING | FIRE RESISTIVE TYPE A NO. 1 | FIRE RESISTIVE TYPE B NO. 2 | METAL FRAME PROTECTED NO. 3 | HEAVY TIMBER NO. 4 | EXTERIOR MASONRY NO. 5 | METAL FRAME UNPROTECTED NO. 6 | WOOD FRAME PROTECTED NO. 7 | WOOD FRAME UNPROTECTED NO. 8 | SEE IND. 51.03 FOR CONSTRUCTION STANDARDS |
| 1. | INTERIOR SUPPORTS (COLUMNS, PIERS, | OVER 8 STORIES OR MORE THAN 85' IN HEIGHT | | | NC-4 | NP | NP | NP | NP | NP | NP | NP | (a)(d) |
| 2. | FRAME LEGS, POSTS) | 8 STORIES OR 85' IN HEIGHT OR LESS | | | NC-3 | NC-2 | SEE IND. 51.03(3) NC-1 | SEE IND. 51.03(4) H.T. OR I | SEE IND. 51.03(5) 0 | SEE IND. 51.03(6) NC-0 | SEE IND. 51.03(7) 3/4 | SEE IND. 51.03(8) 0 | (a)(d)(h) |
| 3. | FLOOR FRAMING (BEAMS, GIRDERS, | MORE THAN 2 STORIES | | | NC-3 | NC-2 | SEE IND. 51.03(3) NC-1 | SEE IND. 51.03(4) H.T. OR I | SEE IND. 51.03(5) 0 | SEE IND. 51.03(6) NC-0 | NP | NP | (a) |
| 4. | JOISTS, SLABS, DECK) | 2 STORIES OR LESS | | | NC-2 | NC-1 | NC-1 | SEE IND. 51.03(4) H.T. OR I 1 STORY-H.T. OR 0 | 0 | SEE IND. 51.03(6) NC-0 | 3/4 | 0 | (a)(h) |
| 5. | ROOF FRAMING | OVER 8 STORIES OR MORE THAN 85' IN HEIGHT | | | NC-2 | NP | NP | NP | NP | NP | NP | NP | (a) |
| 6. | (TRUSSES, BEAMS, GIRDERS, JOISTS, | 3 TO 8 STORIES OR 85' IN HEIGHT OR LESS | | | NC-2 | NC-1 1/2 | SEE IND. 51.03(3) NC-1 | SEE IND. 51.03(4) H.T. OR I | SEE IND. 51.03(5) 0 | SEE IND. 51.03(6) NC-0 | NP | NP | (a) |
| 7. | FRAME RAFTERS, | 2 STORIES OR UNDER 35' IN HEIGHT | | | NC-1 | NC-1 | NC-1 | SEE IND. 51.03(4) H.T. OR I | SEE IND. 51.03(5) 0 | NC-0 | SEE IND. 51.03(7) 3/4 | 0 | (a)(h) |
| 8. | PURLINS, DECK) | 1 STORY - ROOF FRAMING MORE THAN 20' ABOVE FL | | | NC-0 | SEE IND. 51.03(2) NC-0 | NC-0 | SEE IND. 51.03(4) H.T. OR I | 0 | 0 | 0 | 0 | (a) |
| 9. | | 1 STORY - ROOF FRAMING 20' OR LESS ABOVE FL | | | NC-1 | NC-1 | NC-1 | SEE IND. 51.03(4) H.T. OR I | 0 | 0 | SEE IND. 51.03(7) 3/4 | 0 | (a)(h) |
| 10. | ROOF COVERING | OVER 8 STORIES OR MORE THAN 85' IN HEIGHT | | | CLASS A | NP | NP | NP | NP | NP | NP | NP | (a) |
| 11. | | 8 STORIES OR 85' IN HEIGHT OR LESS | | | CLASS A | CLASS A | CLASS A | CLASS B | CLASS B | CLASS C | CLASS C | CLASS C | (a) |
| 12. | EXTERIOR WALLS & COURT WALLS | | LESS THAN 10 FT. | BEARING | NC-4 | NC-3 | NC-2 | NC-2 | NC-2 | NC-2 | NP | NP | (a)(d)(e)(f) |
| 13. | | | 10 FT. TO 30 FT. INCLUSIVE | BEARING | NC-3 | NC-2 | NC-3/4 | 1 | NC-1 | NC-0 | 3/4 | 0 | (a)(c)(d)(e)(f)(h) |
| 14. | (NOT INCLUDING | | OVER 30 FT. | BEARING | NC-2 | NC-1 | NC-0 | 1 | NC-1 | NC-0 | 3/4 | 0 | (a)(c)(d)(e)(f)(h) |
| 15. | INTERIOR FURRING ATTACHED TO | | LESS THAN 10 FT. | NON-BEARING | NC-2 | NC-2 | NC-1 | NC-1 | NC-1 | NC-1 | NP | NP | (a)(d)(e)(f) |
| 16. | INSIDE SURFACE OF WALL) | | 10 FT. TO 30 FT. INCLUSIVE | NON-BEARING | NC-1 | NC-1 | NC-0 | 1 | NC-1 | NC-0 | 3/4 | 0 | (a)(c)(d)(e)(f)(h) |
| 17. | | | OVER 30 FT. | NON-BEARING | NC-0 | NC-0 | NC-0 | 3/4 | NC-0 | NC-0 | 3/4 | 0 | (a)(c)(d)(e)(f)(h) |
| 18. | INTERIOR WALLS BEARING | | | | NC-3 | NC-2 | NC-1 | 1 | 1 | NC-0 | 3/4 | 0 | (a)(h)(i) |
| 19. | PARTITIONS | | | | NC-0 | NC-0 | NC-0 | 0 | 0 | 0 | 0 | 0 | (a)(i) |
| 20. | REQUIRED EXIT CORRIDOR ENCLOS. | | | | NC-2 | NC-2 | NC-1 | 1 | 1 | 1 | 3/4 | 3/4 | (a)(h) |
| 21. | FIRE ENCLOSURE (STAIRWAYS, ELEVATORS, VERTICAL SHAFTS) | 3 STORIES OR MORE / 3 OR MORE FLOOR LEVELS | | | NC-2 | NC-2 | NC-1 | 1 | 1 | 1 | NP / 3/4 | NP / 3/4 | (a)(f) |
| 22. | PENTHOUSE WALLS | | | | NC-0 | NC-0 | NC-0 | 0 | NC-0 | 0 | 0 | 0 | (a) |
| 23. | PENTHOUSE ROOF | | | | NC-0 | NC-0 | NC-0 | 0 | 0 | 0 | 0 | 0 | (a)(b) |

KEY TO ABBREVIATIONS :

NC — NON COMBUSTIBLE
NP — NOT PERMITTED
H.T. — HEAVY TIMBER

(a) — SEE OCCUPANCY SECTIONS OF THE CODE FOR OTHER BASIC REQUIREMENTS AND MORE RESTRICTIVE LIMITATIONS.
(b) — ROOF COVERING SAME AS FOR MAIN BUILDING.
(c) — WALLS OF SOLID WOOD 4" IN THICKNESS ARE ACCEPTABLE AS EQUAL TO ONE HOUR FIRE-RESISTIVE RATING.
(d) — FIRE RESISTIVE REQUIREMENTS ALSO APPLY FOR THOSE BRACING MEMBERS REQUIRED FOR GRAVITY LOADING.
(e) — REFER TO TABLE 51.03-B FOR ALLOWABLE AREAS FOR WINDOWS AND OTHER OPENINGS IN EXTERIOR WALLS.
(f) — FOR EXCEPTIONS REFER TO IND. 51.02

(13) FIRE DIVISION WALLS. Fire division walls shall have not less than a 4-hour fire-resistive rating as specified in section Ind 51.04 and shall comply with one of the following conditions:

(a) The wall shall extend 3 feet above the roof.

(b) The wall shall connect and make tight contact with roof decks of at least 2-hour fire-resistive noncombustible construction on both sides of the wall.

(c) The wall shall connect and make tight contact with roofs of noncombustible construction on both sides of the walls, and the roofs shall be noncontinuous at the wall.

(14) DETERMINATION OF NUMBER OF STORIES.* For purposes of establishing the maximum allowable stories in the various classes of construction stated in section Ind 51.03, the number of stories shall be determined on the following basis:

(a) The first floor shall be determined first and this level shall satisfy the following conditions:

1. Is the lowest floor having one or more required exits for that floor and for any floor(s) above or below.

a. If condition stated in 1. is not satisfied, the highest floor level shall be considered the first floor.

2. The elevation of the first floor shall be at or not more than 6 feet above an exit discharge grade.

3. The door sill of all required exit discharges from the first floor shall be at or not more than 3 feet above exit discharge grade.

(b) An interior balcony or mezzanine floor which exceeds 25,000 square feet or one third ($\frac{1}{3}$), whichever is least, of the net area enclosed within exterior walls and/or fire division walls shall be counted as a story.

(c) Penthouse(s) with a total area that exceeds 50% of the total roof area shall be counted as a story(ies).

(d) Construction according to subsection Ind 51.02 (4) (b) 1. b. shall also be counted as a story(ies).

(e) Total number of stories shall include the first floor plus all stories above and those stories determined by subsections Ind 51.02 (14) (b), (c) and (d).

1. Floor levels satisfying the definition of basement(s), ground floor(s), attic, interior balcony(ies) and/or mezzanine floor(s), unless otherwise stated, shall not be counted as a story(ies). For exception, see Appendix A-51.02 (14), Illustration No. 4.

(15) DECORATIVE WOOD. Decorative wood may be applied to all required noncombustible exterior surfaces of "0" hourly rated construction or better, up to a limit of 10% of the surface area within any 100 lineal feet of the building.

(16) THERMAL PERFORMANCE STANDARDS. (a) The design heat loss, excluding infiltration and ventilation, through above grade gross walls and roofs facing heated interiors shall not exceed 13 BTU per hour per square foot for the total building envelope.

(b) Any innovative building and mechanical system design may be used as an alternative to (a) above, provided technical data and analysis can verify that the design achieves an equivalent to (a) above.

**TABLE 51.03-B**

**MAXIMUM TOTAL ALLOWABLE AREA OF WINDOWS OR OTHER WALL OPENINGS IN PERCENT OF TOTAL EXPOSED EXTERIOR WALL SURFACE**

| Setback from Property Line, or Other Walls on Same Property[1] | Class of Construction | | | | |
|---|---|---|---|---|---|
| | 1. Fire-Resistive "A"<br>2. Fire-Resistive "B"<br>3. Metal Frame Protected<br>4. Heavy Timber<br>5. Exterior Masonry | | 6. Metal Frame Unprotected | 7. Wood Frame Protected | 8. Wood Frame Unprotected |
| | Bearing Wall | Nonbearing Wall | | | |
| Less than 5′ | No Openings | No Openings | No Openings | Not Permitted | Not Permitted |
| 5′ to less than 10′ | 20%[2] Fire window rqd.[3] | 30%[2] Fire window rqd.[3] | 30%[2] | Not Permitted | Not Permitted |
| 10′ to less than 30′ | 30%[2] | 40%[2] | 40%[2] | 40%[2] | 40%[2] |
| 30′ or over | No Limit | No Limit | No Limit | No Limit | No Limit |

[1] Does not apply to property lines along streets.

[2] Tabulated percentage of openings shall be applied to each 100 lineal feet of wall. This tabulation will not allow wing walls or high parapets, etc. to be used to increase exposed wall areas and thereby increase allowable total area of openings. Where openings are permitted, such openings protected with approved automatic-closing, 3-hour fire door or shutter assemblies—No Limit.

[3] Fire windows shall be as required for moderate fire exposure—see Ind 51.047.

**History:** Cr. Register, June, 1972, No. 198, eff. 1–1–73; am. table A, Register, September, 1973, No. 213, eff. 10–1–73; am. table B, Register, July, 1974, No. 223, eff. 8–1–74.

* See Appendix A for further explanatory material.

(c) The thermal performance standards need not apply to special use buildings such as greenhouses, inflatable and similar types of designs, or any building presently exempt from the heating and ventilating requirements.

(17) INFILTRATION STANDARDS. All exterior windows and doors shall be designed to limit air leakage into or from the building and shall be weatherstripped.

**History: Cr. Register, June, 1972, No. 198, eff. 1–1–73; r. (9) and (10), renum. (3) to be (4), (4), (5), (6), (7), (8) to be (6), (7), (8), (9), (10), am. (2) (a), cr. (3), (5), (11), (12), (13) and (14), Register, September, 1973, No. 213, eff. 10–1–73; am. (14) (d), Register, February, 1974, No. 218, eff. 3–1–74; r. and recr. (12) (a); am. (13) (c), Register, May, 1974, No. 221, eff. 6–1–74; cr. (11) (c) and (15), Register, July, 1974, No. 223, eff. 8–1–74; cr. (16) and (17), Register, December, 1974, No. 228, eff. 1–1–75.**

**Ind 51.03 Classes of construction standards.** (1) FIRE RESISTIVE TYPE A (NO. 1):

(a) A building is of fire-resistive construction if all the walls, partitions, piers, columns, floors, ceilings, roof and stairs are built of noncombustible material, with a fire-resistive rating as specified in table 51.03-A.

1. Concealed draft openings in columns, walls and partitions shall be firestopped with noncombustible material at each floor level.

(b) All buildings of this classification shall not be restricted in height.

(c) Stairs and stair platforms shall be constructed of noncombustible material.

(d) Doors and windows may be of wood except as otherwise specified in section Ind 51.02 (5), Table 51.03-B, sections Ind 51.17, 51.18, 51.19 and 51.20, or in the occupancy chapters of this code.

1. Doors leading into main public corridors other than rated exit corridors shall be noncombustible or 20-minute fire door assemblies, or equivalent, unless otherwise specified above.

**Note:** Public corridors are intended to include principal corridors serving a floor and leading directly to building exits, but do not include communicating passageways within a given use area.

(e) Bays, oriels, and similar exterior projections from the walls shall be constructed of material with fire-resistive ratings as required for exterior walls.

(f) Mansards shall be of noncombustible construction.

1. The wall construction behind mansard shall extend to underside of roof deck and shall have a fire-resistive rating of not less than that specified for exterior walls in table 51.03-A.

(g) Penthouses and other roof structures shall have enclosing walls of noncombustible construction and roof framing and coverings shall be equal to that specified in table 51.03-A. Wood cooling towers are permitted.

(h) Wood may be used for finished floors, trim and wall paneling if open spaces behind the material are completely firestopped with noncombustible materials unless prohibited under the occupancy requirements of this code.

* See Appendix A for further explanatory material.

(i) Acoustical materials may be used on ceilings and walls provided they are noncombustible and the open spaces between furring on walls are completely firestopped with noncombustible material.

(j) In required fire-resistive floor and roof assemblies one electric outlet box, not exceeding 16 square inches in area, may be installed in such ceilings in each 90 square feet of ceiling area. Recessed electric fixtures shall have protection boxes built above the fixture, constructed of approved fire-resistant material of rating equal to that of the ceiling, to cover the opening in case fixture is displaced. Duct openings in ceilings shall be protected by fire dampers.

(2) FIRE-RESISTIVE TYPE B (NO. 2):

(a) A building is of fire-resistive construction if all the walls, partitions, piers, columns, floors, ceilings, roof and stairs are built of noncombustible material, with a fire-resistive rating as specified in table 51.03-A.

(b) All buildings of this classification shall not exceed a height of 85 feet, in which height there shall be not more than 8 stories.

(c) Roofs. Where roof framing is greater than 20 feet above the floor, or highest level of any balcony, roof decks may be:

1. Matched or splined wood roof decking of not less than 2 inches in nominal thickness; or

2. Solid lumber not less than 3 inches in nominal thickness, set on edge securely fastened together; or

3. Approved 1⅛ inch thick plywood with exterior glue, tongue and groove with all end joints staggered and butting on centers of beams spaced not over 4 feet apart; or

4. Other forms of roof decks, if of noncombustible material.

(d) Stairs and stair platforms shall be constructed of noncombustible material.

(e) Doors and windows may be of wood except as otherwise specified in section Ind 51.02 (5), Table 51.03-B, sections Ind 51.17, 51.18, 51.19 and 51.20, or in the occupancy chapters of this code.

1. Doors leading into main public corridors other than rated exit corridors shall be noncombustible or 20-minute fire door assemblies, or equivalent, unless otherwise specified above.

**Note:** Public corridors are intended to include principal corridors serving a floor and leading directly to building exits, but do not include communicating passageways within a given use area.

(f) Bays, oriels, and similar exterior projections from the walls shall be constructed of material with fire-resistive ratings as required for exterior walls.

(g) Mansards shall be of noncombustible construction.

1. The wall construction behind mansard shall extend to underside of roof deck and shall have a fire-resistive rating of not less than that specified for exterior walls in table 51.03-A.

(h) Penthouse and other roof structures shall have enclosing walls of noncombustible construction and roof framing and coverings shall be equal to that specified in table 51.03-A. Wood cooling towers are permitted.

* See Appendix A for further explanatory material.

(i) Wood may be used for finished floors, trim and wall paneling if open spaces behind the material are completely firestopped with noncombustible materials unless prohibited under the occupancy requirements of this code.

(j) Acoustical materials may be used on ceilings and walls provided they are noncombustible and the open spaces between furring strips on walls are completely firestopped with noncombustible material.

(3) METAL FRAME—PROTECTED (NO. 3):

(a) A building is of metal frame protected construction if the structural parts and enclosing walls are of metal, or metal in combination with other noncombustible materials, with time resistance ratings as set forth in table 51.03-A.

(b) All buildings of this classification shall not exceed a height of 75 feet, in which height there shall be not more than 4 stories.

(c) Stairs and stair platforms shall be constructed of noncombustible material.

(d) Bays, oriels and similar exterior projections from the walls shall be constructed of material with fire-resistive ratings not less than that specified for exterior walls in table 51.03-A.

(e) Mansards shall be of noncombustible construction.

1. The wall construction behind mansard shall extend to underside of roof deck and shall have a fire-resistive rating of not less than that specified for exterior walls in table 51.03-A.

(4) HEAVY TIMBER (NO. 4):

(a) A building is of heavy timber construction if the structural frame consists of heavy timber or heavy timber in combination with metal, reinforced concrete or masonry. The structural and enclosing wall shall be as set forth in table 51.03-A.

(b) All buildings of this classification shall not exceed a height of 75 feet, in which height there shall be not more than 4 stories.

(c) Columns:

1. Wood columns shall be not less than 8 inches, nominal, in any dimension when supporting floor loads and not less than 6 inches, nominal, in least dimension and not less than 8 inches, nominal, in other dimension when supporting roof loads only.

2. All wood columns in the structural frame shall be superimposed, end to end, one above the other, and joined by metal or wood connectors.

**NOTE:** See structural chapter Ind 53 for design requirements.

(d) Floor framing:

1. Beams and girders of wood shall be not less than 6 inches, nominal, in any dimension and not less than 45 square inches in actual cross-sectional area.

2. Wood arches which support floor loads shall be not less than 8 inches, nominal, in any dimension.

3. Framed timber trusses supporting floor loads shall have members of not less than 8 inches, nominal, in any dimension.

* See Appendix A for further explanatory material.

4. Floor framing and structural framing of material other than wood shall have a fire-resistive protection of not less than one hour.

(e) Roof framing:

1. Beams and girders of wood shall be not less than 6 inches, nominal, in any dimension and not less than 45 square inches in actual cross-sectional area.

2. Wood arches, timber trusses, purlins and rafters for roof construction shall have members not less than 4 inches, nominal, in width and not less than 6 inches, nominal, in depth. Spaced members may be composed of 2 or more pieces not less than 3 inches, nominal, in thickness when blocked solidly throughout their intervening spaces or when such spaces are tightly closed by a continuous wood cover plate of not less than 2 inches, nominal, in thickness, secured to the underside of the members. Splice plates shall be not less than 3 inches, nominal, in thickness.

(f) Floors:

1. Wood floor construction shall be tongued and grooved, or splined lumber not less than 3 inches nominal thickness, or of solid lumber placed on edge and securely fastened together to make a floor not less than 4 inches, nominal, in thickness. A top layer of flooring of one inch nominal thickness shall be placed over all such floor construction.

(g) Stair construction may be of wood in buildings not exceeding 3 stories in height. In 4-story buildings, all stairs, platforms and stair construction shall be constructed of noncombustible material.

(h) Roofs. Roof decks shall be:

1. Matched or splined wood roof decking of not less than 2 inches in nominal thickness; or

2. Solid lumber not less than 3 inches in nominal thickness, set on edge securely fastened together; or

3. Approved 1⅛ inch thick plywood with exterior glue, tongue and groove with all end joints staggered and butting on centers of beams spaced not over 4 feet apart; or

4. Other forms of roof decks, if of noncombustible material.

(5) EXTERIOR MASONRY (NO. 5):

(a) A building is of exterior masonry construction if all enclosing walls are constructed of masonry or reinforced concrete with fire-resistive ratings as set forth in table 51.03-A.

1. Exterior masonry walls shall extend to the underside of projecting roof rafters or joists or bearing points of beams and trusses.

2. Spaces between projecting rafters, joists, beams or trusses shall be firestopped with nominal 2-inch wood blocking or rigid noncombustible material to the underside of the roof decking.

(b) All buildings of this classification shall not exceed a height of 50 feet, in which height there shall be not more than 4 stories.

(c) The interior structural framing shall be metal, reinforced concrete, masonry or wood. Fire protection of metal or wood structural members may be omitted except that all such members supporting load-bearing masonry in all parts of buildings of more than one story shall be of metal, reinforced concrete or masonry with not less than one-hour fire-resistive protection of supporting metal.

* See Appendix A for further explanatory material.

(d) In walls where fire protection is required, the bottom of lower flange of lintels supporting load-bearing masonry shall be protected for openings exceeding 12-foot spans.

(e) Floors, roofs, partitions and stairs may be of wood but no joist, rafter, stud or stringer shall be less than 2 inches in nominal thickness.

(f) Bays, oriels and similar exterior projections from the walls shall be constructed of material with fire-resistive ratings as required for exterior walls.

(g) A mansard shall be constructed entirely of noncombustible material or fire-retardant treated wood satisfying the definition of "noncombustible" if it is subject to one of the following conditions:

1. If the mansard is closer than 20 feet to the adjoining property line or other building(s) on the same property.

2. If the vertical projected area of the mansard exceeds 30% of the area of the wall surface to which it is attached.

(h) Penthouses and other roof structures shall have enclosing walls of noncombustible construction and roof framing and coverings shall be equal to that specified in table 51.03-A.

(6) METAL FRAME—UNPROTECTED (NO. 6):

(a) A building is of metal frame unprotected construction if the enclosing walls are of unprotected metal or unprotected metal in combination with other noncombustible materials and all building elements are as set forth in Table 51.03-A unless otherwise exempted.

1. Heavy timber may be used for interior columns and floor framing.

2. Interior mezzanines and balconies within the first story may be constructed of one-hour fire-resistive construction.

(b) All buildings of this classification shall not exceed a height of 50 feet, in which height there shall be not more than 3 stories.

(c) Stairs and stair platforms may be of wood with stringers not less than 2 inches in nominal thickness.

(d) Bays, oriels and similar exterior projections from the walls shall be constructed of material with fire-resistive ratings not less than that specified for exterior walls in table 51.03-A.

(7) WOOD FRAME—PROTECTED (NO. 7):

(a) A building is of wood frame protected construction if the structural parts and enclosing walls are of protected wood, or protected wood in combination with other materials, with fire-resistive ratings as set forth in table 51.03-A. If such enclosing walls are veneered, encased or faced with stone, brick, tile, concrete, plaster or metal, the building is also termed a wood frame protected building.

(b) All buildings of this classification shall not exceed a height of 40 feet, in which height there shall be not more than 2 stories.

(c) Floors, roofs, partitions and stairs may be of wood but no joist, rafter, stud or stringer shall be less than 2 inches in nominal thickness.

(d) The structural members supporting the finished ceiling in the topmost story shall be protected on the underside by fire-resistive

* See Appendix A for further explanatory material.

material acceptable in systems approved for one-hour fire-resistive ratings as covered in section Ind 51.04.

(8) WOOD FRAME—UNPROTECTED (NO. 8):

(a) A building is of wood frame unprotected construction if the structural parts and enclosing walls are of unprotected wood, or unprotected wood in combination with other materials. If such enclosing walls are veneered, encased or faced with stone, brick, tile, concrete, plaster or metal, the building is also termed a wood frame unprotected building.

(b) All buildings of this classification shall not exceed a height of 35 feet, in which height there shall be not more than 2 stories.

(c) Floors, roofs, partitions and stairs may be of wood but no joist, rafter, stud or stringer shall be less than 2 inches in nominal thickness.

**History:** Cr. Register, June, 1972, No. 198, eff. 1–1–73; am. (1) (d), renum. (1) (e) 1. to be (f), (1) (f) 1. a. to be (1) (f) 1., (1) (f) (g) (h) (i) to be (1) (g) (h) (i) (j), (2) (f) 1. to be (2) (g), (2) (g) 1. a. to be (2) (g) 1., (2) (g) (h) (i) to be (2) (h) (i) (j), (3) (d) 1. to be (e), (3) (e) 1. a. to (3) (e) 1., (7) (b) to be (c), (7) (c) to be (b), am. (2) (e), r. (4) (e) 3., r. and recr. (6) (a), cr. (7) (d), Register, September, 1973, No. 213, eff. 10–1–73; r. and recr. (6) (a), Register, May, 1974, No. 221, eff. 6–1–74; cr. (5) (a) 1. and 2.; am. (5) (f) and r. and recr. (5) (g), Register, July, 1974, No. 223, eff. 8–1–74; am. (1) (d) 1. and (2) (e) 1., Register, December, 1974, No. 228, eff. 1–1–75.

## Fire-Resistive Standards for Materials of Construction

**Ind 51.04 Scope.** This section shall include standards applicable to various types of fire-resistive construction. Requirements established herein are considered minimum safety standards and will not necessarily result in the most advantageous insurance rates.

**History:** Cr. Register, February, 1971, No. 182, eff. 7–1–71; r. eff. 8–1–71 and recr. eff. 1–1–72, Register, July, 1971, No. 187.

**Ind 51.042 General requirements.** (1) Construction details and quality of material used for these systems must be those used by the testing laboratory for the test, and/or those dictated by good construction practice.

(2) Connection of structural members. (a) The minimum fire-resistive protection of a connection shall be equal to the maximum required for the members to which it is attached.

(3) For structural components with a fire-resistive rating obtained by test with restrained ends, the supporting structure shall be designed to provide for this restraint.

(4) ASTM standard methods of test. (a) All products manufactured and tested according to ASTM standard methods prior to effective dates of standards specified in "Fire-Resistive Standards for Materials of Construction" shall be accepted unless the ASTM standard method used in the test is judged to be inadequate in comparison with the currently adopted standard method.

* See Appendix A for further explanatory material.

(5)* The heat transmission requirements of ASTM E–119 (25b), with the exception of high hazard areas, penal and health care facilities and warehouses for combustible materials, may be reduced to one-half (½) of the hourly rating required by this code, but not less than one hour.

**Note:** For ASTM E–119 Standard adopted see Ind 51.25 (49).

(a) The fire-resistive rating for structural integrity required by this code shall be maintained where the heat transmission criteria has been reduced.

(6) The use of fire-resistive protection implies consent by owner to maintain material in a serviceable condition. Where this protection is concealed, provisions shall be made for periodic visual inspection of the structural insulating material at each story.

**Note:** Definition of owner—see 101.01 (2) (i), Wis. Stats.

**History:** Cr. Register, February, 1971, No. 182, eff. 7–1–71; r. eff. 8–1–71, and recr. eff. 1–1–72, Register, July, 1971, No. 187.

**Ind 51.043 Approved rating methods.** (1) Ratings of fire-resistive assemblies shall be determined by one of the following methods:

(a) Test by approved testing laboratories (see Ind 51.044).

(b) Typical examples as listed in this code in lieu of approved test (see Ind 51.045).

(c) Approved method of calculation in lieu of approved test (see Ind 51.046).

**History:** Cr. Register, February, 1971, No. 182, eff. 7–1–71; r. eff. 8–1–71, and recr. eff. 1–1–72, Register, July, 1971, No. 187.

**Ind 51.044 Approved testing laboratories.** (1) Fire rating tests conducted according to table 1 listed ASTM standards shall be acceptable if conducted by the recognized testing laboratory for referenced test.

**NOTE:** Other testing laboratories will be recognized as an approved agency if accepted in writing by the department.

**TABLE 1**

| Name of Recognized Laboratories | ASTM Standard Tests | | | | | |
|---|---|---|---|---|---|---|
| | E-84 | E-108 | E-119 | E-136 | E-152 | E-163 |
| Forest Prod. Lab., Madison, Wis.* | ------- | ------- | X | ------- | X | ------- |
| Nat'l. Bureau of St'd., Washington, D.C. | ------- | ------- | X | X | ------- | ------- |
| Ohio State Univ., Columbus, Ohio | ------- | ------- | X | X | X | X |
| Portland Cement Assoc., Skokie, Ill. | ------- | ------- | X | ------- | ------- | ------- |
| Southwest Research Inst., San Antonio, Tex. | X | ------- | ------- | ------- | ------- | ------- |
| Underwriters' Lab., Inc., Chicago, Ill. | X | X | X | ------- | X | X |
| Underwriters' Lab., Inc., Scarborough, Ont., Canada | X | X | X | X | X | X |
| Univ. of Calif., Berkeley, Calif. | ------- | X | X | ------- | ------- | X |

*NOTE: Reference based on research and development data. Facility is not available for conducting routine rating tests.

* See Appendix A for further explanatory material.

**NOTE:** For column identification and specific standards adopted, see subsections Ind 51.25 (47)–(50) and (52)–(53).

**History:** Cr. Register, February, 1971, No. 182, eff. 7–1–71; r. eff. 8–1–71, and recr. eff. 1–1–72, Register, July, 1971, No. 187.

**Ind 51.045 Typical examples of Fire-Resistive Structural Components.** (1) Basic design and construction for specified fire-resistive protection of structural components listed in table 2, including references (a) through (p), shall be acceptable.

**NOTE: The following table is based on performance, interpretation of various test data and/or data from ASTM E–119 test (see table 2).**

(a) Types of concrete.

1. Type I—normal weight concrete with limestone, calcareous gravel and air-cooled slag aggregate.

2. Type II—normal weight concrete with siliceous gravel, granite or quartz aggregate containing more than 40% quartz, chert or flint. Values given for type I apply except where values are tabulated for type II.

3. Type III—lightweight aggregate with expanded slag, shale or clay aggregate. Includes sanded—lightweight concretes not over 115 lbs. per cu. ft. oven-dried density.

(b) Cover on reinforcing steel is for sides and bottoms. Where tensile reinforcing elements have different cover, the tabulated cover is the average of the minimum values of the individual elements. The cover of an individual element shall not be less than ½ the tabulated value. Top cover to be a minimum of ¾ inch.

(c) For the heat transmission requirements of floor and roof construction, the thickness of the top slab may be reduced if noncombustible insulation is directly applied to either side of the slab and provided the U-factor is equaled or reduced.

(d) The thickness of top slab is in accordance with ASTM E–119 heat transmission requirements. For variations in thickness of top slab see section Ind 51.042 (5).

Note: For ASTM E–119 standard adopted see Ind 51.25 (49).

(e) Longitudinal joints between individual precast floor or roof units, or individual wall units shall be installed as tested or shall be grouted solid for the thickness required by the fire-resistive rating. Noncombustible insulation may be substituted for the grout if the U-factor is equaled or reduced providing the integrity of insulation remains as installed. The topping used in floor or roof units may be included.

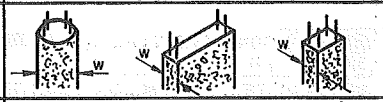
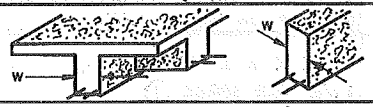
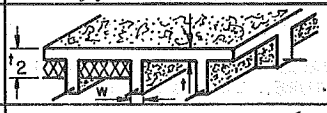
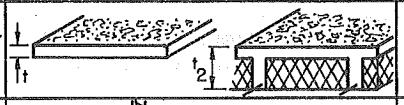
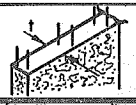
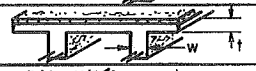
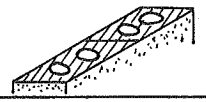
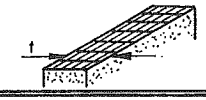
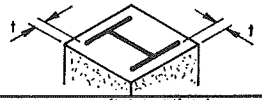
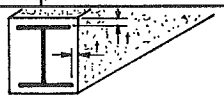
(f) Type I Hollow Masonry is a masonry with calcareous or siliceous aggregate having an oven-dried density exceeding 115 pounds per cubic foot. Type II Hollow Masonry is a masonry with expanded slag, clay, shale or pumice aggregate having an oven-dried density of 115 pounds or less per cubic foot.

(g) Equivalent thickness $= \dfrac{\text{Total volume minus volume of voids}}{\text{length times height}}$

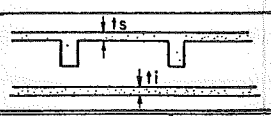
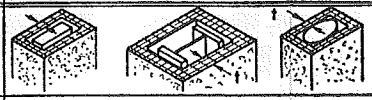
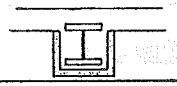
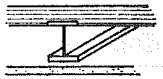
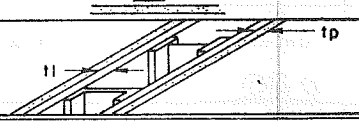
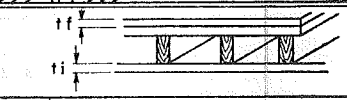
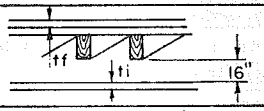
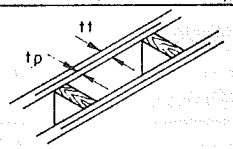
(h) $t_a$-equivalent thickness $= \dfrac{\text{Total conc. area minus area of void}}{\text{width}}$

* See Appendix A for further explanatory material.

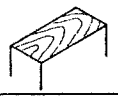
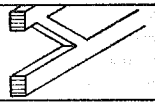
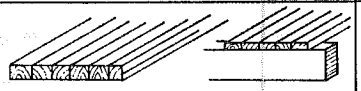
# TYPICAL EXAMPLES OF FIRE RESISTIVE STRUCTURAL COMPONENTS, TABLE 2

| TYPE OF CONSTRUCTION | | ROW NO. | STRUCTURAL COMPONENTS | SKETCHES | INSULATING MATERIAL | DESCRIPTION | MINIMUM REQUIREMENTS 4 HR. I | II | III | 3 HR. I | II | III | 2 HR. I | II | III | 1 HR I | II | III |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| COMPONENTS WITHOUT APPLIED PROTECTION | CONCRETE CAST IN PLACE AND PRECAST MILD STEEL REINF. | 1. | COLUMNS |  | CONCRETE TYPE I II & III ⓐ ⓑ | REINF. COVER | 2 | 2 | 2 | 2 | 2 | 2 | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ |
| | | | | | | MIN. DIM. & AREA-SQ. IN. | 12-144 | | | 10-120 | | | 8-64 | | | 6-48 | | |
| | | 2. | GIRDERS AND BEAMS |  | CONCRETE TYPE I II & III ⓐ ⓑ ⓝ | REINF. COVER | 2 | 2 | 2 | 1½ | 1½ | 1½ | 1½ | 1½ | 1½ | 1 | 1 | 1 |
| | | | | | | WIDTH (w) | 8 | 8 | 8 | 8 | 8 | 8 | 6 | 6 | 4 | 4 | 4 | 4 |
| | | 3. | JOISTS & WAFFLES WITHOUT FILLERS OR PARTIAL FILLERS OF TYPE I OR II MASONRY OR CLAY TILE |  | CONCRETE TYPE I II & III ⓐ ⓑ ⓒ ⓓ ⓔ ⓗ ⓝ | REINF. COVER | 1 | 1 | 1 | 1 | 1 | 1 | ¾ | ¾ | ¾ | ¾ | ¾ | ¾ |
| | | | | | | WIDTH WEB (w) | 6 | 6 | 6 | 5 | 5 | 5 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | | | | | TH. TOP SLAB (t) | 6¾ | 7 | 5½ | 5¾ | 6¼ | 4¾ | 4¾ | 5 | 3¾ | 3¾ | 3½ | 2¾ |
| | | 4. | SLABS OR JOISTS & WAFFLES WITH TYPE I OR II MASONRY OR CLAY TILE FILLER |  | CONCRETE TYPE I II & III ⓐ ⓑ ⓒ ⓓ ⓔ ⓗ ⓝ | REINF. COVER | 1 | 1 | 1 | 1 | 1 | 1 | ¾ | ¾ | ¾ | ¾ | ¾ | ¾ |
| | | | | | | TOP SLAB (t) | 6¾ | 7 | 5½ | 5¾ | 6¼ | 4¾ | 4¾ | 5 | 3¾ | 3¼ | 3½ | 2¾ |
| | | 5. | WALLS AND PARTITIONS BR'G. & NON-BR'G. |  | CONCRETE TYPE I II & III ⓐ ⓑ ⓔ | REINF. COVER | 1 | 1 | 1 | 1 | 1 | 1 | ¾ | ¾ | ¾ | ¾ | ¾ | ¾ |
| | | | | | | THICKNESS (t) | 6 | 6½ | 5 | 5 | 5½ | 4½ | 4 | 4½ | 4 | 3 | 3 | 3 |
| | CONCRETE PRECAST & CAST IN PLACE POSTTENSION OR PRETENSIONED SIMPLE SPAN | 6. | GIRDERS AND BEAMS |  | CONCRETE TYPE I II & III ⓐ ⓑ ⓚ | AVE. COVER (w) | I & II 3½ 11 | III 3 10 | | I & II 3 9½ | III 2¾ 8 | | I & II 2½ 7 | III 2 6¼ | | I & II 1¾ 4 | III 1¾ 4 | |
| | | 7. | JOISTS AND WAFFLES |  | CONCRETE TYPE I II & III ⓐ ⓑ ⓒ ⓓ ⓔ ⓚ | AVE. COVER | 3½ | 3 | | 3 | 2¾ | | 2½ | 2 | | 1¾ | 1¾ | |
| | | | | | | AVE. WEB TH. (w) | 11 | 10 | | 9½ | 8 | | 7 | 6¼ | | 4 | 4 | |
| | | | | | | SLAB TH. (t) | 6¾ | 7 | 5½ | 5¾ | 6 | 4¾ | 4¾ | 5 | 3¾ | 3¼ | 3½ | 2¾ |
| | | 8. | SINGLE TEE |  | CONCRETE TYPE I II & III ⓐ ⓑ ⓒ ⓓ ⓔ ⓚ | AVE. COVER | 2¾ | 2¾ | | 1¾ | 1¾ | | 1¾ | 1¾ | | 1¾ | 1¾ | |
| | | | | | | AVE. WED TH. (w) | 8 | 8 | | 8 | 8 | | 8 | 8 | | 4 | 4 | |
| | | | | | | TOP THICK'S (t) | 6¾ | 7 | 5½ | 5¾ | 6 | 4¾ | 4¾ | 5 | 3¾ | 3¼ | 3½ | 2¾ |
| | | 9. | MULTI-TEE UNITS |  | CONCRETE TYPE I II & III ⓐ ⓑ ⓒ ⓓ ⓔ ⓚ | AVE. COVER | BY TEST OR LISTING BY APPROVED TESTING LAB. | | | | | | 2 | 1¾ | 1½ | 1¾ | 1½ | 1½ |
| | | | | | | AVE. WEB TH. (w) | | | | | | | 4 | 4 | 2½ | 2½ | 2½ | 2½ |
| | | | | | | TOP THICK'S (t) | | | | | | | 4¾ | 5 | 3¾ | 3¼ | 3½ | 2¾ |
| | | 10. | SOLID & CORED SLABS |  | CONCRETE TYPE I II & III ⓐ ⓑ ⓒ ⓓ ⓔ ⓗ ⓚ | $t_1$ OR $t_2$ | 6¾ | 7 | 5½ | 5¾ | 6 | 4 | 4¾ | 5 | 3¾ | 3¼ | 3½ | 2¾ |
| | | | | | | AVE. COVER | 2½ | | 2¼ | 2 | | 1¾ | 1¾ | | 1½ | 1 | | 1 |
| | MASONRY BEARING AND NON BEARING | 11. | UNREINFORCED CONCRETE WALLS & PARTITIONS |  | CONCRETE TYPE I II & III ⓐ ⓜ | WALL TH. (t) | 6 | 6½ | 5 | 5 | 5½ | 4½ | 4 | 4½ | 4 | 3 | 3 | 3 |
| | | 12. | HOLLOW MASONRY WALLS & PARTITIONS...BLOCK TILE CORED BRICKS CAVITY WALLS |  | MASONRY TYPE I | EQUIV. THICK'S. | 6.7 | | | 5.7 | | | 4.5 | | | 3.0 | | |
| | | | | | MASONRY TYPE II ⓕ ⓖ ⓜ | EQUIV. THICK'S. | 5.7 | | | 4.8 | | | 3.8 | | | 2.6 | | |
| | | 13. | SOLID MASONRY BRICK BLOCK...CLAY TILE WITH LESS THAN 25% VOIDS OR WITH THE CORES FILLED |  | MASONRY TYPE I & II CLAY, SHALE, CONCRETE, SAND OR LIME ⓜ | WALL TH. (t) | 8" | | | 8" | | | 8" | | | 4" | | |
| COMPONENTS WITH DIRECT APPLIED PROTECTION | STEEL | 14. | COLUMNS |  | CONCRETE TYPE I II & III ⓐ ⓟ | THICKNESS OF (t) PROTECTION | I 2 | II 2½ | III | I 1½ | II 2 | III | I 1 | II 1½ | III | I 1 | II 1 | III |
| | | | | | SOLID MASONRY ⓘ | | 3¾ | 3¾ | | 3¾ | 3¾ | | 2¼ | 2¼ | | 2¼ | 2¼ | |
| | | 15. | GIRDERS...BEAMS...TRUSSES |  | CONCRETE TYPE I II & III ⓐ ⓟ | THICKNESS OF (t) PROTECTION | I 2 | II 2½ | III | I 1½ | II 2 | III | I 1 | II 1½ | III | I 1 | II 1 | III |
| | | | COLUMNS...BEAMS...GIRDERS...TRUSSES...JOISTS & STEEL | | SPRAYED FIBER...CEMENTITIOUS MIXTURE...INTUMESCENT | | BY TESTS...OR LISTING BY | | | | | | | | | | | |

# TYPICAL EXAMPLES OF FIRE RESISTIVE STRUCTURAL COMPONENTS, TABLE 2 (CON'T.)

| TYPE OF CONSTRUCTION | | ROW NO. | STRUCTURAL COMPONENTS | SKETCHES | INSULATING MATERIAL | DESCRIPTION | MINIMUM REQUIREMENTS 4 HR. | 3 HR. | 2 HR. | 1 HR. |
|---|---|---|---|---|---|---|---|---|---|---|
| COMPONENTS WITH SUSPENDED OR ATTACHED PROTECTION | CONC. | 17. | CONCRETE JOISTS OR WAFFLE |  | ⓐ ⓒ ⓓ CONCRETE TYPE I, II OR III 3/4" COVER | 't's THICK OF SLAB | 3" | 2" | | |
| | | | | | VERMICULITE...GYPSUM...OR PERLITE GYPSUM ON METAL LATH | 'ti THICK OF INSULATION | 1" | 3/4" | | |
| | STEEL FRAMING | 18. | STEEL COLUMNS |  | TYPE I & II MASONRY ⓕ 1 1/2" AIR SPACE ⓙ | THICK OF INSULATION | 4" SOLID | | | |
| | | 19. | STEEL GIRDERS...BEAMS... TRUSSES...JOISTS, COLUMNS INDIVIDUALLY PROTECTED |  | SPRAYED FIBRE...CEMENTITIOUS MIXTURE...LATH & PLASTER | | BY TESTS...OR APPROVED TESTING LAB. | | LISTING | BY |
| | | 20. | STEEL BEAMS, GIRDERS, TRUSSES & JOISTS...W/CEILING PROTECTION & MINIMUM 2 1/2" TH. TYPE I, II OR III CONCRETE SLAB ⓐ ⓒ ⓓ |  | SPRAYED FIBRE...CEMENTITIOUS MIXTURE...LATH & PLASTER ACOUSTICAL TILE | | BY TESTS...OR APPROVED TESTING LAB. | | LISTING | BY |
| | | 21. | STEEL STUD PARTITION NON BEARING |  | GYPSUM...PERLITE PLASTER ON PERFORATED GYP. LATH...2 1/2" STUD | 'tp PLASTER 'ti LATH | | | 3/4" / 3/8" | 1/2" / 3/8" |
| | | | | | GYPSUM WALL BOARD...3 5/8" STUD | NO. LAYERS THICK. EACH | | | TWO 5/8" | ONE 5/8" |
| | COMBUSTIBLE CONSTRUCTION | 22. | WOOD JOISTS MIN. 2" X 10", WOOD FLOOR ATTACHED CEILING |  | GYPSUM WALL BOARD...2-2" X 10"s-4'-0"c, 11/8" PLYWOOD FLOORING | 't'i INSUL. | | | | 5/8" |
| | | | | | GYP. WALL BOARD...2"X 10"s 16"c 1/2" PLYWOOD OR 1" X 6" T. & G. SUB-FLR'G | 't'i INSUL. 'tf FLOORING | | | | 5/8" 5/8" PLYWOOD OR 1" X 3" T. & G. |
| | | 23. | WOOD JOISTS MIN. 2" X 10", WOOD FLOOR SUSPENDED CEILING |  | NON COMBUSTIBLE 2"X 10" 16"c ACOUSTICAL TILE W/5/8" PLYWOOD | 't'i INSUL. | | | | 5/8" 1/2" PLYW'D |
| | | | | | OR 1" X 4" T. & G. SUB FLOORING | 'tf FLOORING | | | | OR 1" X 6" T. & G. |
| | | 24. | WOOD STUD PARTITION MIN. 2" X 4" STUD |  | GYPSUM WALLBOARD | NO. LAYERS / TH. OF EACH | | | TWO 5/8" | TWO 3/8" |
| | | | | | GYPSUM PERLITE PLASTER ON 3/8" GYPSUM LATH | tp | | | 1" PLASTER W/1" HEX. MESH | 9/16" |
| | | | | | GYPSUM & SAND PLASTER ON U.L. LISTED WIRE LATH | tt | | | | 3/4" |
| | | | | | GYPSUM & VERMICULITE PLASTER ON METAL LATH | tt | | | | 3/4" |

## ⓛ HEAVY TIMBER CONSTRUCTION TABLE

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| HEAVY TIMBER SOLID OR LAMINATED | | 25. | COLUMNS |  | WOOD ALL SPECIES | FLOOR...WIDTH X DEPTH MIN. NOM. | | | | 8" X 8" |
| | | | | | | ROOF...WIDTH X DEPTH MIN. NOM. | | | | 6" X 8" |
| | | 26. | GIRDERS & BEAMS |  | WOOD ALL SPECIES | MIN. WIDTH X DEPTH (NOM.) | | | | 6" X 10" |
| | | 27. | ARCH & TRUSS FOR ROOF ONLY |  | WOOD ALL SPECIES | MIN. WIDTH X DEPTH EACH MEMBER | | | | 4" X 6" |
| | | 28. | FLOOR & ROOF DECK |  | WOOD ALL SPECIES | ROOF | | | | 2" T. & G. OR 3" SOLID |
| | | | | | | FLOOR | | | | 3" T. & G. + 1" T. & G. OR 4" SOLID |

(i) Clay, shale, concrete or sand lime—with less than 25% voids or with all spaces filled.

(j) 1½ inch space between column and masonry unit—no fill required.

(k) For restrained conditions, thickness of fire protection may be reduced if substantiated by test data or calculation method.

(l) Elements with this minimum size are recognized for heavy timber construction, acceptable for certain buildings in lieu of one hour noncombustible construction.

(m) Where combustible members are framed into a wall, the wall shall be of such thickness or be so constructed that the fire barrier between the member and the opposite face of the wall, or between adjacent members set in from opposite sides will be 93% of the equivalent thickness shown in table 2.

(n) Cover thickness on reinforcing steel as indicated is based on continuity of system. For simple span conditions increase cover thickness by 50%.

(p) Wire mesh reinforced and with a minimum area of 0.015 inches square per foot of length or equivalent.

**History:** Cr. Register, February, 1971, No. 182, eff. 7–1–71; r. eff. 8–1–71, and recr. eff. 1–1–72, Register, July, 1971, No. 187; am. (1) (f), Register, March, 1972, No. 195, eff. 4–1–72.

**Ind 51.046 Calculation method.** (1) The rational design of structural members for fire resistance shall be submitted to the department and shall be based on the type of span (simple or restrained), the magnitude of longitudinal restraint, accepted structural engineering principals and methods.

(a) Appropriate research data and design criteria to substantiate the method, interpreting between known information, shall accompany the above material and shall include:

1. Time—temperature relationship ASTM E–119.

2. The temperature—strength characteristics of the structural components.

3. The time—temperature characteristics of the insulating material, at temperature range designated by ASTM E–119.

4. The expansion characteristics of the materials comprising the member, at the temperature range designated by ASTM E–119.

**Note:** 1. For ASTM E–119 standard adopted see Ind 51.25 (49).

2. The department will accept published research data from Portland Cement Association, American Iron & Steel Institute, and American Institute of Steel Construction, Inc.

5. The safety factor of not less than 1.0 shall be maintained at the end of the time requirement for the full design live and dead load.

**History:** Cr. Register, February, 1971, No. 182, eff. 7–1–71; r. eff. 8–1–71, and recr. eff. 1–1–72, Register, July, 1971, No. 187.

**Ind 51.047 Openings in fire rated construction.** (1) Openings in fire-rated construction, where permitted by other sections of the code, shall satisfy the following appropriate requirements unless otherwise exempted.

* See Appendix A for further explanatory material.

(a) *Fire door assemblies.* 1. Openings. a. All openings in 3- and 4-hour fire-resistive walls shall be protected with not less than 3-hour rated doors.

b. All openings in 2-hour fire-resistive walls shall be protected with not less than 1½-hour rated doors.

c. All openings in one-hour fire-resistive walls, including openings to exterior fire escapes, shall be protected with not less than ¾-hour rated doors.

d. All openings in ¾-hour fire-resistive walls shall be protected with not less than ¾-hour rated doors.

e. Where the occupancy or class of construction chapters of this code permit, fire door assemblies with a 20-minute rating, or equivalent, may be provided, without a closing device.

**Note:** The department will accept fire door assemblies which are time rated and labeled by an approved laboratory, and tested in accordance with ASTM E–152 standard method [Ind 51.25 (52)] or solid core door assemblies approved by the department.

2. The door assemblies shall be installed with frame, hinges, latches, closing devices and counterweights in accordance with methods and standards approved by the department.

3. Methods of securing door frame to adjacent construction shall be illustrated on the plans submitted to the department for approval.

**NOTE:** The department will accept recommended practices for installation covered in "Standard for Fire Door and Windows" N.F.P.A. No. 80.

4. The maximum swinging door clearances to frame shall be ⅛ inch on sides and top and ¾ inch at bottom between sill or floor.

5. All labeled fire doors where required shall be equipped with an approved closing device.

a. Doors with self-closing device shall remain in a closed position except when in use.

**NOTE:** The intent was to accept normal usage of door but not permit doors with this device to be blocked open at any time.

b. Where a pilot weight is used, it shall be suspended from a chain or wire cable and shall be installed in a protective housing.

**NOTE:** For type of closing device permitted please refer to chapters for classes of construction and/or occupancy.

6. Adequate clearance shall be maintained to permit free operation of fire doors.

**Note:** 1. See secton Ind 51.15 for exit door requirements.

2. Transoms, vision panels and/or louvers may be incorporated if tested in accordance with ASTM E–152 standard method.

(b) *Fire window assemblies.** 1. Openings. Where openings are permitted in fire rated walls protected with fire window assemblies they shall be time rated as ¾ hour by an approved laboratory and tested in accordance with ASTM E–163 standard method.

**Note:** For ASTM E–163 standard adopted see section Ind 51.25 (53).

2. *Size.* The fire window assembly size shall not exceed size tested. Windows combined in multiple assemblies shall be separated by approved nonbearing metal mullions.

3. *Wired Glass.* Labeled wired glass ¼ inch thick shall be installed in a fire window assembly.

***NOTE:** Fire windows have been classified for either moderate or light fire exposure. For moderate fire exposure the individual glass size

* See Appendix A for further explanatory material.

is limited to 720 sq. inches. (Size limitation either 48 inch max. width or 54 inch max. height.) For light fire exposure the individual glass size is limited to 1,296 sq. inches. (Size limitation either 54 inch max. width or 54 inch max. height.) Please refer to chapters for classes of construction and/or occupancy for fire window classifications.

4. *Installation.** a. Frames shall be securely fastened to the construction and be capable of resisting all wind stresses and other stresses to which they are likely to be subjected.

b. The wired glass shall be well bedded in approved glazing compound and all exposed joints between the metal shall be struck and pointed. The clearance between the edges of the glass and metal framing shall not exceed ⅛ inch.

***NOTE:** The department will accept recommended practices for installation covered in "Standard for Fire Doors and Windows" N.F.P.A. No. 80.

(c) *Glass block.* 1. *Openings.* Where openings are permitted in fire rated walls protected with glass block they shall be time rated as ¾ hour by an approved laboratory and tested in accordance with ASTM E–163 standard method.

**Note:** For ASTM E–163 standard adopted see section Ind 51.25 (53).

2. *Size of opening.* Glass blocks are suitable for openings not exceeding 120 square feet in area, with neither the width nor height exceeding 12 feet.

3. *Installation.*

**NOTE:** The department will accept recommended practices for installation covered in "Standard for Fire Doors and Windows" N.F.P.A. No. 80.

(d) *Labels.* 1. The label shall identify the time rating for fire door assemblies and class of fire window assemblies and glass block.

2. The label shall identify the testing laboratory, listing agency and manufacturer.

3. The label shall be securely attached and located to permit visual inspection after installation.

(e) *Miscellaneous openings.* 1. Openings around ducts, pipes, conduit or other service installations penetrating required fire-resistive rated floor, wall and roof assemblies shall be filled solidly with material of fire-resistive rating equal to the required rating of assembly penetrated.

2. Duct openings in required fire-resistive rated floor and wall assemblies shall be protected as specified under section Ind 59.69 (13).

**History:** Cr. Register, February, 1971, No. 182, eff. 7–1–71; r. eff. 8–1–71 and recr. eff. 1–1–72, Register, July, 1971, No. 187; am. (1) (intro.), r. and recr. (1) (a) 1., Register, September, 1973, No. 213, eff. 10–1–73; cr. (1) (a) 1 e, Register, December, 1974, No. 228, eff. 1–1–75.

**Ind 51.048 Roof coverings.** (1) Roof coverings of class A, B, C or unclassified shall be provided as specified under "Classes of Construction" or under the specific occupancy requirements.

**NOTE:** Brick, concrete, tile, slate, ferrous and cupreous metals and their alloys will be accepted as "Class A" roof coverings.

**History:** Cr. Register, February, 1971, No. 182, eff. 7–1–71; r. eff. 8–1–71, and recr. eff. 1–1–72, Register, July, 1971, No. 187.

**Ind 51.08 Occupancy separations.** (1) When a building is used for more than one occupancy purpose, each part of the building comprising a distinct occupancy division shall be separated from any

* See Appendix A for further explanatory material.

other occupancy division as provided for under the occupancy requirements of this code.

(2) Occupancy separations shall be classed as "Absolute", "Special" and "Ordinary" and shall apply to both horizontal and vertical separations.

(a) An absolute occupancy separation shall have no openings therein and shall have walls and floors of not less than 4-hour fire-resistive construction as specified in section Ind 51.04.*

(b) A special occupancy separation shall have walls and floors of not less than 3-hour fire-resistive construction as specified in section Ind 51.04.* All openings in walls forming such separation shall be protected on each side thereof by self-closing fire-resistive doors as specified in section Ind 51.047,* and such doors shall be kept normally closed. The total width of all openings in any such separating wall in any one story shall not exceed 25% of the length of the wall in that story and no single opening shall have an area greater than 120 square feet.

1. All openings in floors forming this type of separation shall be protected by vertical enclosures extending above and below such openings. The walls of such vertical enclosures shall be of not less than 2-hour fire-resistive construction as specified in section Ind 51.04* and all openings therein shall be protected on one side thereof by self-closing 1-hour fire-resistive doors as specified in section Ind 51.047* and such doors shall be kept normally closed.

(c) An ordinary occupancy separation shall have walls and floors of not less than 1-hour fire-resistive construction as specified in section Ind 51.04.* All openings in such separations shall be protected by self-closing fire-resistive doors as specified in section Ind 51.047* and such doors shall be kept normally closed.

**History:** 1–2–56; r. and recr. (2) (c), Register, October, 1967, No. 142, eff. 11–1–67; am. (2) (a), (b) and (c), Register, February, 1971, No. 182, eff. 7–1–71; r. and recr. (2) (a), (b) and (c) eff. 8–1–71 and expiring 1–1–72 and cr. (2) (a), (b) and (c) eff. 1–1–72, Register, July, 1971, No. 187.

**Ind 51.14 Glazing.** (1) SAFETY GLAZING. All glazing material used in hazardous impact locations shall be safety glazing material.

(a) *Location.* Hazardous impact locations are all glazed elements such as framed or unframed interior or exterior glass doors, glazed panels adjacent to interior or exterior doors, exterior doors with glass lights, or any other glazed element which may be mistaken for a means of egress or ingress to a room or building. Other hazardous impact locations are sliding glazed doors and the adjacent glazed fixed panel(s), storm doors, shower doors, tub enclosures, and display cases in areas of human impact in schools.

(b) *Material.* Safety glazing means any glazing material such as tempered glass, laminated glass, wire glass, safety plastic, or safety insulating units which meet the test requirements of the American National Standards Institute (ANSI) standard Z 97.1 [Ind 51.27* (5)], or an equivalent standard, and which are so constructed, treated or combined with other materials to minimize the likelihood of cutting

* See Appendix A for further explanatory material.

and piercing injuries resulting from human impact with the glazing material.

(c) *Labeling.* Safety glazing material shall be labeled with a permanent label by such means as etching, sand blasting, firing of ceramic material, or hot die stamping. Labels identifying safety glazing materials may be omitted provided that a notarized affidavit is submitted to the department certifying the installation of safety glazing material. The label or affidavit shall identify the seller, manufacturer, fabricator, or installer, the nominal thickness and type of safety glazing material, and the fact that the material meets the test requirements of the American National Standards Institute (ANSI) standard Z 97.1 [Ind 51.27 (5)], or other equivalent standard. The label shall be legible and visible after installation.

(2) GUARDING OF GLAZING. All interior and exterior glazed panels subject to human impact not in a hazardous impact location shall be guarded or provided with safety glazing, except that glazed panels with a sill height of more than 24 inches, or glazed panels less than 12 inches in width, are not required to be safety glazed or guarded.

(a) Guarding shall consist of a horizontal bar, rail, mullion, grille or screen at least 1½ inches wide and located within 3 feet 6 inches to 4 feet 6 inches above the floor. The guard assembly shall be capable of withstanding a lateral force of 100 pounds applied at any point and installed to avoid contact with the glazing when the force is applied.

(b) Safety glazing materials shall conform with the requirements of Ind 51.14 (1) (b).

(3) INTERIOR DOORS WITH GLASS LIGHTS. (a) All interior doors with glass lights greater than 8 inches in the least dimension shall be provided with safety glazing material.

(b) All interior doors with glass lights less than 8 inches in the least dimension shall be provided with ¼-inch glazing material.

(c) Safety glazing materials shall conform with the requirements of Ind 51.14 (1) (b).

(4) SKYLIGHTS AND SLOPED GLAZING. (a) *Skylights.* All glazing in skylights shall be safety glazing material and shall comply with the requirements of Ind 51.02 (6).

(b) *Sloped glazing.* All glazing installed more than 15° with the vertical shall be safety glazing material.

(5) FIRE WINDOW ASSEMBLIES. All glazing in fire window assemblies shall be designed and installed in accordance with the requirements of Ind 51.047 (1) (b).

(6) STRUCTURAL REQUIREMENT. Glazing material shall be designed and installed to safely withstand the loads specified in chapter Ind 53 of this code.

**History:** Cr. Register, December, 1974, No. 228, eff. 1-1-75.

*See Appendix A for further explanatory material.

**Ind 51.15 Standard exit.** (1) Every door which serves as a required exit from a public passageway, stairway or building shall be a standard exit door unless exempted by the occupancy requirements of this code.

**Note:** For required exits see Wis. Adm. Code sections Ind 54.06, 55.10, 56.08 and 57.09.

(2) Every standard exit door shall swing outward or toward the natural means of egress (except as below). It shall be level with the floor, and shall be so hung that, when open, it will not block any part of the required width of any other doorway, passageway, stairway or fire escape. No revolving door, and no sliding door except where it opens onto a stairway enclosure or serves as a horizontal exit, shall be considered as a standard exit door.

(3) A standard exit door shall have such fastenings or hardware that it can be opened from the inside by pushing against a single bar or plate or turning a single knob or handle.

(a) The use of a key for opening door from the inside is prohibited.

1. *Exception:* Upon written request by the owner, key-locking, or securing, of exits may be approved in fire-resistive buildings, or parts of fire-resistive buildings, accommodating occupants who must be detained in order to protect the occupants or the public from physical harm.

*Note #1:* Subsection Ind 51.15 (3) (a) 1. is intended to apply only to jails, prisons, mental institutions, asylums, nursing homes with senile patients, and similar type occupancies.

*Note #2:* The owner's request should include the following considerations: accessibility of keys to the fire department and staff personnel for the locked areas; electrical devices which release the locks; and 24-hour supervision of the locked areas by personnel who carry keys for the locked areas while on duty. Electrical devices which release the locks upon power failure or upon activation of the fire alarm or sprinkler system or the product of combustion detectors should be considered for securing of exits in nursing homes.

*Note #3:* Written approval to lock exits must also be obtained from the department of health and social services in accordance with the rules of that department.

(b) The door shall not be barred, bolted or chained at any time.

1. *Exception:* When authorized persons (employes, frequenters, patrons, etc.) are not present, the exit door may be secured by the use of a single bar or bolt.

*Note:* The intent of this rule is to prohibit padlocks or use of a key to open a door or lock at any time. The bar and bolt exception is to give added security against intruders from the outside while protecting persons in the building from being trapped.

(4) A standard exit doorway shall not be less than 6 feet 4 inches high by 3 feet 4 inches wide, except where especially provided under occupancy classifications and in Wis. Adm. Code section Ind 51.20. Where double doors are provided with or without mullions, the width of each single door may be reduced to 2 feet 6 inches.

(5) All exit doors, unless otherwise exempted by the occupancy requirements of this code, shall be plainly marked by a red illuminated translucent exit sign bearing the word EXIT or OUT in

*See Appendix A for further explanatory material.

plain letters not less than 5 inches in height and in such other places as may be necessary to direct the occupants to exit doorways.

(6) * REQUIRED AGGREGATE WIDTH. (a) The required aggregate width of exits from a level shall be determined by using the full occupant load of that level, plus the percentage effects of the occupant loads of adjacent levels (above and below) which exit through it as follows:

1. 50% of the occupant load of each first-adjacent level (s);

2. 25% of the occupant load of each second-adjacent level (s).

(b) The width shall be based upon the following ratios:

1. Types No. 1 through No. 4 construction unsprinklered, 40 inches per 100 persons;

2. Types No. 5 through No. 8 construction unsprinklered, 50 inches per 100 persons;

3. Types No. 1 through No. 4 construction sprinklered, 30 inches per 100 persons;

4. Types No. 5 through No. 8 construction sprinklered, 40 inches per 100 persons.

**History:** 1-2-56; am. Register, December, 1962, No. 84, eff. 1-1-63; am. (5) and cr. (7), Register, November, 1963, No. 95, eff. 12-1-63; r. and recr., Register, October, 1967, No. 142, eff. 11-1-67; am. (7) (j), Register, May, 1968, No. 149, eff. 6-1-68; r. and recr. (7), Register, December, 1970, No. 180, eff. 1-1-71; r. and recr. (3), Register, February, 1971, No. 182, eff. 3-1-71; am. (7) (a) 1., Register, September, 1973, No. 213, eff. 10-1-73; r. (7), r. and recr. (6), Register, December, 1974, No. 228, eff. 1-1-75; cr. (3) (a) 1. and (3) (b) 1., Register, November, 1975, No. 239, eff. 12-1-75.

**Ind 51.16 Stairways.** (1) DEFINITION. A stairway is one or more flights of steps, and the necessary platforms or landings connecting

*See Appendix A for further explanatory material.

them, to form a continuous passage from one elevation to another, including exterior porches, platforms and steps providing means of ingress or egress.

(2) REQUIRED AGGREGATE WIDTH. (a) The required aggregate width of stairway exits from any level shall be as determined in accordance with the requirements of Ind 51.15 (6).

(b) In no case shall the minimum width of an exit stair be less than that specified in Ind 51.16 (3).

(c) Under no circumstances shall stairways decrease in width in the line of travel toward the exit.

(3) MINIMUM WIDTH. (a) Every required exit stairway shall be not less than 3 feet 8 inches wide, except as provided in the occupancy chapters, of which not more than 4 inches on each side may be occupied by a handrail. The clear dimension between handrails, or stringers, shall not be less than 3 feet 0 inches.

(b) Nonrequired stairways need not conform to the width requirements of this code.

(4) RISERS AND TREADS. Risers and treads shall be designed and provided in accordance with the following:

(a) All stairways and steps required as exits by this code shall have a rise of not more than 7¾ inches and a tread not less than 9½ inches, measured from tread to tread and from riser to riser. Treads and risers shall be uniform in any one flight. Winders shall not be used.

**Note #1:** The department recommends that steps be proportioned so the sum of 2 risers and a tread, exclusive of its nosing or projection, should be not less than 24 inches or more than 25 inches.

**Note #2:** The department will accept stairways not normally used by the public to be designed with uniform risers not more than 8 inches in height and a uniform tread of not less than 9 inches. Winders may be used if the tread is at least 7 inches in width at a point one foot from the narrow end.

**Note #3:** Round or smooth nosings are recommended as they are not difficult to negotiate for individuals with restrictions in the knee, ankle or hip, or with artificial legs or long leg braces.

(b) The edges of all treads and the edges of all stairway landings shall be finished with a nonslippery surface not less than 3 inches in width.

(c) Where an exit door leads to an outside platform or sidewalk, the level of the platform or sidewalk shall not be more than 7¾ inches below the doorsill.

(d) Every stairway flight shall have at least 3 risers (unless additional safety is provided which meets the approval of the department).

(e) There shall be no more than 22 risers in any one flight.

(5) HANDRAILS. Handrails shall be designed and provided in accordance with the following:

(a) All stairways of more than 3 risers shall have one handrail on the left side as one mounts the stairs, and on the open side, if any. Stairways and steps 5 feet, or more, in width shall have a handrail on each side. One handrail shall extend at least 6 inches beyond the top and bottom riser.

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* See Appendix A for further explanatory material.

**Note:** The handrail extension is intended for support prior to ascending or descending the stairs. The ends of the rails should not constitute a projecting hazard.

(b) Stairways which are more than 8 feet wide shall be divided by center handrails into widths of not more than 8 feet nor less than 3 feet 8 inches.

(c) Exterior stairways with more than 3 risers, and an integral part of the building, shall have a handrail on each side. Exterior stairways more than 50 feet wide shall be provided with one or more intermediate handrails.

(d) Handrails shall be not less than 2 feet 6 inches above the nose of the treads on stairways and 3 feet 6 inches above platforms, walks, balconies and mezzanines.

(e) All railings shall be designed to withstand a load of at least 200 pounds applied in any direction at any point.

(f) Railings guarding differences of elevation (i.e., open sides of stairways, elevated platforms, walks, balconies, mezzanines) shall be designed to prevent the passage of an object with a diameter larger than 9 inches.

**Note:** The requirement of 9 inches is not intended to apply to utility stairs, utility exit stairs, storage mezzanines and platforms. In such cases, an intermediate rail(s) at mid height, or its equivalent in safety, will be accepted.

(6) TOEBOARDS. A toeboard shall be provided at exposed edges of all elevated platforms, walks, balconies, mezzanines, ramps and floor openings to prevent the fall of materials. The toeboard shall extend 4 inches above the finished floor. Where material is stockpiled to a height where the toeboard does not provide adequate protection, additional measures shall be taken to prevent the fall of materials.

(7) HEADROOM. Every stairway shall be provided with a headroom clearance of not less than 7 feet 0 inches. The clearance shall be established by measuring vertically from the edge of the tread nosing to the ceiling or soffit above the tread nosing.

(8) STAIRWAY LANDINGS AND PLATFORMS. (a) If a door is provided at the head and/or foot of a stairway, a landing or platform shall be placed between the door and the stairway regardless of the direction of swing of the door.

(b) Every landing or platform shall be at least as wide as the stairway, measured at right angles to the direction of travel. Every landing or platform must have a length of at least 3 feet, measured in the direction of travel.

(9) CURVED STAIRS. Interior or exterior curved stairs used as required exits shall meet all the requirements for stairways. Curved stairs shall have a radius of at least 25 feet at the interior edge of the tread.

**History: 1–2–56; am. (2); (2) (a); (2) (b); Register, June, 1956, No. 6, eff. 7–1–56; r. and recr. Register, September, 1959, No. 45, eff. 10–1–59; r. (4) (b), renum. (c) to be (b), and cr. (5), Register, February, 1971, No. 182, eff. 3–1–71; am. (2) (a), Register, September, 1973, No. 213, eff. 10–1–73; r. and recr. Register, December, 1974, No. 228, eff. 1–1–75.**

**Ind 51.17 Smokeproof stair tower.** (1) A smokeproof stair tower

* See Appendix A for further explanatory material.

shall be an enclosed stairway which is entirely cut off from the building and which is reached by means of open balconies or platforms. The stairways, landings, platforms and balconies shall be of noncombustible material throughout. The enclosing walls shall be of not less than 4-hour fire-resistive construction, and the floors and ceilings of not less than 2-hour fire-resistive construction as specified in section Ind 51.04.

(2) The doors leading from the buildings to the balconies and from the balconies to the stairways shall be fire-resistive doors, and all openings within 10 feet of any building shall be protected with fire-resistive windows for moderate fire exposure, or fire-resistive doors as specified in section Ind 51.047.

(3) Each balcony shall be open on at least one side, with a railing not less than 3'6" high on all open sides.

**History:** 1-2-56; am. Register, December, 1962, No. 84, eff. 1-1-63; am. (1) and (2), Register, February, 1971, No. 182, eff. 7-1-71; r. and recr. (1) and (2) eff. 8-1-71 and exp. 1-1-72, and cr. (1) and (2) eff. 1-1-72, Register, July, 1971, No. 187; am. (2), Register, June, 1972, No. 198, eff. 7-1-72.

**Ind 51.18 Interior enclosed stairway.** (1) An interior enclosed stairway shall be completely enclosed as specified in table 51.03-A, and all doors opening into such enclosure shall be as specified in section Ind 51.047.

(2) The enclosure shall include at each floor level a portion of such floor which will be at least as wide as the stairway; and such enclosure shall also include the passageway of the first floor level (if any) leading from the stairway to an outside door, so as to afford uninterrupted passage from the uppermost floor to such outside door without leaving the enclosure.

(3) If windows are placed in any such enclosure they shall be fixed fire-resistive windows as specified in section Ind 51.047 except in outside walls.

**History:** 1-2-56; am. (1) and (3), Register, February, 1971, No. 182, eff. 7-1-71; r. and recr. (1) and (3), eff. 8-1-71 and exp. 1-1-72, and cr. (1) and (3), eff. 1-1-72, Register, July, 1971, No. 187; r. and recr. (1), Register, June, 1972, No. 198, eff. 1-1-73

**Ind 51.19 Horizontal exit.** (1) A horizontal exit shall consist of one or more openings through or around an exterior wall or occupancy separation, or of one or more bridges or balconies connecting 2 buildings or parts of buildings entirely separated by occupancy separations as described in section Ind 51.08.

(2) Openings used in connection with horizontal exits shall be protected by fire-resistive doors as specified in section Ind 51.047. If swinging doors are installed in pairs, they shall be arranged to swing in opposite directions; with direction of travel indicated by signs, except that where the travel is in one direction only, both doors shall swing in that direction. Such doors shall be kept continuously unlocked whenever the building is occupied and be normally closed or be self-closing and equipped with fusible links.

(3) Floors in horizontal exits shall have a slope of not more than one foot in 6.

* See Appendix A for further explanatory material.

(4) All doors and windows within 10 feet of any balcony or bridge shall be fire-resistive windows for moderate fire exposure or fire-resistive doors as specified in section Ind 51.047, except that if such windows or doors are in the same plane, this requirement shall apply only to those within 5 feet of the balcony or bridge.

(5) The floor on each side of a horizontal exit and all passageways leading thereto shall be kept clear and unobstructed at all times.

History: 1–2–56; am. (2) and (4), Register, February, 1971, No. 182, eff. 7–1–71; r. and recr. (2) and (4) eff. 8–1–71 and exp. 1–1–72, and cr. (2) and (4) eff. 1–1–72, Register, July, 1971, No. 187; am. (4) Register, June, 1972, No. 198, eff. 7–1–72

**Ind 51.20 Fire escapes.** (1) LOCATION. Every fire escape shall be so located as to lead directly to a street, alley, or open court connected with a street.

(a) Every fire escape shall be placed against a blank wall if possible. If such a location is not possible then every wall opening which is less than 6 feet distant horizontally from any tread or platform of the fire escape shall be protected by a fire-resistive window for moderate fire exposure or by a fire-resistive door as specified in section Ind 51.047.

(2) EXITS TO FIRE ESCAPES. Every fire escape shall be accessible from a public passageway or shall be directly accessible from each occupied room. Exits to fire escapes shall be standard exit doors as specified in section Ind 51.15, except that doors to "A" fire escapes may be not less than 2 feet 6 inches wide.

(3) DESIGN AND FABRICATION. Each part of every fire escape (except counterweights for balanced stairways) shall be designed and constructed to carry a live load of 100 pounds per square foot of horizontal area over the entire fire escape. Each part of every fire escape shall be designed and constructed in accordance with the requirements of section Ind 53.50, except that the unit stresses therein specified shall be reduced by one-fourth. The minimum sections and sizes specified below shall be increased whenever necessary so that under full load the allowable unit stresses will not be exceeded.

(a) No other material than wrought iron, soft steel or medium steel shall be used for any part of a fire escape, except for weights, separators and ornaments. No bar material less than ¼ inch thick shall be used in the construction of any fire escape, except for separators, ornaments, structural shapes over 3 inches and rigidly built up treads and platforms of approved design. In the fabrication of a fire escape, all connections or joints shall be made by riveting, bolting or welding in an approved manner. All bolts or rivets, except for ornamental work, shall be not less than ⅜ inch in diameter.

(4) PLATFORMS. Each platform on an "A" fire escape shall be at least 28 inches wide; each platform on a "B" fire escape shall be at least 3 feet 4 inches wide. Such widths shall be the clear distance between stringers, measuring at the narrowest point. Each platform shall extend at least 4 inches beyond the jambs of exit opening. The above minimum widths and lengths shall be increased, wherever necessary, so that no exit door or window will, when open, block any part

* See Appendix A for further explanatory material.

of the required width of the fire escape. Every platform shall consist of either,

(a) Flat bars on edge, not less than 1 x ¼ inch, but not less than 1¼ x ¼ inch where bolts and separators are used except that platforms and treads constructed of flat bars on edge may be made of material $\frac{3}{16}$ inch in thickness provided the material is galvanized after fabrication. Bars shall not be spaced more than 1¼ inches, center to center.

(b) ½ inch or ⅝ inch square bars with sharp edge up, not more than 1½ inches, center to center.

(c) ⅝ inch round bars, not more than 1½ inches, center to center.

(d) Platform and treads may be solid if covered by a roof.

(e) The platform frame shall consist of not less than 2 x ⅜ inch flat bars on edge or equivalent, provided the brackets are not more than 4 feet apart. If brackets are more than 4 feet apart, the frame shall be correspondingly stronger and stiffer. Every platform wider than 30 inches, if made of square or round bars, shall have a third frame bar through the center; if made of flat bars, the platform shall have separators and bolts through the center. Frame bars shall not project more than ¼ inch above platform bars, except around the outside of platform.

(f) There shall be a platform at each story above the first, and intermediate platforms if floors are more than 18 feet apart vertically.

(g) Platforms shall not be more than 8 inches below the door sill.

(5) BRACKETS. Brackets for a 28 inch or 30 inch platform, when spaced not more than 4 feet apart, shall be made of not less than ⅞ inch square bars or 1½ x 1½ x ¼ inch angles; such bars or angles shall be larger if the platform is wider or if the brackets are farther apart. Each bracket shall be fastened at the top to the wall by a through bolt (at least ⅞ inch diameter), nut, and washer (at least 4 inch diameter). The slope of the lower bracket bar shall be not less than 30 degrees with the horizontal. The lower bar shall have a washer or shoulder to give sufficient bearing against the wall.

(a) The strength of the wall to which brackets are to be attached shall be carefully considered in determining the spacing, shape and inside connection of brackets, so that under full load the wall will not be unduly strained. Where it is necessary to install brackets adjacent to wall openings they shall be located at a suitable distance therefrom, or the wall shall be properly reinforced.

(6) STAIRWAYS. (a) Each stairway of an "A" fire escape shall be at least 24 inches wide between stringers; such stairway shall have a uniform rise of not more than 8 inches and a uniform run of not less than 8 inches.

(b) Each stairway of a "B" fire escape shall be at least 3 feet 4 inches wide between stringers; such stairway shall have a uniform rise of not more than 8 inches, and a uniform run of not less than 9 inches.

1. The rise is the vertical distance from the extreme edge of any step to the corresponding extreme edge of the next step. The run is the horizontal distance between the same points.

* See Appendix A for further explanatory material.

(c) Stairway stringers shall consist of either:

1. A 5 inch channel or larger.
2. Two angles 2 x 2 x ¼ inch or larger.
3. Two flat bars 2 x ⅜ inch or larger.
4. One flat bar 6 x ¼ inch or larger.

5. If 2 angles or 2 flat bars are used, they shall be properly tied together by lattice bars, vertical as well as horizontal. If flat bars are used, every stairway of more than 10 risers shall have lateral bracing. The connection of stringers to platform, at top and bottom, shall be at least equal in strength to the stringers and shall safely carry the full live and dead loads. If stringers are carried by intermediate brackets, the stringers shall have a horizontal bearing on the brackets and shall be properly and securely connected thereto.

6. Treads shall consist of either flat or square bars, (not round), of the size and spacing specified for platforms. An "A" tread shall consist of at least 6 square bars, or 7 flat bars. A "B" tread shall consist of at least 7 square bars, or 8 flat bars. A "B" tread made of flat bars shall have separators and bolt through the center. A "B" tread made of square bars shall be trussed.

7. Treads and platforms may be solid if covered by a roof.

(7) BALANCED STAIRWAY. All "B" fire escapes, and all fire escapes on schools, theaters, assembly halls, hospitals, nursing homes, residential care institutions, group foster homes, and homes for the elderly either shall reach to the ground or shall have a balanced stairway reaching to the ground. "A" fire escapes which are not on schools, theaters, assembly halls, hospitals, nursing homes, residential care institutions, group foster homes and homes for the elderly may terminate in a platform at least 3 feet long, located not more than 10 feet above the ground and does not serve more than 8 persons.

(8) RAILINGS. A railing at least 42 inches in height and having 2 intermediate rails, uniformly spaced, measuring vertically from the floor of the platform, shall be provided on all open sides of platforms. Railings at least 36 inches in height, measuring vertically from the nose of the treads, shall be provided on the open sides of all stairways and on both sides of balanced stairways. Either a railing or a handrail fastened to the wall shall be provided on each side of all "B" fire escape stairways.

(a) Every railing shall have posts, not more than 5 feet apart made of not less than 1½ x 1½ x ¼ inch angles or tees, or 1¼ inch pipe; top rail not less than 1¼ x 1¼ x ¼ inch angle or equivalent; center rail not less than 1¼ x $\frac{5}{16}$ flat bar or equivalent. All connections shall be such as to make the railing stiff; 2 bolts (⅜ inch or larger) shall be used at the foot of each post wherever possible, or at least one ½ inch bolt shall be used. Railing shall be continuous. No projections on the inside of the railing shall be permitted. Where a railing returns to the wall, it shall be fastened thereto with a through bolt (at least ⅝ inch diameter), nut, and washer; or (in reinforced concrete) with an approved insert; or the railing shall be made equally secure with a diagonal brace extending at least 3 feet horizontally and 3 feet vertically.

(b) All outside railings which are more than 60 feet above grade

* See Appendix A for further explanatory material.

shall be at least 6 feet high, measuring vertically from floor of platform or from nose of step. Such railings shall be of special design approved by the department of industry, labor and human relations, having not less than 4 longitudinal rails, and vertical lattice bars not more than 8 inches apart, and proper stiffening braces or brackets.

(9) LADDER TO ROOF. Every fire escape which extends higher than the second floor shall be provided with a ladder leading from the upper platform to the roof, unless the fire escape stairway leads to the roof. The ladder shall have stringers not less than 1¼ inch pipe, or not less than 2 x ⅝ inch flat bars, at least 17 inches apart in the clear. The rungs shall be not less than ½ inch square or ⅝ inch round bars, 14 inches center to center. The stringers shall be securely tied together at intervals no greater than every fifth rung. The stringers of each ladder shall extend not less than 4 feet above the roof coping and return to within 2 feet of the roof, with the top rung of the ladder level with the coping.

(10) OTHER TYPES OF FIRE ESCAPES. Sliding or chute fire escapes may be used, upon the approval of the department of industry, labor and human relations, in place of "A" or "B" fire escapes. Every sliding fire escape shall be provided with a ladder constructed as in subsection Ind 51.20 (9), extending from 5 feet above grade, to 4 feet above the roof coping.

**History:** 1–2–56; am. Register, December, 1962, No. 84, eff. 1–1–63; am. (1) (a), Register, February, 1971, No. 182, eff. 7–1–71; am. (7), Register, February, 1971, No. 182, eff. 3–1–71; r. and recr. 51.20 (1) (a) eff. 8–1–71 and exp. 1–1–72 and cr. (1) (a) eff. 1–1–72, Register, July, 1971, No. 187; am. (1) (a), Register, June, 1972, No. 198, eff. 7–1–72; am. (3) (intro. par.), Register, December, 1974, No. 228, eff. 1–1–75.

**Ind 51.21 Standpipes.** (1) CLASSES OF SERVICE. Standpipe systems are designed for 2 classes of service: (a) for use by fire departments or others trained in handling heavy streams from 2½ inch hose, and (b) for use by occupants of a building on incipient fires. These are referred to in these sections as fire departments, and first aid standpipes, respectively. The features of each system may be combined in a single equipment, if served by an automatic water supply conforming to subsection (2) (g) or (h). All threads on hose and hose connections shall be interchangeable with those of the public fire department.

(2) FIRE DEPARTMENT STANDPIPES. (a) Standpipes shall be provided for all buildings exceeding 60 feet in height. Required standpipes shall be installed as construction progresses, to make them available to the fire department in the topmost floor constructed.

(b) Standpipes shall be sufficient in number so that any part of every floor area can be reached within 30 feet by a nozzle attached to 100 feet of hose connected to the standpipe. When 2 or more standpipes are required, they shall be cross connected at the bottom, and equipped with individual controlling valves located not higher than the first story.

(c) Standpipes shall be protected against mechanical and fire damage, with outlets in stairway enclosures; where stairways are not enclosed, outlets shall be at inside or outside of outside walls, within

* See Appendix A for further explanatory material.

one foot of a fire tower, interior stairway or fire escape. Dry standpipes shall be accessible for inspection and not concealed.

(d) No required standpipe shall be less than 4 inches in diameter, and not less than 6 inches in diameter for buildings exceeding 75 feet in height. Material shall be steel or wrought iron pipe with approved fittings, designed for a working pressure of 100 pounds in excess of the static pressure due to elevation. An approved 2½ inch hose valve shall be located at each story, not over 5 feet above the floor level. An approved pressure reducing device shall be installed at hose valves where the pressure would otherwise be in excess of 50 pounds. Where a standpipe is not normally under pressure, hose valves shall be equipped with a tight fitting cap on a chain and having lugs for a spanner wrench.

(e) An approved siamese connection with a check valve in each inlet shall be installed on a 4 inch pipe connecting with each standpipe system and shall be marked "To Standpipe". The elevation of the connection shall be not over 3 feet above the sidewalk or ground. An automatic drip valve shall be installed where necessary to prevent freezing. In buildings with several standpipes, more than one siamese connection may be required.

(f) Fire department standpipes need not be equipped with attached hose.

(g) Automatic water supplies will not ordinarily be required, except as provided in subsection (2) (h), or where judged necessary by reason of the high combustibility or potential hazard of the occupancy. When required, they shall be designed to provide not less than 40 pounds flowing pressure at the top outlet, with volume for two fire streams. Any of the following supplies will be acceptable:

1. Connection to city water works system when providing required minimum volume and pressure.

2. Gravity tank of not less than 3,500 gallons capacity, elevated 50 feet above the top story.

3. Pressure tank of 5,250 gallons gross capacity (3,500 gallons water capacity).

4. Automatic pump or pumps, with combined effective capacity of 500 gallons per minute.

(h) An automatic water supply from an approved fire pump shall be provided in buildings over 150 feet high, or in buildings over 10,000 square feet in area per floor and requiring a standpipe. The capacity of the pump shall be not less than 500 gallons per minute for a 4 inch standpipe, 750 gallons per minute for 2 interconnected 4 inch or single 6 inch standpipes, and 1,000 gallons per minute for larger systems.

(3) FIRST AID STANDPIPES. (a) Standpipes shall be provided as required in sections Ind 54.14, 55.33, and 57.21.

(b) Standpipes shall be sufficient in number so that any part of every floor area can be reached within 20 feet by a nozzle attached to not more than 75 feet of hose connected to a standpipe.

*Note:* Standpipe outlets should be located in occupied areas, and usually at interior columns in large area buildings. Asylums and places of detention

* See Appendix A for further explanatory material.

may require special arrangements. It should be possible in all cases to direct the stream into all important enclosures, such as closets, etc.

(c) No required standpipe shall be less than 2 inches in diameter, and not less than 2½ inches in diameter for buildings 5 stories or more in height. Material shall be wrought iron or steel and pipe and fittings shall be of suitable weight for the pressure used. An approved 1½ inch hose valve shall be located in each story, not more than 5 feet above the floor level; valves of the gate type shall be equipped with a suitable open drip connection. An approved pressure-reducing device shall be installed at hose valves where pressure would otherwise be over 50 pounds.

(d) Not more than 75 feet of hose shall be attached to each outlet. Hose shall be of unlined linen construction, 1½ inches in diameter, with a ½ inch nozzle attached, and shall be located in approved cabinets or racks.

(e) Water supply shall be automatic, and be designed for 70 gallons per minute for 30 minutes with 25 pounds flowing pressure at the top outlet. Such supply may be from city connection, gravity tank, pressure tank or pump.

*Note:* Data on the design of standpipe systems can be found in the Standards of the National Board of Fire Underwriters for the Installation of Standpipe and Hose Systems. The department of industry, labor and human relations will ordinarily approve any installation which is approved by the Underwriters.

**Ind 51.22 Fire extinguishers.** (1) Where fire extinguishers are required, they shall be of a type approved by the department of industry, labor and human relations. All fire extinguishers shall be charged in accordance with the instructions of the manufacturer.

(2) Extinguishers shall be conspicuously located where they will always be readily accessible and so distributed as to be immediately available in event of fire. They shall be hung on hangers or set on brackets or shelves so that the top of the extinguisher is not more than 5 feet above the floor.

*Note:* The department of industry, labor and human relations will ordinarily approve any extinguisher which bears the Underwriters' label and which is of the size, and suitable, for the hazard for which it is intended. Consult the department of industry, labor and human relations for lists of approved extinguishers.

**Ind 51.23 Automatic sprinklers.** (1) GENERAL REQUIREMENTS. All required automatic sprinkler systems shall be designed and constructed in accordance with NFPA No. 13, Standard for the Installation of Sprinkler Systems [Ind 51.27 (7a)*]. Reinstallation of used sprinkler heads is prohibited. Approved secondhand devices may be installed by special permission of the department.

**Note:** The department will accept equipment, materials and devices listed or labeled by Underwriters' Laboratories or Factory Mutual. Other testing laboratories or inspection agencies will be recognized as an approved agency if accepted in writing by the department.

(2) WATER SUPPLY. (a) Approved automatic water supplies for the sprinkler system recognized by the department are listed below:

1. City water main;
2. Gravity or pressure tank;
3. Ground storage reservoir;

* See Appendix A for further explanatory material.

4. Natural bodies of water approved by the department (lakes, rivers, streams, etc.).

(b) If the water supply has inadequate pressure, an approved fire pump or tank shall be provided. The design and installation of water supply facilities for gravity tanks, fire pumps, reservoirs or pressure tanks, and underground piping shall conform to NFPA No. 22, Standard for Water Tanks for Private Fire Protection; NFPA No. 20, Installation of Centrifugal Fire Pumps; and NFPA No. 24, Outside Protection [Ind 51.27 (7a)].

(3) BASEMENT SPRINKLERS. Every basement sprinkler system shall also include sprinklers in all shafts (except elevator shafts) leading to the story above.

(4) FIRE DEPARTMENT CONNECTION. Every sprinkler system shall have an approved siamese connection. The siamese connection shall be marked and readily accessible to the fire department and shall conform to the requirements of subsection Ind 51.21 (2) (e).

(5) SPRINKLER ALARMS. Every sprinkler system shall be provided with a suitable audible alarm. In all buildings over 60 feet in height, each sprinkler system on each floor shall be equipped with a separate water flow device connected to an alarm system.

(6) MAINTENANCE. All installed automatic sprinkler systems shall be properly maintained for efficient service. The employer or owner shall be responsible for the condition of his sprinkler system and shall use due diligence in keeping the system in good operating condition.

(7) PARTIAL AUTOMATIC SPRINKLER SYSTEMS. The sprinkler system shall be so installed and maintained as to provide complete coverage for all portions of the building except where partial protection is specified by this code.

**History:** 1–2–56; r. and recr. Register, December, 1974, No. 228, eff. 1–1–75.

**Ind 51.24 Fire alarm systems. Interior fire alarm systems required under Wis. Adm. Code sections Ind 54.16, 56.19 and 57.22 shall be designed and constructed in conformity with the following requirements:**

**(1) All such alarm systems shall consist of operating stations on each floor of the building, including the basement, with bells, horns, or other approved sounding devices which are effective throughout the building. The system shall be so arranged that the operation of any one station will actuate all alarm devices connected to the system except in the case of a presignal system. Fire alarms shall be readily distinguishable from any other signalling devices used in the building. A system designed for fire alarm and paging service may be used if the design is such that fire alarm signals will have precedence over all others.**

**(2) Every fire alarm system shall be electrically operated or activated by non-combustible, non-toxic gas except as provided in section Ind 56.19. Electrically operated systems shall be oper-**

* See Appendix A for further explanatory material.

ated on closed circuit current under constant electrical supervision, so arranged that upon a circuit opening and remaining open or in case of a ground or short circuit in the undergrounded conductor, audible trouble signals will be given instantly. Gas activated systems shall be mechanically supervised and under constant gas pressure, so arranged that in case of a pressure drop an audible trouble signal will be given instantly. Means shall be provided for testing purposes.

(3) In buildings more than 3 stories in height, coded fire alarm systems shall be provided, and the systems shall be so arranged that the code transmitted shall indicate the location and the story of the structure in which the signal originated.

*Exception:* (a) In apartment buildings, non-coded continuous sounding fire alarm systems under constant electrical or gas activated supervision will be approved.

(4) Operating stations shall be prominently located in an accessible position at all required exit doors and required exit stairways. Operating stations shall be of an approved type and shall be conspicuously identified. All such operating stations shall be of a type, which after being operated, will indicate that an alarm has been sent therefrom until reset by an authorized means. (Operating stations having a "Break Glass" panel will be acceptable. On coded systems having a device to permanently record the transmission of an alarm, "Open Door" type stations may be used). The fire alarm operating stations shall be mounted not less than 4 feet nor more than 5 feet above the finished floor as measured from the floor to the center of the box.

(5) All such alarm systems shall be tested at least once a week and a record of such tests shall be kept.

(6) Existing fire alarm systems that are effective in operation will be accepted if approved by the department of industry, labor and human relations.

(7) The gas for operation of non-combustible, non-toxic gas activated fire alarm systems shall be supplied from approved pressure cylinders on the premises. The cylinders shall have sufficient capacity and pressure to properly operate all sounding devices connected to the system for a period of not less than 10 minutes. Cylinders shall be removed for recharging immediately after use and shall be replaced by fully charged cylinders.

(8) Spare cylinders shall be kept on the premises at all times for immediate replacement and separate cylinders for testing shall be incorporated in the system.

(9) Tubing in connection with non-combustible, non-toxic gas activated fire alarm systems shall be installed in rigid metal conduit, flexible metal conduit, or surface metal raceways where subject to mechanical injury. Non-corrosive metallic tubing not less than 3/16" in diameter which will withstand a bursting pressure of not less than 500 pounds per square inch shall be used. The maximum length of 3/16" tubing shall not exceed 300 feet between charged cylinders. All

* See Appendix A for further explanatory material.

tubing and other component parts shall be installed by skilled workmen in accordance with the provisions of this code.

*Note:* The following sections are taken from the Wisconsin Administrative Electrical Code.

(10) The energy for the operation of electrical fire alarm systems shall be taken from sources suited to the design of the system. Batteries on systems of less than 110 volts shall not be used.

(11) A 3-wire 120–240 volt or 120–208 volt (3 phase 4 wire) service will be accepted for supervised systems provided the operating current is secured from one ungrounded conductor and the neutral, or ungrounded conductor, and the current for operating trouble signal or signals is secured from the other ungrounded conductor and the neutral or grounded conductor.

(12) Electrical wiring in connection with fire alarm systems shall be installed in rigid metal conduit, flexible metal conduit, electrical metallic tubing or surface metal raceways. Armored cable (metal) may be used where it can be fished in hollow spaces of walls or partitions in apartments or rooming houses not over 3 stories in height. Where the wiring is subject to excessive moisture or severe mechanical injury, rigid metal conduit shall be used. The smallest size conductor to be used in any fire alarm system in a building over 3 stories in height shall be No. 14 AWG or No. 16 AWG for buildings not over 3 stories in height. The wires shall be provided with insulation suitable for use on circuits not exceeding 600 volts. Fire alarm systems shall be connected to the line inside of the main service switch or to the emergency feeder through 2 single pole breakers or switches used for no other purpose and arranged so they can be locked in the "on" position, and under the supervision of a qualified person. The breaker or switches shall be identified by a red color. Two pole breakers shall not be used.

**History:** 1–2–56; am. (4) (a), Register, November, 1963, No. 95, eff. 12–1–63; am. Register, August, 1964, No. 104, eff. 9–1–64.

**Ind 51.25 Adoption of ASTM Standards.** Pursuant to section 227.025, Wis. Stats., the attorney general and the revisor of statutes have consented to the incorporation by reference of the following standards of the American Society of Testing and Materials (ASTM), 1916 Race Street, Philadelphia, Pa. 19103. Copies of the standards in reference are on file in the offices of the department, the secretary of state, and the revisor of statutes.

**Note:** Part numbers refer to 1973 set of standards.

(1) GENERAL REQUIREMENTS FOR DELIVERY OF ROLLED STEEL PLATES, SHAPES, SHEET PILING AND BARS FOR STRUCTURAL USE. Part 4 ASTM Designation A 6–72.

(2) STRUCTURAL STEEL. Part 4 ASTM Designation A 36–70a.

(3) COLD-DRAWN STEEL WIRE FOR CONCRETE REINFORCEMENT. Part 4 ASTM Designation A 82–72.

(4) ZINC-COATED (GALVANIZED) IRON OR STEEL FARMFIELD AND RAILROAD RIGHT-OF-WAY WIRE FENCING. Part 3 ASTM Designation A 116–71.

* See Appendix A for further explanatory material.

(5) ZINC COATING (HOT-DIP) ON IRON AND STEEL HARDWARE. Part 3 ASTM Designation A 153–73.

(6) DEFORMED AND PLAIN BILLET-STEEL BARS FOR CONCRETE REINFORCEMENT. Part 4 ASTM Designation A 615–72.

(7) RAIL-STEEL DEFORMED AND PLAIN BARS FOR CONCRETE REINFORCEMENT. Part 4 ASTM Designation A 616–72.

(8) AXLE-STEEL DEFORMED AND PLAIN BARS FOR CONCRETE REINFORCEMENT. Part 4 ASTM Designation A 617–72.

(9) GYPSUM. Part 9 ASTM Designation C 22–50 (1972).

(10) CHEMICAL ANALYSIS OF LIMESTONE, QUICKLIME, AND HYDRATED LIME. Part 9 ASTM Designation C 25–72.

(11) STRUCTURAL CLAY LOAD-BEARING WALL TILE. Part 12 ASTM Designation C 34–62 (1970).

(12) COMPRESSIVE STRENGTH OF CYLINDRICAL CONCRETE SPECIMENS. Part 10 ASTM Designation C 39–72.

(13) OBTAINING AND TESTING DRILLED CORES AND SAWED BEAMS OF CONCRETE. Part 10 ASTM Designation C 42–68.

(14) SAMPLING, INSPECTION, PACKING, AND MARKING OF LIME AND LIMESTONE PRODUCTS. Part 9 ASTM Designation C 50–57 (1968).

(15) GYPSUM PARTITION TILE OR BLOCK. Part 12 ASTM Designation C 52–54 (1972)

(16) CONCRETE BUILDING BRICK. Part 12 ASTM Designation C 55–71.

(17) STRUCTURAL CLAY NON-LOAD-BEARING TILE. Part 12 ASTM Designation C 56–71.

(18) STRUCTURAL CLAY FLOOR TILE. Part 12 ASTM Designation C 57–57 (1972).

(19) BUILDING BRICK (SOLID MASONRY UNITS MADE FROM CLAY OR SHALE). Part 12 ASTM Designation C 62–69.

(20) SAMPLING AND TESTING BRICK. Part 12 ASTM Designation C 67–66.

(21) HOLLOW LOAD-BEARING CONCRETE MASONRY UNITS. Part 12 ASTM Designation C 90–70.

(22) MASONRY CEMENT. Part 9 ASTM Designation C 91–71.

(23) ABSORPTION AND BULK SPECIFIC GRAVITY OF NATURAL BUILDING STONE. Part 12 ASTM Designation C 97–47 (1970).

(24) MODULUS OF RUPTURE OF NATURAL BUILDING STONE. Part 12 ASTM Designation C 99–52 (1970).

(25) PHYSICAL TESTING OF QUICKLIME AND HYDRATED LIME. Part 9 ASTM Designation C 110–71.

(26) SAMPLING AND TESTING STRUCTURAL CLAY TILE. Part 12 ASTM Designation C 112–60 (1970).

* See Appendix A for further explanatory material.

(27) Not used.

(28) SAMPLING AND TESTING CONCRETE MASONRY UNITS. Part 12 ASTM Designation C 140–70.

(29) AGGREGATE FOR MASONRY MORTAR. Part 12 ASTM Designation C 144–70.

(30) SOLID LOAD-BEARING CONCRETE MASONRY UNITS. Part 12 ASTM Designation C 145–71.

(31) PORTLAND CEMENT. Part 9 ASTM Designation C 150–73a.

(32) COMPRESSIVE STRENGTH OF NATURAL BUILDING STONE. Part 12 ASTM Designation C 170–50 (1970).

(33) HYDRATED LIME FOR MASONRY PURPOSES. Part 9 ASTM Designation C 207–49 (1968)

(34) MORTAR FOR UNIT MASONRY. Part 12 ASTM Designation C 270–71.

(35) GYPSUM CONCRETE. Part 9 ASTM Designation C 317–64 (1970).

(36) MICROSCOPICAL DETERMINATION OF AIR-VOID CONTENT AND PARAMETERS OF THE AIR-VOID SYSTEM IN HARDENED CONCRETE. Part 10 ASTM Designation C 457–71.

(37) CHEMICAL ANALYSIS OF GYPSUM AND GYPSUM PRODUCTS. Part 9 ASTM Designation C 471–72.

(38) PHYSICAL TESTING OF GYPSUM PLASTERS AND GYPSUM CONCRETE. Part 9 ASTM Designation C 472–73.

(39) PHYSICAL TESTING OF GYPSUM BOARD PRODUCTS AND GYPSUM PARTITION TILE OR BLOCK. Part 9 ASTM Designation C 473–68.

(40) MORTAR AND GROUT FOR REINFORCED MASONRY. Part 12 ASTM Designation C 476–71.

(41) HOLLOW BRICK (HOLLOW MASONRY UNITS MADE FROM CLAY OR SHALE). Part 12 ASTM Designation C 652–70.

(42) RESISTANCE OF CONCRETE TO RAPID FREEZING AND THAWING. Part 10 ASTM Designation C 666–73.

(43) ESTABLISHING STRUCTURAL GRADES AND RELATED ALLOWABLE PROPERTIES FOR VISUALLY GRADED LUMBER. Part 16 ASTM Designation D 245–70.

(44) EVALUATING THE PROPERTIES OF WOOD-BASE FIBER AND PARTICLE PANEL MATERIALS. Part 16 ASTM Designation D 1037–72a.

(45) LOAD-SETTLEMENT RELATIONSHIP FOR INDIVIDUAL PILES UNDER STATIC AXIAL LOAD. Part 11 ASTM Designation D 1143–69.

(46) CONDUCTING STRENGTH TESTS OF PANELS FOR BUILDING CONSTRUCTION. Part 14 ASTM Designation E 72–68.

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* See Appendix A for further explanatory material.

(47) SURFACE BURNING CHARACTERISTICS OF BUILDING MATERIALS. Part 14 ASTM Designation E 84–70.

(48) FIRE TESTS OF ROOF COVERINGS. Part 14 ASTM Designation E 108–58 (1970).

(49) FIRE TESTS OF BUILDING CONSTRUCTION AND MATERIALS. Part 14 ASTM Designation E 119–73.

(50) NONCOMBUSTIBILITY OF ELEMENTARY MATERIALS Part 14 ASTM Designation E 136–73.

(51) BOND STRENGTH OF MORTAR TO MASONRY UNITS. Part 14 ASTM Designation E 149–66.

(52) FIRE TESTS OF DOOR ASSEMBLIES. Part 14 ASTM Designation E 152–73.

(53) FIRE TESTS OF WINDOW ASSEMBLIES. Part 14 ASTM Designation E 163–65 (1972).

(54) COMPRESSIVE STRENGTH OF MASONRY ASSEMBLAGES. Part 14 ASTM Designation E 447–72.

**History:** Cr. Register, October, 1967, No. 142, eff. 11–1–67; cr. (88) to (93), Register, February, 1971, No. 182, eff. 7–1–71; r. (88) to (93) eff. 8–1–71 and recr. (88) to (93) eff. 1–1–72, Register, July, 1971, No. 187; r. and recr., Register, July, 1974, No. 223, eff. 1–1–75.

**Ind 51.26 Adoption of ACI Standards.** Pursuant to section 227.025, Wis. Stats., the attorney general and the revisor of statutes have consented to the incorporation by reference of the following standards of the American Concrete Institute (ACI), P. O. Box 4754, Redford Station, Detroit, Michigan 48219. Copies of the standards in reference are on file in the offices of the department, the secretary of state, and the revisor of statutes.

(1) BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE. ACI 318–71.

(2) RECOMMENDED PRACTICE FOR MANUFACTURED REINFORCED CONCRETE FLOOR AND ROOF UNITS. ACI 512–67.

(3) MINIMUM REQUIREMENTS FOR THIN-SECTION PRECAST CONCRETE CONSTRUCTION. ACI 525–63.

**History:** Cr. Register, October, 1967, No. 142, eff. 11–1–67; r. and recr., Register, July, 1974, No. 223, eff. 1–1–75.

**Ind 51.27 Adoption of miscellaneous standards.** Pursuant to section 227.025, Wis. Stats., the attorney general and the revisor of statutes have consented to the incorporation by reference of the following standards. Copies of the standards in reference are on file in the offices of the department, the secretary of state, and the revisor of statutes.

(1) Aluminum Association (The), 750 Third Avenue, New York City 10017, SPECIFICATIONS FOR ALUMINUM STRUCTURES, Aluminum Construction Manual, Section 1, second edition, November 1971.

(2) American Institute of Steel Construction, 101 Park Avenue,

* See Appendix A for further explanatory material.

New York, N.Y. 10017, SPECIFICATION FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS, February 12, 1969; and COMMENTARY ON THE SPECIFICATIONS FOR THE DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL FOR BUILDINGS, February 12, 1969.

(3) American Institute of Timber Construction, 333 West Hampden Ave., Englewood, Colorado 80110, STANDARD SPECIFICATIONS FOR STRUCTURAL GLUED LAMINATED TIMBER OF DOUGLAS FIR, WESTERN LARCH, SOUTHERN PINE AND CALIFORNIA REDWOOD, AITC 117–71; STANDARD SPECIFICATIONS FOR HARDWOOD GLUED LAMINATED TIMBER, AITC 119–71; STANDARD SPECIFICATIONS FOR STRUCTURAL GLUED LAMINATED TIMBER USING "E" RATED AND VISUALLY GRADED LUMBER OF DOUGLAS FIR, SOUTHERN PINE, HEM-FIR, AND LODGEPOLE PINE, AITC 120–71.

(4) American Iron and Steel Institute, 150 East 42nd St., New York, N. Y. 10017, SPECIFICATION FOR THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS, 1968 edition, including Addendum No. 1, Nov. 19, 1970; SPECIFICATION FOR THE DESIGN OF LIGHT GAGE, COLD-FORMED STAINLESS STEEL STRUCTURAL MEMBERS, 1968 edition.

(5) American National Standards Institute, Inc., 1430 Broadway, New York, N. Y. 10018, SPECIFICATION FOR REINFORCED GYPSUM CONCRETE, ANSI A 59.1–1968; SPECIFICATION FOR VERMICULITE CONCRETE ROOFS AND SLABS ON GRADE, ANSI A 122.1–1965; PERFORMANCE SPECIFICATIONS AND METHODS OF TESTING FOR SAFETY GLAZING MATERIALS USED IN BUILDINGS, ANSI Z 97.1–1972.

(6) American Welding Society, 2501 NW 7th Street, Miami, Florida 33125, STRUCTURAL WELDING CODE, AWS D 1.1–72.

(7) American Wood Preservers' Association, 1625 Eye Street NW, Washington, D. C. 20006, ALL TIMBER PRODUCTS, STANDARD FOR PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, AWPA C 1–73; LUMBER, TIMBERS, BRIDGE TIES AND MINE TIES, PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, AWPA C 2–73; ROUND POLES AND POSTS USED IN BUILDING CONSTRUCTION—PRESERVATIVE TREATMENT BY PRESSURE PROCESSES, AWPA C 23–72.

(7a) National Fire Protection Association, 470 Atlantic Avenue, Boston, Mass. 02210, STANDARD FOR THE INSTALLATION OF SPRINKLER SYSTEMS, NFPA No. 13–1974; STANDARD FOR THE INSTALLATION OF CENTRIFUGAL FIRE PUMPS, NFPA No. 20–1974; STANDARD FOR WATER TANKS FOR PRIVATE FIRE PROTECTION, NFPA No. 22–1974; STANDARD FOR OUTSIDE PROTECTION, NFPA No. 24–1973; STANDARD FOR CENTRAL STATION PROTECTIVE SIGNALING SYSTEMS, NFPA No. 71–1974; STANDARD FOR AUXILIARY PROTECTIVE SIGNALING SYSTEMS, NFPA No. 72B–1974; STANDARD FOR REMOTE

* See Appendix A for further explanatory material.

STATION PROTECTIVE SIGNALING SYSTEMS, NFPA No. 72C–1974; STANDARD FOR PROPRIETARY PROTECTIVE SIGNALING SYSTEMS, NFPA No. 72D–1974; STANDARD ON AUTOMATIC FIRE DETECTORS, NFPA No. 72E–1974.

(8) National Forest Products Association (Recommended by), 1619 Massachusetts Ave. NW, Washington, D. C. 20036, NATIONAL DESIGN SPECIFICATION FOR STRESS-GRADE LUMBER AND ITS FASTENINGS, 1973 edition, including SUPPLEMENT TO 1973 EDITION, dated April 1973.

(9) Steel Joist Institute, 2001 Jefferson Davis Highway, Arlington, Virginia 22202, STANDARD SPECIFICATIONS AND LOAD TABLES, 1973.

(10) Truss Plate Institute, Inc., 7100 Baltimore Avenue, College Park, Maryland 20740, DESIGN SPECIFICATIONS FOR LIGHT METAL PLATE CONNECTED WOOD TRUSSES, TPI–74.

(11) Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402, U. S. PRODUCT STANDARDS PS 1–66 for softwood plywood/construction and industrial, including all amendments through No. 6, dated June 8, 1970 (National Bureau of Standards).

**History:** Cr. Register, July, 1974, No. 223, eff. 1–1–75, am. (5) and (10), cr. (7a), Register, December, 1974, No. 228, eff. 1–1–75.

* See Appendix A for further explanatory material.