Chapter 17-08
Rules and Regulations of the
Department of Development and Environmental Services

Fire Hydrants and Water Mains

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17-08-010 Definitions. The following definitions shall apply to these rules and regulations:

A. "Compartmentalize" shall mean to divide the aggregate floor area of a structure into smaller components by means of area separation walls per U.B.C. 505(d).

B. "Dead end main" shall mean a water main over fifty feet long which is not supplied from both ends.

C. "Flush type hydrant" shall mean a fire hydrant installed entirely below grade.

D. "Fire hydrant" shall mean a permanently installed mechanical device by which water is made available to fire apparatus operated by a fire department.

E. "Fire resistive construction" shall mean Type I fire resistive structures and Type II fire resistive structures as defined in the Uniform Building Code.

F. "Non combustible construction" shall mean Type II-N and Type II one-hour structures as defined in the Uniform Building Code.

G. "Ordinary construction" shall mean Type III one-hour, Type Ill-N, Type IV H.T. and Type V one-hour structures as defined in the Uniform Building Code.

H. "Wood frame construction" shall mean Type VN structures as defined in the Uniform Building Code.

17-08-020 Fire Hydrant Design Criteria. A. Fire hydrants shall have a minimum six (6) inch barrel, shall have a minimum of two 2 1/2 inch outlets and one 4 inch minimum inside diameter pumper port.

B. All hydrant connections shall have threads compatible with those used by the local fire department.

C. Fire hydrants shall be self-draining and frost-free.

D. Fire hydrants shall meet American Waterworks Association standards and any additional specifications required by the local water purveyor.

E. Fire hydrants shall be provided with an auxiliary gate valve, installed to permit the repair and/or replacement of the fire hydrant without disruption of water service.

F. Flush-type hydrants are prohibited, except upon specific approval of the Fire Marshal.

G. All hydrants shall be subject to testing by the local fire department and the Fire Marshal. The water purveyor shall be notified prior to any such testing. Testing shall be done in cooperation with such purveyors.

17-08-030 Installation Criteria. A. Fire hydrants and water mains shall be installed to meet sound engineering practices as specified by the Fire Marshal based on applicable circumstances. The Fire Marshal shall make applications and plans available for comment by the local fire department. Fire hydrants shall be accessible to fire department pumpers over roads capable of supporting such vehicles.

B. Fire hydrants shall stand plumb and be set to the finished grade. The bottom of the lowest outlet of the fire hydrants shall be not less than eighteen (18) inches above

finished grade. There shall be thirty-six (36) inches of clear area around the hydrant to allow for operation of a hydrant wrench on the outlets and on the control valve.

C. The pumper port shall face the street. Where the street cannot be clearly defined or recognized, the port shall face the most likely route of approach and location of the fire apparatus while pumping, as determined by the Fire Marshal.

D. Fire hydrants shall be located a minimum of fifty (50) feet from buildings, except upon specific approval of the Fire Marshal.

E. All hydrants shall be located between 18 and 120 inches from the edge of the roadway surface, unless specifically approved otherwise by the Fire Marshal. Hydrants located in areas subject to commercial or industrial motor traffic shall be protected against vehicular damage by curbs, space separation, grade-level changes, guard ports or other means approved by the Fire Marshal.

F. Hydrants shall not be obstructed by any structure or vegetation nor shall the visibility of the hydrant be impaired for a distance of fifty (50) feet in the direction of vehicular approach to the fire hydrant.

G. Fire hydrants shall, when possible, be located at street intersections.

H. The location and design of all water mains, fire hydrants, and valves to be installed shall be properly and accurately marked on identifiable plans or drawings, two copies of which shall be attached to the building plans for Fire Marshal approval.

17-08-040 Number of Fire Hydrants. A. All buildings having a gross ground floor area of twenty thousand (20,000) square feet or more, or requiring a fire flow of three thousand (3,000) gallons per minute or more, shall have fire hydrants located on all sides, spaced three hundred (300) feet on center, unless otherwise approved by the Fire Marshal.

B. All buildings which have a gross ground floor area of less than twenty thousand (20,000) square feet and a fire flow of less than three thousand (3,000) gallons per minute may have fire hydrants located on one side only.

C. All fire hydrants required pursuant to this section shall be located within one hundred and fifty (150) feet of the building, unless otherwise approved by the Fire Marshal.

D. All buildings having automatic sprinklers and/or standpipe system(s) shall have one fire hydrant located within one hundred and fifty (150) feet of each fire department pumper connection or group of fire department pumper connections.

E. If the required fire flow for a structure or use exceeds 1250 gallons per minute, the minimum number of fire hydrants shall be not less than the required flow divided by one thousand two hundred fifty (1250), rounded off to the nearest whole number. In no case shall the fire flow be reduced below that required by these rules and regulations as a result of this computation.

17-08-050 Water-Flow Requirements. The determination of required water flow for any structure or use shall be based upon the following criteria, and upon the Fire Marshal's determination of the water flow required to provide reasonable fire protection:

A. The minimum water flow for detached single-family residential dwellings, including mobile homes, shall be one thousand (1,000) gallons per minute. The water system providing water for water flow requirements shall be capable of supplying such flow for the following durations of time:

No. of Dwellings	Duration of Time
2-9	1/2 hour
10-50	1 hour
51-75	1 1/2 hours
Over 75	2 hours

B. For all other uses, the water system providing water flow shall be capable of providing such flow for a duration of two hours.

C. An estimate of the fire flow required for a given fire area may be determined by the formula:

$$F = 18\ C(A)\ 0.5$$

where

F = the required fire flow in gpm
C = coefficient related to the type of construction
C = 1.5 for wood frame construction
= 1.0 for ordinary construction
0.9 for heavy timber-type buildings
= 0.8 for noncombustible construction
= 0.6 for fire-resistive construction

Note: For types of construction and/or materials that do not fall within the categories given, use a coefficient reflecting the difference. Coefficients shall not be greater than 1.5 nor less than 0.6 and may be determined by interpolation. Such interpolation shall be between consecutive types of construction as listed above. Definitions of types of construction are included in the Appendix.

1. A = the total floor area (including all stories, but excluding basements) in the building being considered. For fire-resistive buildings consider the six largest successive floor areas if the vertical openings are unprotected; if the vertical openings are properly protected, consider only the three largest successive floor areas.

2. The fire flow as determined by the above shall not exceed

8,000 gpm for wood-frame construction
8,000 gpm for ordinary and heavy timber construction
6,000 gpm for noncombustible construction
6,000 gpm for fire-resistive construction

except that for a normal one-story building of any type of construction, the fire flow shall not exceed 6,000 gpm.

3. The fire flow calculated in this step shall not be less than 1000 gpm.

4. For one-family and small two-family dwellings not exceeding two stories in height, see Note 10.

D. The value obtained in subsection (C) above may be reduced by up to 25% for occupancies having a low fire hazard or may be increased by up to 25% for occupancies having a high fire hazard. As a guide for determining low or high hazard occupancies, see the lists in the Appendix.

The fire flow calculated in this step shall not be less than 1000 gpm.

E. The value obtained in subsection (D) above may be reduced by up to 50% for complete systematic sprinkler protection. Where buildings are either fire resistive or non-combustible construction, and have a low fire hazard, the reduction may be up to 75%. The percentage reduction made for an automatic sprinkler system will depend upon the extent to which the system is judged to reduce the possibility of fire spreading within and beyond the fire area. Normally this reduction will not be the maximum allowed without proper system supervision, including water flow and valves. The fire flow shall not be less than 1000 gpm.

F. To the value obtained in subsection (D) above a percentage should be added for structures exposed within 150 feet by the fire area under consideration. This percentage shall depend upon the height, area and construction of the building(s) being exposed, the separation, openings in the exposed building(s), the length of exposure, the provision of automatic sprinklers and/or outside sprinklers in the building(s) exposed, the occupancy of the exposed building(s), and the effect of hillside locations on the possible spread of fire.

1. The percentage for any one side generally should not exceed the following limits for the separations shown:

Separation	Percentage
0-10 feet	25%
11-30 feet	20%
31-60 feet	15%
61-100 feet	10%
101-150 feet	5%

2. The total percentage shall be the sum of the percentages for all sides, but shall not exceed 75%.

G. The value obtained in subsection (D) above is reduced by the percentage (if any) determined in subsection (E) above and increased by the percentage (if any) determined in subsection (F) above.

The fire flow shall not exceed 12,000 gpm nor be less than 1000 gpm.

17-08-060 Notes.

Note 1: The guide is not expected to necessarily provide an adequate value for lumber yards, petroleum storage, refineries, grain elevators, and large chemical plants, but may indicate a minimum value for these hazards.

Note 2: Judgment must be used for business, industrial and other occupancies not specifically mentioned.

Note 3: Consideration should be given to the configuration of the building(s) being considered and to the fire department accessibility.

Note 4: Wood-frame structures separated by less than 10 feet shall be considered as one fire area.

Note 5: Party Walls. Normally an unpierced party (common) wall may warrant up to a 10% exposure charge.

Note 6: High one-story buildings. When a building is stated at 1 - 2, or more stories, the number of stories to be used in the formula depends upon the use being made of the building. For example consider a 1 - 3-story building. If the building is being used for high-piled stock, or for rack storage, the building would probably be considered as 3 stories and, in addition, an increased percentage for occupancy may be warranted. However, if the building is being used for steel fabrication and the extra height is provided only to facilitate movement of objects by a crane, the building would probably be considered as a 1-story building and a decreased percentage for occupancy may be warranted.

Note 7: If a building is exposed within 150 feet, normally some percentage increase for exposure will be made.

Note 8: Where wood shingle roofs could contribute to spreading fires, add 500 gpm.

Note 9: Any noncombustible building is considered to warrant a 0.8 coefficient.

Note 10: Dwellings. For groupings which contain only 1-family and small 2-family dwellings not exceeding 2 stories in height, the required fire flow shall be 1000 gpm.

17-08-070 Additional Criteria. A. The total floor area used in the formula or tables for determination of water flow may be reduced in individual buildings by compartmentizing the structure with two (2) hour rated fire walls and basing the water flow on the total square feet of the largest undivided area if the Fire Marshal determines that such reduction will not unreasonably affect fire safety.

B. If area separation walls are used to compartmentize a building, or the building in question has at least two (2) hour rated walls on the property line, a zero percent exposure factor shall be calculated into the fire flow formula for that particular wall.

C. The required fire flow for a building addition shall be based on the total square foot area of the addition only if the addition is separated from the existing building by two (2) hour rated wall. Should there be no two (2) hour separation between the existing building and the addition, fire flow calculations and requirements shall be based on the aggregate square feet area of both the new and existing portions of the building.

D. The minimum acceptable fire flow for commercial or industrial properties having no buildings or structures and for changes of use of existing structures shall be determined on an individual basis by the Fire Marshal. Such flow shall be capable of providing sufficient water to provide adequate fire-fighting capabilities for the hazards presented.

17-08-080 Outline of Procedure.

A. Determine the type of construction.
B. Determine the ground-floor area.
C. Determine the height in stories.
D. Using tables in the Appendix, determine the required fire flow to the nearest 250 gpm.
E. Determine the increase or decrease for occupancy and apply to the value obtained in D above. Do not round off the answer.
F. Determine the decrease, if any, for automatic sprinkler protection. Do not round off the value.
G. Determine the total increase for exposures. Do not round off the value.
H. To the answer obtained in E, subtract the value obtained in F and add the value obtained in G.
I. Round off the final answer to the nearest 250 gpm if less than 2500 gpm and to the nearest 500 gpm if greater than 2500 gpm.

Use of Tables (Steps A, B, C, D)

The tables use the GROUND AREA of the building and the height of the building in stories. Using the table corresponding to the type of construction, look under the number of stories and locate the ground area of the building(s) being considered between two ground areas given in the table. The corresponding fire flow is found in the left column.

A P P E N D I X
OCCUPANCY

Low Hazard Occupancies:

- Apartments
- Asylums
- Churches
- Clubs
- Colleges and Universities
- Dormitories
- Dwellings
- Hospitals
- Hotels
- Institutions
- Libraries (except large stack room areas)
- Museums
- Nursing, Convalescent and Care Homes
- Office Buildings
- Prisons
- Public Buildings
- Rooming Houses
- Schools
- Tenements

High Hazard Occupancies:

- Aircraft Hangars
- Cereal, Feed, Flour and Grist Mills
- Chemical Works - High Hazard
- Cotton Picker and Opening Operations
- Explosives and Pyrotechnics Manufacturing
- High Piled Combustible Storage in excess of 21 feet high
- Linoleum and Oilcloth Manufacturing
- Linseed Oil Mills
- Match Manufacturing
- Oil Refineries
- Paint Shops
- Pyroxylin Plastic Manufacturing and Processing
- Shade Cloth Manufacturing
- Solvent Extracting
- Varnish and Paint Works
- Wood Working with Flammable Finishing
- Other occupancies involving processing, mixing, storage and dispensing flammable and/or combustible liquids.

Experience has shown that the following credits should normally be applied for the occupancies listed:

Dwellings*, apartments and dormitories	-25%
Hospitals	-20%
Elementary schools	-20%
Junior and senior high schools	-15%
Open parking garages	-25%

*when applying the standard method

For other occupancies, good judgment should be used, and the percentage increase or decrease will not necessarily be the same for all buildings that are in the same general category - for example, "Colleges and Universities": this could range from a 25% decrease for buildings used only as dormitories to an increase for a chemical laboratory. Even when considering high schools, the decrease should be less if they have extensive shops.

It is expected that in commercial buildings no percentage increase or decrease for occupancy will be applied in most of the fire flow determinations. In general, percentage increase or decrease will not be at the limits of +/-25%.

EXPOSURES

When determining exposures it is necessary to understand that the exposure percentage increase for a fire in a building (x) exposing another building (y) does not necessarily equal the percentage increase when the fire is in building (y) exposing building (x). The Guide gives the maximum possible percentage for exposure at specified distances. However, these maximum percentages should not be used for all exposures at those distances. In each case the percentage applied should reflect the actual conditions but should not exceed the percentage listed.

The maximum percentage for the separations listed generally should be used if the exposed building meets all of the following conditions:

a. Same type or a poorer type of construction than the fire building.
b. Same or greater height than the fire building.

c. Contains unprotected exposed openings.
d. Unsprinklered.

FIRE FLOW VS. GROUND AREA $F=l8C(A)^{0.5}$

Wood Frame Construction F=gpm; C=1.5

(Ground area in Square Feet) A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
1000	1,700	900	600	400	300	300
1250	2,600	1,300	900	700	500	400
1500	3,600	1,800	1,200	900	700	600
1750	4,800	2,400	1,600	1,200	1,000	800
2000	6,200	3,100	2,100	1,600	1,200	1,000
2250	7,700	3,900	2,600	1,900	1,500	1,300
2500	9,400	4,700	3,100	2,400	1,900	1,600
2750	11,300	5,700	3,800	2,500	2,300	1,900
3000	13,400	6,700	4,500	3,400	2,700	2,200
3250	15,600	7,800	5,200	3,900	3,100	2,600
3500	18,000	9,000	6,000	4,500	3,600	3,000
3750	20,600	10,300	6,900	5,200	4,100	3,400
4000	23,300	11,700	7,800	5,800	4,700	3,900
4250	26,300	13,200	8,800	6,600	5,300	4,400
4500	29,300	14,700	9,800	7,300	5,900	4,900
4750	32,600	16,300	10,900	8,200	6,500	5,400
5000	36,000	18,000	12,000	9,000	7,200	6,000
5250						

FIRE FLOW VS. GROUND AREA $F=l8C(A)^{0.5}$

Wood Frame Construction F=gpm; C=1.5

(Ground area in Square Feet) A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
5250						
	39,600	19,800	13,200	9,900	7,900	6,600
5500						
	43,400	21,700	14,500	10,900	8,700	7,200
5750						
	47,400	23,700	15,800	11,900	9,500	7,900
6000						
	51,500	25,800	17,200	12,900	10,300	8,600
6250						
	55,700	27,900	18,600	13,900	11,100	9,300
6500						
	60,200	30,100	20,100	15,100	12,000	10,000
6750						
	64,800	32,400	2l,600	16,200	13,000	10,800
7000						
	69,600	34,800	23,200	17,400	13,900	11,600
7250						
	74,600	37,300	24,900	18,700	14,900	12,400
7500						
	79,800	39,900	26,600	20,000	16,000	13,300
7750						
	85,100	42,600	28,400	21,300	17,000	14,200
8000						

FIRE FLOW VS. GROUND AREA — $F=180(A)^{0.5}$

Ordinary Construction — F=gpm; 0=1.0

(Ground Area in Square Feet) — A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
1000	3,900	2,000	1,300	1,000	800	700
1250	5,800	2,900	1,900	1,500	l,200	1,000
1500	8,200	4,100	2,700	2,l00	1,600	1,400
1750	10,900	5,500	3,600	2,700	2,200	1,800
2000	13,900	7,000	4,600	3,500	2,800	2,300
2250	17,400	8,700	5,800	4,400	3,500	2,900
2500	21,300	10,700	7,100	5,300	4,300	3,600
2750	25,500	12,800	8,500	6,400	5,100	4,300
3000	30,100	15,100	10,000	7,500	6,000	5,000
3250	35,200	17,600	11,700	8,800	7,000	5,900
3500	40,600	20,300	13,500	10,200	8,100	6,800
3750	46,400	23,200	15,500	11,600	9,300	7,700
4000	52,500	26,300	17,500	13,100	10,500	6,800
4250	59,100	29,600	19,700	14,800	11,800	9,900
4500	66,000	33,000	22,000	16,500	13,200	11,000
4750	73,300	36,700	24,400	18,300	14,200	12,200
5000	81,100	40,600	27,000	20,300	16,200	13,500
5250						

FIRE FLOW VS. GROUND AREA — $F=180(A)^{0.5}$

Ordinary Construction — F=gpm; 0=1.0

(Ground Area in Square Feet) — A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
5250						
------	89,200	---- 44,600	--- 29,700	---- 22,300	--- 17,800	--- 14,900
5500						
------	99,700	---- 48,900	--- 32,600	---- 24,400	--- 19,500	--- l6,300
5750						
-----	106,500	---- 53,300	--- 35,500	---- 26,600	--- 21,300	--- 17,800
6000						
-----	115,800	---- 57,900	--- 38,600	---- 28,900	--- 23,200	--- 19,300
6250						
-----	125,500	---- 62,800	--- 41,800	---- 31,400	--- 25,100	--- 20,900
6500						
-----	135,500	---- 67,800	--- 45,200	---- 33,900	--- 27,100	--- 22,600
6750						
-----	145,800	---- 72,900	--- 48,600	---- 36,500	--- 29,200	--- 24,300
7000						
-----	156,700	---- 78,400	--- 52,200	---- 39,200	--- 31,300	--- 26,100
7250						
-----	167,900	---- 84,000	--- 56,000	---- 42,000	--- 33,600	--- 28,000
7500						
-----	179,400	---- 89,700	--- 59,800	---- 44,900	--- 35,900	--- 29,900
7750						
-----	191,400	---- 95,700	--- 63,800	---- 47,900	--- 38,300	--- 31,900
8000						

FIRE FLOW VS. GROUND AREA — $F=l8C(A)^{0.5}$

NonCombustible Construction — F=gpm; C=0.8

(Ground Area in Square Feet) — A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
1000	6,100	3,100	2,000	1,500	1,200	1,000
1250	9,100	4,600	3,000	2,300	1,800	1,500
1500	12,700	6,400	4,200	3,200	2,500	2,100
1750	17,000	8,500	5,700	4,100	3,400	2,800
2000	21,800	10,900	7,300	5,500	4,400	3,600
2250	27,200	13,600	9,100	6,800	5,400	4,500
2500	33,200	16,600	11,100	8,300	6,600	5,500
2750	39,700	19,900	13,200	9,900	7,900	6,000
3000	47,100	23,600	15,700	11,800	9,400	7,900
3250	54,900	27,500	18,300	13,700	11,000	9,200
3500	63,400	31,700	21,100	15,900	12,200	10,600
3750	72,400	36,200	24,100	18,100	14,500	12,100
4000	82,100	41,200	27,400	20,500	16,400	13,700
4250	92,400	46,200	30,800	23,100	18,500	15,400
4500	103,100	5l,600	34,400	25,800	20,000	17,200
4750	114,600	57,300	38,200	28,700	22,900	19,100
5000	126,700	63,400	42,200	31,700	25,300	21,100
5250						

FIRE FLOW VS. GROUND AREA — $F=l8C(A)^{0.5}$

NonCombustible Construction — F=gpm; C=0.8

(Ground Area in Square Feet) — A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
5250						
-----	139,400	69,700	46,500	34,900	27,900	23,200
5500						
-----	152,600	76,300	50,000	38,200	30,500	25,400
5750						
-----	166,500	83,300	55,500	41,600	33,300	27,800
6000						

FIRE FLOW VS. GROUND AREA $F=l8C(A)^{0.5}$

Fire Resistive Construction F=gpm; C=0.6

(Ground Area in Square Feet) A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
1000						
	10,900	5,500	3,600	2,700	2,200	1,800
1250						
	16,200	8,100	5,400	4,100	3,200	2,700
1500						
	22,700	11,400	7,600	5,700	4,500	3,800
1750						
	30,200	15,100	10,100	7,600	6,000	5,000
2000						
	38,700	19,400	12,900	9,700	7,700	6,500
2250						
	48,300	24,200	16,100	12,100	9,700	8,100
2500						
	59,000	29,500	19,700	14,800	11,800	9,800
2750						
	70,900	35,500	23,600	17,700	14,200	11,800
3000						
	83,700	41,900	27,900	20,900	16,800	13,900
3250						
	97,700	48,900	32,600	24,400	19,500	16,300
3500						
	112,700	56,400	37,600	28,200	22,500	18,800
3750						
	128,700	64,400	42,900	32,200	25,700	21,500
4000						
	145,900	73,000	48,600	36,500	29,200	24,300
4250						
	164,200	82,100	54,700	41,100	32,800	27,400
4500						
	183,400	91,700	61,100	45,900	36,700	30,600
4750						
	203,700	101,900	67,900	50,900	40,700	34,000
5000						
	225,200	112,600	75,100	56,300	45,000	37,600
5250						

FIRE FLOW VS. GROUND AREA $F=l8C(A)^{0.5}$

Fire Resistive Construction F=gpm; C=0.6

(Ground Area in Square Feet) A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
5250						
-----	247,700	123,900	82,600	61,900	49,500	41,300
5500						
-----	271,200	135,600	90,400	67,800	54,200	45,200
5750						
-----	295,900	148,000	98,600	74,000	59,200	49,300
6000						