Code of the City of Alexandria- Fire Flow Requirements (ISO)

SECTION A102 - FIRE FLOW REQUIREMENTS

A102.1 Fire Flow Requirements. Fire flow requirements shall be based on the methodology described in the Insurance Services Office's (ISO) Fire Suppression Rating Schedule. This methodology considers building construction, occupancy, adjacent exposed buildings and communication paths between buildings. (See Section A102.10 - Fire Flow Analysis for guidance)

A102.2 One and Two Family Dwellings. The fire flow required shall be based on the minimum exposure distance listed in Table A102.1:

Table 102.1 - MINIMUM EXPOSURE DISTANCE

Minimum Exposure Distance	Fire Flow (GPM)
0 ft.--10 ft.	1,500--2,000
11 ft.--30 ft.	1,000--1,500
31 ft. and greater	1,000

A102.3 Townhouses or Multiplex Units. Townhouses or multiplex units (residential or professional) where individual units are not separated by two-hour fire, party, or separation walls require a flow of 2,500 GPM. Townhouses (residential or professional) where individual units are separated by a minimum one-hour fire, party or separation walls and approved fire sprinkler systems establish fire flow requirements based on calculations for Other Uses as described in Section A102.4. Multiplex units (residential or professional) where individual units are separated by two-hour fire, party, or separation walls and approved fire sprinkler systems establish fire flow requirements based on calculations for Other Uses as described in Section A102.4.
Note: The Code Enforcement Bureau reserves the right to increase the required fire flow if building construction issues or access factors present an unusual fire or life safety challenge.

A102.4 Other Uses. Fire flow requirements established by the procedures and formula for needed fire flow delineated below is based on the Insurance Services Office (ISO) methodology.

A102.5 Computation of Needed Fire Flow. The needed fire flow shall be calculated at a minimum 20-psi residual pressure on the water system.
The basic formula is: $NFFi = (Ci)(Oi)(X + P)i$
Ci = Construction factor where: $Ci = 18F-\sqrt{}Ai$
F = coefficient related to type of construction:
• F = 1.5 for wood frame construction (2000 VUSBC Types VA & VB)
• F = 1.0 for ordinary construction (2000 VUSBC Types IIIA & IIIB)
• F = 0.9 for heavy timber construction (2000 VUSBC Type IV)

• F = 0.8 for noncombustible construction (2000 VUSBC Types IIA and IIB)
• F = 0.6 for fire-resistive construction (2000 VUSBC Types IA & IB)
A (effective building area) = the total area of the largest floor plus:
• Construction Type I & II - 25% of the area not exceeding the other two largest floors when all vertical openings have at least 1 1/2-hour fire-rated protection
or,
• 50% of the area not exceeding eight other floors when the vertical openings are unprotected or have less than 1 1/2-hour protection.
• Construction Type III through V - 50% of all other floors.
NOTE: In buildings with mixed construction a value Cm shall be calculated for each class of construction using the effective area of the building. The Cm values are multiplied by their individual percentage of the total area. The Ci applicable to the entire building is the sum of these values. However, the value of the Ci shall not be less than the values for any part of the building based upon its own construction and area.
Oi = Occupancy Factor, which reflects the combustibility of the occupancy.
• = 0.75 for non-combustible
• = 0.85 for limited combustible
• = 1.00 for combustible
• = 1.15 for free burning
• = 1.25 for rapid burning

(X + P)i = Exposure and Communication Factors

(X+P)i= 1.0 + (Xi + Pi) (with a maximum value of 1.60)
Values for X and P are determined from Tables A102.3 and A102.4 containing factors for type of separation or connections, and separation distance. (See Section A102.10 - Example Fire Flow Calculation for guidance).
Add 500 gpm to total fire flow for building with wood construction members, sheeting, shingles, or roof.

A102.6 Minimum Flow. Fire flow shall never be less than 500 gpm for a structure. Fire flow required for single-family detached dwellings shall never be less that 1,000 gpm. Both values are absolute minimums after all reductions are taken.

A102.7 Maximum Flow. The maximum fire flow shall be as listed in Table A102.2, except for structures requiring special consideration as described in Section A102.8.

TABLE 102.2 - MAXIMUM FLOW

Construction Type	Flow in gpm
III, IV or V	8,000
I or II	6,000

A102.8 Reductions Based on Sprinkler Protection. The value obtained from the formula in Section A102.5, COMPUTATION OF NEEDED FIRE FLOW, may be reduced by 50 percent when the structure under consideration is protected throughout with an approved automatic sprinkler system in accordance with the Virginia Uniform Statewide Building

Code and the currently referenced edition of NFPA 13 Standards for the Installation of Sprinkler Systems or other approved fire sprinkler system design and installation codes. Reductions are not permitted for structures with partial protection. Reductions for installations based on NFPA 13D or NFPA 13R designs, shall be approved by the Director of Code Enforcement on a case-by-case basis.

A102.9 Special Consideration. The above calculation procedures do not apply to the following, which require special consideration and direct consultation with the Code Enforcement Bureau:

a. Structures containing a group H fire area
b. Lumber yards
c. Petroleum Storage
d. Refineries
e. Chemical plants
f. Grain storage
g. Power generating facilities
h. Hazardous manufacturing processes
i. Paint, flammable liquid storage
j. High plies combustible storage

			Construction of Facing Wall of Exposed Building Classes			
Construction of Facing Wall of Subject Bldg.	Distance Feed to the Exposed Building	Length-Height of Facing Wall of Exposed Building	3.5	Unprotected Openings	1, 2, 4 Semi-Protected Openings (wired glass or outside open sprinklers)	Blank Wall
Frame, Metal or Masonry with Openings	0--10	1--100	0.22	0.21	0.16	0
		101--200	0.23	0.22	0.17	0
		201--300	0.24	0.23	0.18	0
		301--400	0.25	0.24	0.19	0
		Over 400	0.25	0.25	0.20	0
	11--30	1--100	0.17	0.15	0.11	0
		101--200	0.18	0.16	0.12	0

		201--300	0.19	0.18	0.14	0
		301--400	0.20	0.19	0.15	0
		Over 400	0.20	0.19	0.15	0
	31--60	1--100	0.12	0.10	0.07	0
		101--200	0.13	0.11	0.08	0
		201--300	0.14	0.13	0.10	0
		301--400	0.15	0.14	0.11	0
		Over 400	0.15	0.15	0.12	0
	61--100	1--100	0.08	0.06	0.04	0
		101--200	0.08	0.07	0.05	0
		201--300	0.09	0.08	0.06	0
		301--400	0.10	0.09	0.07	0
		Over 400	0.10	0.10	0.08	0
Blank Masonry Wall	Facing Wall of the Exposed Building is Higher Than Subject Building: Use the above table EXCEPT use only the Length-Height of Facing Wall of the Exposed Building ABOVE the Height of the Facing Wall of the Subject Building. Buildings five stories or over in height, consider as five stories When the Height of the Facing Wall of the Exposed Building is the Same or Lower than the Height of the Facing wall of the Subject Building, X j =0.					

Description	**Fire Resistance, Non-**	**Communications with Combustible**

of Protection off Passageway Openings	**Combustible or Slow-Burning Communications**				**Construction**					
					Open			**Enclosed**		
	Any Length	**10 ft. or Less**	**11 ft. to 20 ft.**	**21 ft. to 50 ft.**	**10 ft. or Less**	**11 ft. to 20 ft.**	**21 ft. to 50 ft.**	**10 ft. or Less**	**11 ft. to 20 ft.**	**21 ft. to 50 ft.**
Unprotected	**0**	**0**	**0.30**	**0.20**	**0.30**	**0.20**	**0.10**	**0**	**0**	**0.30**
Single Class A Fire Door at One End of passageway	**0**	**0.20**	**0.10**	**0**	**0.20**	**0.15**	**0**	**0.30**	**0.20**	**0.10**
Single Class B Fire Door at One End of passageway	**0**	**0.30**	**0.20**	**0.10**	**0.25**	**0.20**	**0.10**	**0.35**	**0.25**	**0.15**
Single class A fire door at each end or double class A fire doors at one end of passage	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Single class B fire door at each end or double class B fire doors at one end of passage	**0**	**0.10**	**0.05**	**0**	**0**	**0**	**0**	**0.15**	**0.10**	**0**

+ For over 50 feet, Pi =0

++ For unprotected passageways of this length, consider the two buildings as a single fire division

Note: When a party wall has communicating openings protected by a single automatic or self-closing Class B fire door, it qualifies as a division wall* for reduction of area.

Note: Where communications are protected by a recognized water curtain, the value of Pi is 0.

A102.10 - EXAMPLE FIRE FLOW ANALYSIS

A new cinema building will be constructed and has a footprint area of 77,680 square feet and a gross area of 134,320 square feet. The building is three stories, type 1B construction and is classified as use group A1 for theaters with the ground floor primarily movie theater seating. To the west of the proposed cinema is a hi-rise office building approximately 85 feet away. To the north and south there is on grade parking and no structure within 100 feet. To the east there is a future structure planned and it will be within 30 feet of the cinema. All vertical openings are unprotected or have less than one 1/2 hour fire rated protection. The facility will have full fire sprinkler protection based on the NFPA 13 standard.

Needed Fire Flow = NFFi = (Ci)(Oi)(X+P)i

(1) Ci = Construction Factor where Ci = 18 F✓ Ai

F = coefficient related to type of construction:

• F = 0.6 for fire-resistive construction (2000 VUSBC Types IA &IB)

A = effective building area = the total area of the largest floor plus 50% of the area not exceeding eight other floors when all vertical openings are unprotected or have at less than 1 1/2-hour fire-rated protection for Construction Type I and II.

A = 77,680 + (134,320 – 77,680) × .50 = 106,000 square feet

C = 18 × .6 ×✓106,000 = 3516 gpm

(2) Oi = Occupancy Factor, which reflects the combustibility of the occupancy.

• O = 1.15 for free burning based on a conservative design approach from undetermined plastic and fabric seating fixtures

(3) (X + P)i = Exposure and Communication Factors from Tables 102.3 and 102.4. Values for X and P are determined from charts containing factors for type of separation or connections, separation distance.

(Xi + Pi) = 1 + (Xi+ Pi) =	1.0 + (0.10 + 0.0 + 0.19 + 0.0) + 0 = 1.29 west north east south

Needed Fire Flow = (C) × (O) × (1 + Xi + Pi) = 3,516 × 1.15 × 1.29 = 5250 gpm

NOTE: 50% reduction available since a full NFPA 13 sprinkler system will be installed. Therefore:

N.F.F. = 5250 × 0.50 = 2,625 gpm = 2,705 (rounding to the nearest 250 gpm increment)

SECTION A103 - SITE PLAN INFORMATION

A103.1 Site Plan Requirements. The following information shall be provided on site plans:

1. Submitter name, address, telephone number
2. Building name and address
3. Edition of the building code (Virginia Uniform Statewide Building Code), occupancy classification, use group and type of construction.
4. Height of building in feet and stories
5. Foot print area of building and gross floor area of building.
6. Identification of fire walls, fire barriers, other fire separations with hourly rating.
7. Existing and proposed water and fire main locations and sizes.
8. Existing and proposed fire hydrants locations size of pipe, and expected flow and pressure.

Note: Fire Hydrant Coverage and Location.

(a) Minimum 40-foot clearance from hydrant to any structure.
(b) Maximum 100 feet from hydrant to fire department connection.
(c) Fire hydrant coverage: 300 feet, measured from the hydrant to the most remote point of vehicular access on the site, via the vehicular travel path.
(d) Dead-end water main to fire hydrant distance:

6" line	380 feet max. distance
8" line	1,550 feet max. distance
10" line	4,600 feet max. distance
12" line	11,150 feet max. distance

(e) No obstructions within 4 feet of hydrant (plants, fences, retaining walls, etc.)
(f) Fire hydrants and water mains in or on parking structures shall be protected from freezing, but no heat tape permitted.
(g) Fire hydrant location for single-family dwellings: lot line and/or curve of pavement
9. State if a full or partial fire sprinkler system will be installed.
10. If fire sprinkler system will be installed, show location of fire department siamese connections(s).
Note: Siamese shall be located on street front, address side of building but provide additional siamese for buildings five stories or 50 feet or greater, on the other side of the building.
Siamese connection shall be visible and accessible with no obstructions within 4 feet.
11. Topographical map relating grade and elevation to fire department connections.
12. Available water pressure and flow capacity, static pressure, residual pressure, flow in gpm.
13. Calculate required fire flow and indicate available fire flow at 20 psi per Insurance Services Office (ISO) methodology as described in this document.
14. Location of all Emergency Vehicle Easements (EVE) and locations of EVE signs.
15. Adequate emergency vehicle access, turning radii.
Note: (a) Buildings more than 5 stories or 50 feet in height require ladder truck access on the two longest opposing sides with 100% of those respective sides accessible to the fire department.
(b) Dead-end emergency vehicle easements greater than 100 feet require turnaround.
(c) Emergency vehicle access to within 100 feet of main entrance.
(d) Swimming pool access - to be within 50 feet of edge of pool.
(e) Show all overhangs and obstructions to emergency vehicle easement. The minimum emergency vehicle clearance for canopies, overhangs, and obstructions is 15 feet.
(f) Design live load for emergency vehicle on parking structure, deck shall conform at a minimum to A.A.H.S.T.O. Loading Standard HS-20.
16. Check VUSBC Table 503 for area and height requirements