Fire-Flow Requirements for Buildings

April 1, 2021

GRAND JUNCTION FIRE DEPARTMENT

DIVISION OF FIRE PREVENTION

If you have any questions or comments regarding the information contained within, or if you need assistance interpreting these requirements, please contact:

625 Ute Avenue
Grand Junction, Colorado 81501
Tel: (970) 549-5800
Website: gjcity.org/FirePrevention.aspx
Email: fire@gjcity.org

Table of Contents

General Requirements _____ 2

Determining Required Fire Flow for New Developments _____ 3

Fire Hydrant Locations and Distribution _____ 4

IFC Appendix B Tables _____ 7

IFC Appendix C Table _____ 8

General Requirements

One of the basic essentials needed to control and extinguish a structure fire is adequate water supply. Fire flow is the amount of water available for fire-fighting purposes. Designing the water supply for new buildings is an important part of the initial planning for new development projects whether the new building is a 1500 square foot house or a 200,000 square foot retail store.

The City of Grand Junction has adopted the 2018 edition of the International Fire Code, as amended, via Municipal Ordinance No. 4830, which sets minimum standard requirements for fire flow and fire hydrant locations listed throughout and in Appendix B and C. These standards are based on fire flow calculations originally developed by the Insurance Services Office (ISO). This guide is intended to help developers understand these requirements. Please consult the listed documents for more details.

All new developments must submit a **New Development Fire Flow Form**. Consult the Planning Department or visit our website to obtain a copy of the form. This form must be completed for new developments before a Planning Clearance is approved by the Fire Department. To complete the form:

1. The developer must fill out Section A.
2. Ute Water, Clifton Water, or Grand Junction Water fill out Section B.
3. The last part of the form is completed by the developer (or by a Colorado licensed engineer, if required by the fire code official).

The completed form will be reviewed for acceptance by the fire code official during the Community Development application phase.

Developers, designers and engineers should be cognizant that water supply for fire fighting purposes and fire department access work in consort with one another. Fire Hydrants should be located along primary and secondary fire apparatus roads (i.e. streets, fire lanes, etc.).

Determining Required Fire Flow for New Developments

The minimum fire flow and flow duration for all structures shall be determined according to Appendix B of the 2018 IFC. Follow these steps to determine required flows:

1. Determine the use of the buildings:

- One- and two-family dwellings, and townhouses.
- Buildings other than one and two-family dwellings.

A. O***ne- and two-family dwellings, and townhouses:***

- For all dwellings with a **fire area** up to 3,600 square feet, the required fire flow is 1,000 gallons per minute. See Table B105.1(1).
- For all dwellings with a **fire area** of 3,601 or greater square feet, the required fire flow shall be determined by Table B105.1(2).

B. ***All buildings <u>other</u> than one- and two family dwellings, and townhouses:***

- Determine the **fire area, type of construction and if the structure will contain a fire sprinkler system** for each building.
- Use Table B105.2 and Table B105.1(2) to determine the required fire flow.

2. The required fire flow for a building can be reduced by two methods:

A. Installing an approved fire sprinkler system:

• For one- and two-family dwellings and townhouses, the required fire flow is reduced by 50% in fire sprinkled buildings (2018 IFC Section 903.3.1.3 or 2018 IRC Section P2904 approved systems), **but the resulting fire flow cannot be reduced below 500 gpm or 50% of the value you table B105.1(2) for homes 3,600 sf or more.**

• For buildings other than one- and two-family dwellings, and townhouses the required fire flow can be effectively reduced up to 75% in accordance with Table B105.2, ***but the resulting fire flow cannot be reduced below 1,000 gpm (NFPA 13 System) and 1,500 gpm (NFPA 13R System). See table footnotes.***

3. Important design elements to consider:

Fire Flow Calculation Area (2018 IFC, B104.1): 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.

Separate Fire Flow Calculation Areas (2018 IFC, B104.2): Portions of building which are separated by fire walls WITHOUT OPENINGS, constructed in accordance with the International Building Code (IBC), are allowed to be considered as separate **fire flow calculation areas**.

Fire Wall (2018 IBC 702.1 and Chapter 2): a fire-resistance rated wall having protected openings which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall (NO OPENINGS OF ANY KIND, whether protected or otherwise, are allowed under the International Fire Code for the purposes of separating fire flow calculation areas.)

Example: Dividing the building into separate **fire flow calculation areas** constructed in accordance with the International Building Code. The fire flow for each **fire flow calculation area** within the building is then calculated according to Table B105.1(2) or B105.2. If a 50,000square foot Type IIIB building is separated into two 25,000 square foot **fire flow calculation areas** by a fire wall, the fire flow for each area is 3,250 gallons per minute. Without the fire wall, the 50,000 square foot **fire flow calculation area** has a fire flow of 4,750 gallons per minute. For most development projects, the building with the largest fire flow determines the fire flow requirements for the entire project.

Fire Hydrant Locations and Distribution

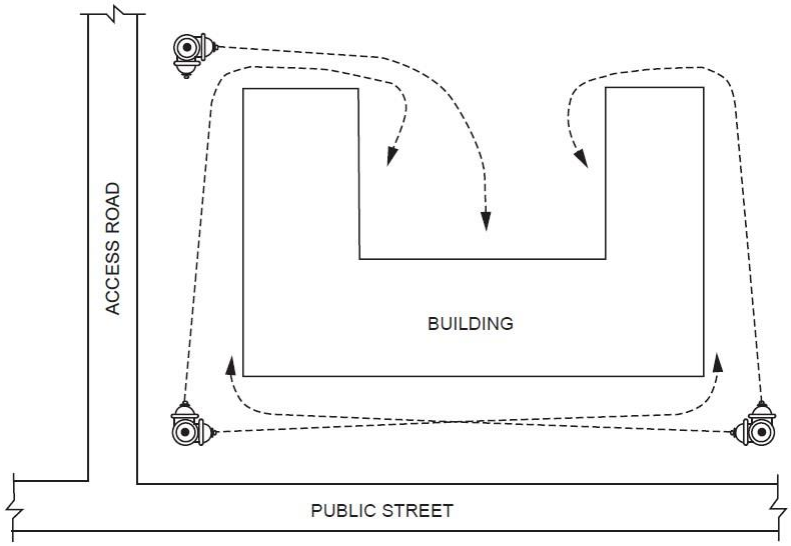
As a general rule, water mains supplying fire hydrants should be at least 8" in size. Fire hydrant quantities, locations and overall distribution is dictated by Appendix C, Table C102.1 (2018 IFC ed.) and based primarily on the fire flow needs of the project.

Fire Hydrants – One- and Two- Family Dwellings, and Townhouses:

Fire hydrants should be located at all major intersections when possible. All residential lots must have a fire hydrant within 250 feet of the lot frontage as measured along the street. All lots must be within 200 feet when located on a dead end street or cul-de-sac.

Fire Hydrants - Commercial Facilities and Buildings:

All exterior portions of a facility or building must be located within 400 feet of a fire hydrant. All fire hydrants must be located adjacent to a fire apparatus road.



Where a portion of the facility and building is more than 400 feet from a fire hydrant on a fire apparatus road, as measured by an approved route around the exterior of the facility or building, on site fire hydrants and mains shall be provided where required by the fire code official and Appendix C, Table C102.1 (2018 IFC ed.) shall be utilized. A fire hydrant must be located within 150 feet of the structure's fire department connection (FDC) which services the building's fire sprinkler system. The measurement shall be completed along an approved fire apparatus road (i.e. street, fire lane, or other drivable surface).

WHEN ARE LOOPED WATER LINES REQUIRED?

Looped water lines are fed from two directions in such a way that a line break at any point along the looped line does not result in shutting off the water supply. Looped lines are important in a fire situation because a water main break could result in loss of a building or group of buildings if a second source of supply is not available.

The City of Grand Junction has adopted the following rules for when looped lines are required (Ordinance No. 4830):

Section C102.2 **Water supply lines.** Hydrants shall be on a looped (receiving water from more than one direction) water supply line of at least six inches (6") in diameter.

> **Exceptions:**
> **1.** One or two-family residential developments may have hydrants supplied by a dead-end water line where there are 30 or fewer dwelling units. Up to 60 dwelling units may have hydrants supplied by a dead-end water line when all units are protected by an approved residential fire sprinkler system. In any case, the Fire Chief may require such developments provide for water line connections to adjacent properties to ensure the overall water distribution system meets recognized standards.

2. Multiple-family residential developments having up to 100 dwelling units may be protected by fire hydrants supplied by a dead-end water line. Up to 200 dwelling units may be protected by fire hydrants supplied by a dead-end water line when all units are protected by an approved residential fire sprinkler system. In no case shall such developments be supplied by a dead-end line exceeding 1000 feet in length. The Fire Chief may require such developments provide for water line connections to adjacent properties to ensure the overall water distribution system meets recognized standards.

3. For commercial and industrial developments, any building not exceeding three stories or 30 feet in height may be protected by fire hydrants supplied by a dead-end water line.

4. For commercial and industrial developments, buildings or facilities having a gross building area up to 62,000 square feet may be protected by fire hydrants supplied by a dead-end water line. The gross building area may be increased to 124,000 square feet without a looped water line when all buildings are equipped with an approved automatic fire sprinkler system. In no case shall such developments be supplied by a dead-end line exceeding 1000 feet in length. The Fire Chief may require such developments to provide for water line connections to adjacent properties to ensure the overall water distribution system meets recognized standards.

5. The Fire Chief may allow a new development that would otherwise be required to provide a looped water line for required fire hydrants, to have a dead-end line as long as the development provides a means to connect to a looped system as future development occurs. The time period and conditions under which this exception is allowed shall be as determined by the Chief.

6. The Fire Chief may allow fire hydrants to be supplied by other than a looped water line when the permittee can demonstrate, to the satisfaction of the Fire Chief, that a looped system is not practicable. In such event, the Fire Chief shall make his findings in writing and shall copy such findings to the Public Works Director and the Director of Community Development. In such cases, additional fire protection may be required as determined by the chief.

The Fire Department recognizes that, for many new development projects, it is not always practical to **immediately** provide looped water lines. For example, if the new project is surrounded by undeveloped land or by areas that are already developed with no means of connecting to existing lines, dead-end lines **might** be allowed according to two basic rules:

1. If the required fire flows can be provided with dead-end lines, the looping can be delayed until either a later phase of the project is completed or until adjacent properties are developed, so that water-line extensions result in completion of the loop.

2. If the required fire flows can be provided with dead-end lines and looping the water lines is demonstrated to be impracticable, then the Fire Chief may allow the project to develop.

In all cases, if looping the water lines is the only way to provide the required fire flows, then the project will not be approved without the looping.

Appendix B

FIRE-FLOW REQUIREMENTS FOR BUILDINGS

TABLE B105.1(1)
REQUIRED FIRE FLOW FOR ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

FIRE-FLOW CALCULATION AREA (square feet)	AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
0–3,600	No automatic sprinkler system	1,000	1
3,601 and greater	No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2) at the required fire-flow rate
0–3,600	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	500	$^1/_2$
3,601 and greater	Section 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*	$^1/_2$ value in Table B105.1(2)	1

For SI: 1 square foot = 0.0929 m^2, 1 gallon per minute = 3.785 L/m.

TABLE B105.1(2)
REFERENCE TABLE FOR TABLES B105.1(1) AND B105.2

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 m^2, 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.

TABLE B105.2
REQUIRED FIRE FLOW FOR BUILDINGS OTHER THAN ONE- AND TWO-FAMILY DWELLINGS, GROUP R-3 AND R-4 BUILDINGS AND TOWNHOUSES

AUTOMATIC SPRINKLER SYSTEM (Design Standard)	MINIMUM FIRE FLOW (gallons per minute)	FLOW DURATION (hours)
No automatic sprinkler system	Value in Table B105.1(2)	Duration in Table B105.1(2)
Section 903.3.1.1 of the *International Fire Code*	25% of the value in Table B105.1(2)[a]	Duration in Table B105.1(2) at the reduced flow rate
Section 903.3.1.2 of the *International Fire Code*	25% of the value in Table B105.1(2)[b]	Duration in Table B105.1(2) at the reduced flow rate

For SI: 1 gallon per minute = 3.785 L/m.

a. The reduced fire flow shall be not less than 1,000 gallons per minute.

b. The reduced fire flow shall be not less than 1,500 gallons per minute.

Appendix C

FIRE HYDRANT LOCATIONS AND DISTRIBUTION

TABLE C102.1
REQUIRED NUMBER AND SPACING OF FIRE HYDRANTS[h]

FIRE-FLOW REQUIREMENT (gpm)	MINIMUM NUMBER OF HYDRANTS	AVERAGE SPACING BETWEEN HYDRANTS[a, b, c, f, g] (feet)	MAXIMUM DISTANCE FROM ANY POINT ON STREET OR ROAD FRONTAGE TO A HYDRANT[d, f, g]
1,750 or less	1	500	250
1,751–2,250	2	450	225
2,251–2,750	3	450	225
2,751–3,250	3	400	225
3,251–4,000	4	350	210
4,001–5,000	5	300	180
5,001–5,500	6	300	180
5,501–6,000	6	250	150
6,001–7,000	7	250	150
7,001 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 that 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.

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.

f. A 50-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1 of the *International Fire Code*.

g. A 25-percent spacing increase shall be permitted where the building is equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.2 or 903.3.1.3 of the *International Fire Code* or Section P2904 of the *International Residential Code*.

h. The fire code official is authorized to modify the location, number and distribution of fire hydrants based on site-specific constraints and hazards.