

APPENDIX B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION B101 GENERAL

B101.1 Scope.

The procedure for determining fire-flow requirements for buildings or portions of buildings hereafter constructed shall be in accordance with this appendix. This appendix does not apply to structures other than buildings.

SECTION B102 DEFINITIONS

B102.1 Definitions.

For the purpose of this appendix, certain terms are defined as follows:

FIRE-FLOW. The flow rate of a water supply, measured at 20 pounds per square inch (psi) (138 kPa) residual pressure, that is available for fire fighting.

FIRE-FLOW CALCULATION AREA. The floor area, in square feet (m^2), used to determine the required fire flow.

SECTION B103 MODIFICATIONS

B103.1 Decreases.

The fire chief is authorized to reduce the fire-flow requirements for isolated buildings or a group of buildings in rural areas or small communities where the development of full fire-flow requirements is impractical.

B103.2 Increases.

The fire chief is authorized to increase the fire-flow requirements where conditions indicate an unusual susceptibility to group fires or conflagrations. An increase shall not be more than twice that required for the building under consideration.

B103.3 Areas without water supply systems.

For information regarding water supplies for fire-fighting purposes in rural and suburban areas in which adequate and reliable water supply systems do not exist, the *fire code official* is authorized to utilize NFPA 1142 or the *International Wildland-Urban Interface Code*.

SECTION B104

FIRE-FLOW CALCULATION AREA

B104.1 General.

The fire-flow calculation area shall be the total floor area of all floor levels within the *exterior walls*, and under the horizontal projections of the roof of a building, except as modified in Section B104.3.

B104.2 Area separation.

Portions of buildings which are separated by *fire walls* without openings, constructed in accordance with the *International Building Code*, are allowed to be considered as separate fire-flow calculation areas.

B104.3 Type IA and Type IB construction.

The fire-flow calculation area of buildings constructed of Type IA and Type IB construction shall be the area of the three largest successive floors.

Exception: Fire-flow calculation area for open parking garages shall be determined by the area of the largest floor.

SECTION B105 FIRE-FLOW REQUIREMENTS FOR BUILDINGS

B105.1 One- and two-family dwellings.

The minimum fire-flow and flow duration requirements for one- and two-family *dwellings* having a fire-flow calculation area that does not exceed 3,600 square feet (344.5 m²) shall be 1,000 gallons per minute (3785.4 L/min) for 1 hour. Fire-flow and flow duration for dwellings having a fire-flow calculation area in excess of 3,600 square feet (344.5m²) shall not be less than that specified in Table B105.1.

Exception: A reduction in required fire-flow of 50 percent, as *approved*, is allowed when the building is equipped with an *approved automatic sprinkler system*.

**TABLE B105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS**

FIRE-FLOW CALCULATION AREA (square feet)				
Type IA and IB ^a	Type IIA and IIIA ^a	Type IV and V-A ^a	Type IIB and IIIB ^a	Type V-B ^a
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600

97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500
—	—	115,801-125,500	83,701-90,600	51,501-55,700
—	—	125,501-135,500	90,601-97,900	55,701-60,200
—	—	135,501-145,800	97,901-106,800	60,201-64,800
—	—	145,801-156,700	106,801-113,200	64,801-69,600
—	—	156,701-167,900	113,201-121,300	69,601-74,600
—	—	167,901-179,400	121,301-129,600	74,601-79,800
—	—	179,401-191,400	129,601-138,300	79,801-85,100
—	—	191,401-Greater	138,301-Greater	85,101-Greater

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

- Types of construction are based on the *International Building Code*.
- Measured at 20 psi residual pressure.

B105.2 Buildings other than one- and two-family dwellings. The minimum fire-flow and flow duration for buildings other than one- and two-family *dwellings* shall be as specified in Table B105.1.

Exception: A reduction in required fire-flow of up to 75 percent, as *approved*, is allowed when the building is provided with an *approved automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2. The resulting fire-flow shall not be less than 1,500 gallons per minute (5678 L/min) for the prescribed duration as specified in Table B105.1.

SECTION B106 REFERENCED STANDARDS

ICC	IBC-09	International Building Code	B104.2, Table B105.1
ICC	IWUIC-09	International Wildland- Urban Interface Code	B103.3
NFPA	1142-07	Standard on Water Supplies for Suburban and Rural Fire Fighting	B103.3

**TABLE B105.1
MINIMUM REQUIRED FIRE-FLOW AND FLOW DURATION FOR BUILDINGS**

FIRE-FLOW CALCULATION AREA (square feet)					FIRE-FLOW (gallons per minute) ^b	FLOW DURATION (hours)
Type IA and IB ^a	Type IIA and IIIA ^a	Type IV and V-A ^a	Type IIB and IIIB ^a	Type V-B ^a		
0-22,700	0-12,700	0-8,200	0-5,900	0-3,600	1,500	2
22,701-30,200	12,701-17,000	8,201-10,900	5,901-7,900	3,601-4,800	1,750	
30,201-38,700	17,001-21,800	10,901-12,900	7,901-9,800	4,801-6,200	2,000	
38,701-48,300	21,801-24,200	12,901-17,400	9,801-12,600	6,201-7,700	2,250	
48,301-59,000	24,201-33,200	17,401-21,300	12,601-15,400	7,701-9,400	2,500	
59,001-70,900	33,201-39,700	21,301-25,500	15,401-18,400	9,401-11,300	2,750	
70,901-83,700	39,701-47,100	25,501-30,100	18,401-21,800	11,301-13,400	3,000	3
83,701-97,700	47,101-54,900	30,101-35,200	21,801-25,900	13,401-15,600	3,250	
97,701-112,700	54,901-63,400	35,201-40,600	25,901-29,300	15,601-18,000	3,500	
112,701-128,700	63,401-72,400	40,601-46,400	29,301-33,500	18,001-20,600	3,750	
128,701-145,900	72,401-82,100	46,401-52,500	33,501-37,900	20,601-23,300	4,000	4
145,901-164,200	82,101-92,400	52,501-59,100	37,901-42,700	23,301-26,300	4,250	
164,201-183,400	92,401-103,100	59,101-66,000	42,701-47,700	26,301-29,300	4,500	
183,401-203,700	103,101-114,600	66,001-73,300	47,701-53,000	29,301-32,600	4,750	
203,701-225,200	114,601-126,700	73,301-81,100	53,001-58,600	32,601-36,000	5,000	
225,201-247,700	126,701-139,400	81,101-89,200	58,601-65,400	36,001-39,600	5,250	
247,701-271,200	139,401-152,600	89,201-97,700	65,401-70,600	39,601-43,400	5,500	
271,201-295,900	152,601-166,500	97,701-106,500	70,601-77,000	43,401-47,400	5,750	
295,901-Greater	166,501-Greater	106,501-115,800	77,001-83,700	47,401-51,500	6,000	
—	—	115,801-125,500	83,701-90,600	51,501-55,700	6,250	
—	—	125,501-135,500	90,601-97,900	55,701-60,200	6,500	
—	—	135,501-145,800	97,901-106,800	60,201-64,800	6,750	
—	—	145,801-156,700	106,801-113,200	64,801-69,600	7,000	
—	—	156,701-167,900	113,201-121,300	69,601-74,600	7,250	
—	—	167,901-179,400	121,301-129,600	74,601-79,800	7,500	
—	—	179,401-191,400	129,601-138,300	79,801-85,100	7,750	
—	—	191,401-Greater	138,301-Greater	85,101-Greater	8,000	

For SI: 1 square foot = 0.0929 m², 1 gallon per minute = 3.785 L/m, 1 pound per square inch = 6.895 kPa.

a. Types of construction are based on the *International Building Code*.

b. Measured at 20 psi residual pressure.

APPENDIX C

FIRE HYDRANT LOCATIONS AND DISTRIBUTION

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance .

SECTION C101 GENERAL

C101.1 Scope.

Fire hydrants shall be provided in accordance with this appendix for the protection of buildings, or portions of buildings, hereafter constructed.

SECTION C102 LOCATION

C102.1 Fire hydrant locations.

Fire hydrants shall be provided along required fire apparatus access roads and adjacent public streets.

SECTION C103 NUMBER OF FIRE HYDRANTS

C103.1 Fire hydrants available.

The minimum number of fire hydrants available to a building shall not be less than that listed in Table C105.1. The number of fire hydrants available to a complex or subdivision shall not be less than that determined by spacing requirements listed in Table C105.1 when applied to fire apparatus access roads and perimeter public streets from which fire operations could be conducted.

SECTION C104 CONSIDERATION OF EXISTING FIRE HYDRANTS

C104.1 Existing fire hydrants.

Existing fire hydrants on public streets are allowed to be considered as available. Existing fire hydrants on adjacent properties shall not be considered available unless fire apparatus access roads extend between properties and easements are established to prevent obstruction of such roads.

SECTION C105 DISTRIBUTION OF FIRE HYDRANTS

C105.1 Hydrant spacing.

The average spacing between fire hydrants shall not exceed that listed in Table C105.1.

Exception: The fire chief is authorized to accept a deficiency of up to 10 percent where existing fire hydrants provide all or a portion of the required fire hydrant service.

Regardless of the average spacing, fire hydrants shall be located such that all points on streets and access roads adjacent to a building are within the distances listed in Table C105.1.

**TABLE C105.1
NUMBER AND DISTRIBUTION OF FIRE HYDRANTS**

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS^{a, b, c} (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET TO ROAD FRONTAGE HYDRANT^d
1,750 or less	1	500	250
2,000-2,250	2	450	225
2,500	3	450	225
3,000	3	400	225
3,500-4,000	4	350	210
4,500-5,000	5	300	180
5,500	6	300	180
6,000	6	250	150
6,500-7,000	7	250	150
7,500 or more	8 or more ^e	200	120

For SI: 1 foot = 304.8 mm, 1 gallon per minute = 3.785 L/m.

- a. Reduce by 100 feet for dead-end streets or roads.
- b. Where streets are provided with median dividers which cannot be crossed by fire fighters pulling hose lines, or where arterial streets are provided with four or more traffic lanes and have a traffic count of more than 30,000 vehicles per day, hydrant spacing shall average 500 feet on each side of the street and be arranged on an alternating basis up to a fire-flow requirement of 7,000 gallons per minute and 400 feet for higher fire-flow requirements.
- c. Where new water mains are extended along streets where hydrants are not needed for protection of structures or similar fire problems, fire hydrants shall be provided at spacing not to exceed 1,000 feet to provide for transportation hazards.
- d. Reduce by 50 feet for dead-end streets or roads.
- e. One hydrant for each 1,000 gallons per minute or fraction thereof.

APPENDIX D FIRE APPARATUS ACCESS ROADS

The provisions contained in this appendix are not mandatory unless specifically referenced in the adopting ordinance.

SECTION D101 GENERAL

D101.1 Scope.

Fire apparatus access roads shall be in accordance with this appendix and all other applicable requirements of the *International Fire Code* .

**SECTION D102
REQUIRED ACCESS**

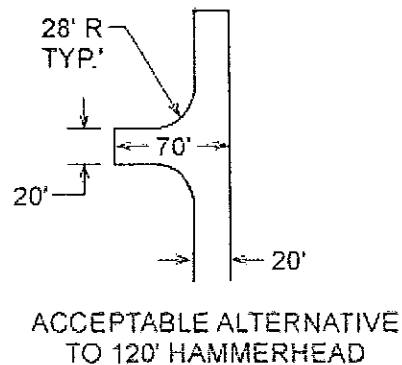
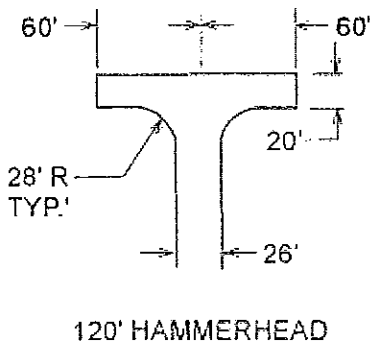
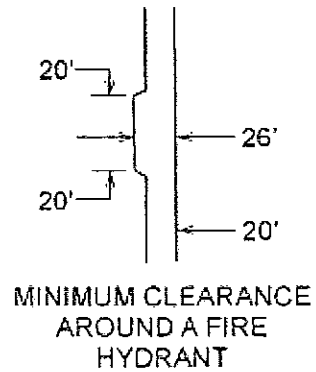
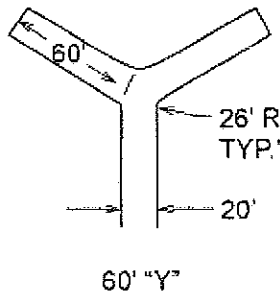
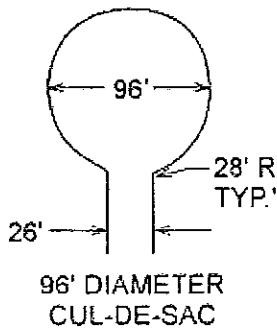
D102.1 Access and loading.

Facilities, buildings or portions of buildings hereafter constructed shall be accessible to fire department apparatus by way of an *approved* fire apparatus access road with an asphalt, concrete or other *approved* driving surface capable of supporting the imposed load of fire apparatus weighing at least 75,000 pounds (34 050 kg).

**SECTION D103
MINIMUM SPECIFICATIONS**

D103.1 Access road width with a hydrant.

Where a fire hydrant is located on a fire apparatus access road, the minimum road width shall be 26 feet (7925 mm), exclusive of shoulders (see Figure D103.1).



For SI: 1 foot = 304.8 mm.

**FIGURE D103.1
DEAD-END FIRE APPARATUS ACCESS ROAD TURNAROUND**

D103.2 Grade. Fire apparatus access roads shall not exceed 10 percent in grade.

Exception: Grades steeper than 10 percent as *approved* by the fire chief.

D103.3 Turning radius.

The minimum turning radius shall be determined by the *fire code official* .

D103.4 Dead ends.

Dead-end fire apparatus access roads in excess of 150 feet (45 720 mm) shall be provided with width and turnaround provisions in accordance with Table D103.4.

**TABLE D103.4
REQUIREMENTS FOR DEAD-END FIRE APPARATUS ACCESS ROADS**

LENGTH (feet)	WIDTH (feet)	TURNAROUNDS REQUIRED
0-150	20	None required
151-500	20	120-foot Hammerhead, 60-foot "Y" or 96-foot-diameter cul-de-sac in accordance with <u>Figure D103.1</u>
501-750	26	120-foot Hammerhead, 60-foot "Y" or 96-foot-diameter cul-de-sac in accordance with <u>Figure D103.1</u>
Over 750	Special approval required	

For SI: 1 foot = 304.8 mm.

D103.5 Fire apparatus access road gates.

Gates securing the fire apparatus access roads shall comply with all of the following criteria:

1. The minimum gate width shall be 20 feet (6096 mm).
2. Gates shall be of the swinging or sliding type.
3. Construction of gates shall be of materials that allow manual operation by one *person* .
4. Gate components shall be maintained in an operative condition at all times and replaced or repaired when defective.
5. Electric gates shall be equipped with a means of opening the gate by fire department personnel for emergency access. Emergency opening devices shall be *approved* by the *fire code official* .

6. Manual opening gates shall not be locked with a padlock or chain and padlock unless they are capable of being opened by means of forcible entry tools or when a key box containing the key(s) to the lock is installed at the gate location.
7. Locking device specifications shall be submitted for approval by the *fire code official*.
8. Electric gate operators, where provided, shall be *listed* in accordance with UL 325.
9. Gates intended for automatic operation shall be designed, constructed and installed to comply with the requirements of ASTM F 2200.

D103.6 Signs.

Where required by the *fire code official*, fire apparatus access roads shall be marked with permanent NO PARKING—FIRE LANE signs complying with Figure D103.6. Signs shall have a minimum dimension of 12 inches (305 mm) wide by 18 inches (457 mm) high and have red letters on a white reflective background. Signs shall be posted on one or both sides of the fire apparatus road as required by Section D103.6.1 or D103.6.2.

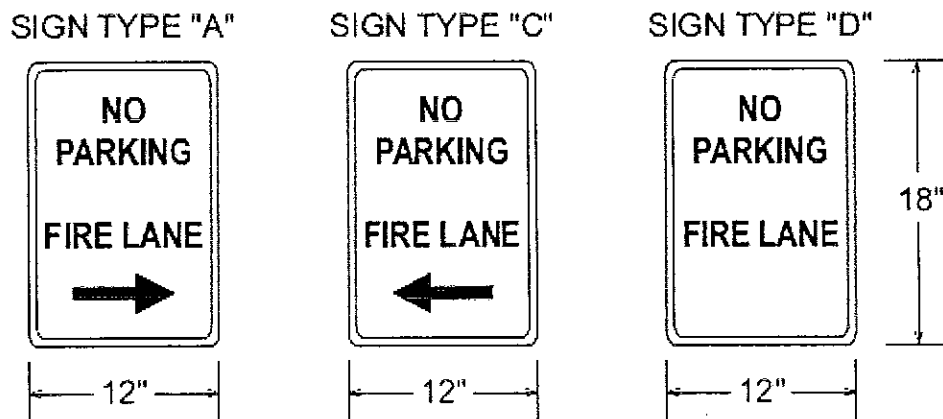


FIGURE D103.6
FIRE LANE SIGNS

D103.6.1 Roads 20 to 26 feet in width.

Fire apparatus access roads 20 to 26 feet wide (6096 to 7925 mm) shall be posted on both sides as a *fire lane*.

D103.6.2 Roads more than 26 feet in width.

Fire apparatus access roads more than 26 feet wide (7925 mm) to 32 feet wide (9754 mm) shall be posted on one side of the road as a *fire lane*.

SECTION D104 COMMERCIAL AND INDUSTRIAL DEVELOPMENTS

D104.1 Buildings exceeding three stories or 30 feet in height.

Buildings or facilities exceeding 30 feet (9144 mm) or three stories in height shall have at least two means of fire apparatus access for each structure.

D104.2 Buildings exceeding 62,000 square feet in area.

Buildings or facilities having a gross *building area* of more than 62,000 square feet (5760 m²) shall be provided with two separate and *approved* fire apparatus access roads.

Exception: Projects having a gross *building area* of up to 124,000 square feet (11 520 m²) that have a single *approved* fire apparatus access road when all buildings are equipped throughout with *approved automatic sprinkler systems*.

D104.3 Remoteness.

Where two access roads are required, they shall be placed a distance apart equal to not less than one half of the length of the maximum overall diagonal dimension of the property or area to be served, measured in a straight line between accesses.

**SECTION D105
AERIAL FIRE APPARATUS ACCESS ROADS**

D105.1 Where required.

Buildings or portions of buildings or facilities exceeding 30 feet (9144 mm) in height above the lowest level of fire department vehicle access shall be provided with *approved* fire apparatus access roads capable of accommodating fire department aerial apparatus. Overhead utility and power lines shall not be located within the aerial fire apparatus access roadway.

D105.2 Width.

Aerial fire apparatus access roads shall have a minimum unobstructed width of 26 feet (7925 mm), exclusive of shoulders, in the immediate vicinity of any building or portion of building more than 30 feet (9144 mm) in height.

D105.3 Proximity to building.

At least one of the required access routes meeting this condition shall be located within a minimum of 15 feet (4572 mm) and a maximum of 30 feet (9144 mm) from the building, and shall be positioned parallel to one entire side of the building.

**SECTION D106
MULTIPLE-FAMILY RESIDENTIAL DEVELOPMENTS**

D106.1 Projects having more than 100 dwelling units.

Multiple-family residential projects having more than 100 *dwelling units* shall be equipped throughout with two separate and *approved* fire apparatus access roads.

Exception: Projects having up to 200 *dwelling units* may have a single *approved* fire apparatus access road when all buildings, including nonresidential occupancies, are equipped throughout with *approved automatic sprinkler systems* installed in accordance with Section 903.3.1.1 or 903.3.1.2.

D106.2 Projects having more than 200 dwelling units.

Multiple-family residential projects having more than 200 *dwelling units* shall be provided with two separate and *approved* fire apparatus access roads regardless of whether they are equipped with an *approved automatic sprinkler system* .

**SECTION D107
ONE- OR TWO-FAMILY RESIDENTIAL DEVELOPMENTS**

D107.1 One- or two-family dwelling residential developments.

Developments of one- or two-family *dwelling units* where the number of *dwelling units* exceeds 30 shall be provided with separate and *approved* fire apparatus access roads and shall meet the requirements of Section D104.3.

Exceptions:

1. Where there are more than 30 *dwelling units* on a single public or private fire apparatus access road and all *dwelling units* are equipped throughout with an *approved automatic sprinkler system* in accordance with Section 903.3.1.1, 903.3.1.2 or 903.3.1.3 of the *International Fire Code* , access from two directions shall not be required.
2. The number of *dwelling units* on a single fire apparatus access road shall not be increased unless fire apparatus access roads will connect with future development, as determined by the *fire code official* .

**D108
REFERENCED STANDARDS**

ASTM	F 2200-05	Standard Specification for Automated Vehicular Gate Construction	D103.5
ICC	IFC-09	International Fire Code	D101.5, D107.1
UL	325-02	Door, Drapery, Gate, Louver, and Window Operators and Systems, with revisions through February 2006	D103.5