NEW JERSEY AMERICAN WATER

Needed Fire Flow Calculation Worksheet

The ability of a distribution system to provide safe, adequate and reliable service to its customers is analyzed based on forecasted customer demands and Needed Fire Flow (NFF) requirements. Hydraulic computer modeling of the distribution system is utilized as the primary tool in the analysis. The model will determine system adequacy/deficiency and evaluate the effectiveness of proposed improvements under requested fire demand conditions. Published reports from the ISO are used as a guide in determining a "non" automatic sprinkler system NFF. The calculations and tables contained within are obtained from the ISO's Guide For Determination of Needed Fire Flow, Edition 05-2006.

***This worksheet is only a guide and in no way does New Jersey American Water take responsibility for the calculated Needed Fire Flow indicated within. In some cases the requested Needed Fire Flow for a site may be more or less based on other factors not accounted for in this worksheet. ISO's municipal fire protection testing may identify sites with needed fire flows greater than 3,500 gpm for a duration of three hours. In many pressure zones, particularly in residential areas, the identified maximum is less than 3,500 gpm. Where individual structures are assigned ISO Needed Flows above 3,500 gpm, fire protection needs in excess of 3,500 gpm at these sites will be satisfied through the development of individual customer-owned fire suppression systems.**

Preparer: Please fill in only the yellow shaded cells on worksheets

Municipal Fire Official or assigned Delegate: Please fill in only the blue shaded cells as appropriate on Sign Off Sheet

NJAW Worksheet - Determine Needed Fire Flow

***Complete Parts 1 - 5 for NON-Residential Buildings**

Part 1

1. Determine The Construction Class of the Building. And calculate the Effective Area (see note below)

2. Insert the Class Factor (F) and the Effective Area in the yellow cells to Determine The Construction Factor (C)

"Effective Area" is not necessarily equal to total area. Please refer to ISO Guide for Determination of Needed Fire Flow, Chapter 2, paragraph 5 - Determining Effective Area (Ai) and Chapter 6 - Determining Recognition of Automatic Sprinkler Systems for additional information.

Construction Factor				
		Example	Actual	
Inputs:		Value	Value	
(F)	Construction Coefficient	1.5		<<Enter Value
(A)	Effective Area	2655		<<Enter Value
	C calculated =	1391	0	$C = 18F(A)^{0.5}$
	C =	1500		<<<Rounded nearest 250 gpm

Classification of Basic Construction Types

ISO classifies construction types into six different categories:

Construction Class 6 (fire-resistive construction)
Construction Class 5 (modified fire-resistive construction)
Construction Class 4 (masonry noncombustible construction)
Construction Class 3 (noncombustible construction)
Construction Class 2 (joisted-masonry construction)
Construction Class 1 (wood frame construction)

Maximum and Minimum Value of C:

The value of C shall not exceed

8,000 gpm for Construction Class 1 and 2
6,000 gpm for Construction Class 3, 4, 5, and 6
6,000 gpm for a 1-story building of any class of construction

The value of C shall not be less than 500 gpm.

ISO rounds the calculated value of C to the nearest 250 gpm.

c. Effective-area calculation:

After modification for division walls as provided above, the effective area shall be the total square foot area of the largest floor in the building, plus the following percentage of the total area of the other floors:

(1) Buildings classified as Construction Classes 1 - 4: 50% of all other floors.

(2) Buildings classified as Construction Classes 5 or 6:

(a) If all vertical openings in the building are protected (see 4d., "Protection requirements," below), 25% of the area of not exceeding the two other largest floors.
(b) If one or more vertical openings in the building are unprotected (see 4d., "Protection requirements," below), 50% of the area of not exceeding 8 other floors with unprotected openings.

Note: The effective area determined under item 4c.(2)(b), above, shall not be less than the effective area that would be determined under item 4c.(2)(a), above, if all openings were protected.

Needed Fire Flow/Effective Area Table

TYPE OF CONSTRUCTION FACTOR AS DETERMINED BY RANGE IN EFFECTIVE AREA

Class	1		2		3,4		5,6	
Factor (F)	1.5		1.0		0.8		0.6	
	Effective Area (A)		Effective Area (A)		Effective Area (A)		Effective Area (A)	
(C)	At Least	Not Over	At Least	Not Over	At Least	Not Over	At Least	Not Over
500	0	535	0	1,205	0	1,883	0	3,348
750	536	1,050	1,206	2,363	1,884	3,692	3,349	6,564
1,000	1,051	1,736	2,364	3,906	3,693	6,103	6,565	10,850
1,250	1,737	2,593	3,907	5,835	6,104	9,117	10,851	16,209
1,500	2,594	3,622	5,836	8,150	9,118	12,734	16,210	22,639
1,750	3,623	4,822	8,151	10,852	12,735	16,954	22,640	30,140
2,000	4,823	6,194	10,853	13,937	16,955	21,776	30,141	38,714
2,250	6,195	7,737	13,938	17,409	21,777	27,202	38,715	48,359
2,500	7,738	9,452	17,410	21,267	27,203	33,230	48,360	59,076
2,750	9,453	11,338	21,268	25,511	33,231	39,861	59,077	70,864
3,000	11,339	13,395	25,512	30,140	39,862	47,095	70,865	83,724
3,250	13,396	15,624	30,141	35,156	47,096	54,931	83,725	97,656
3,500	15,625	18,025	35,157	40,557	54,932	63,374	97,657	112,659
3,750	18,026	20,597	40,558	46,344	63,375	72,413	112,660	128,734
4,000	20,598	23,341	46,345	52,517	72,414	82,058	128,735	145,881
4,250	23,342	26,256	52,518	59,076	82,059	92,306	145,882	164,100
4,500	26,257	29,342	59,077	66,020	92,307	103,156	164,101	183,390
4,750	29,343	32,600	66,021	73,350	103,157	114,610	183,391	203,751
5,000	32,601	36,029	73,351	81,066	114,611	126,666	203,752	225,185
5,250	36,030	39,630	81,067	89,168	126,667	139,325	225,186	247,690
5,500	39,631	43,402	89,169	97,656	139,326	152,587	247,691	271,267
5,750	43,403	47,346	97,657	106,529	152,588	166,452	271,268	295,915
6,000	47,347	51,461	106,530	115,788	166,453		295,916	
6,250	51,462	55,748	115,789	125,434				
6,500	55,749	60,206	125,435	135,464				
6,750	60,207	64,836	135,465	145,881				
7,000	64,837	69,637	145,882	156,684				
7,250	69,638	74,609	156,685	167,872				
7,500	74,610	79,753	167,873	179,446				
7,750	79,754	85,069	179,447	191,406				
8,000	85,070		191,407					

Part 2

1. Fill in the Occupancy Factor that Pertains to the Proposed Building Type.

Occupancy Factor			
		Example	Actual
Inputs:		Value	Value
O	Occupancy Factor	1.15	

<<Enter Value

Occupancy Factor (O)

The factors below reflect the influence of the occupancy in the subject building on the needed fire flow:

Occupancy Combustibility Class	Occupancy Factor (O)
C-1 (Noncombustible)	0.75
C-2 (Limited-combustible)	0.85
C-3 (Combustible)	1.00
C-4 (Free-burning)	1.15
C-5 (Rapid-burning)	1.25

- C-1 combustibility shall apply ONLY where 95% or more of the total floor area of the building is occupied by C-1 occupants, and there are no C-5 occupancies.

- C-2 combustibility shall apply to buildings which
  a. do not qualify as C-1 above, but where 90% or more of the total floor area of the building is occupied by C-1 and C-2 occupancies; OR
  b. are classified as CSP Construction Class 5 or 6, AND where 80% or more of the total floor area of the building is occupied by C-1 and C-2 occupancies, AND NOT MORE THAN 5% of the total floor area is occupied by C-5 occupancies.

- C-4 combustibility shall apply to any building containing C-4 occupants, where the combined total area occupied by C-4 and C-5 (if any) occupants is 25% OR MORE OF THE TOTAL FLOOR AREA of the building, provided the C-5 occupancies occupy, in total, less than 15% of the total floor area.

- C-5 combustibility shall apply to any building where 15% OR MORE OF THE TOTAL FLOOR AREA is occupied by C-5 occupancies.

- C-3 combustibility shall apply to any building not provided for above.

Part 3

1. Determine the Exposure Factor Using Table 330.A Below.

2. Determine the Communication Factor Using Table 330.B Below.

(X + P), with a maximum value of 0.60

Exposure and Communication Factor (X+P)				
		Example	Actual	
Inputs:		**Value**	**Value**	
X	**Exposure Factor**	**0.17**		<<Enter Value
P	**Communication Factor**	**0.10**		<<Enter Value

TABLE 330.A FACTOR FOR EXPOSURE (X)

Construction of Facing Wall of Subject Building	Distance in Feet to the Exposure Building	Length-Height of Facing Wall of Exposure Building	Construction of Facing Wall of Exposure Building Classes			
			1,3	2, 4, 5, & 6		
				Unprotected Openings	Semiprotected 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 exposure building is higher than the subject building. Use the above table EXCEPT use only the length-height of the facing wall of the exposure 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 exposure building is the same or lower than the height of the facing wall of the subject building, X = 0.					

TABLE 330.B FACTOR FOR COMMUNICATIONS (P)

Description of Protection of Passageway Openings	Fire-resistive, Noncombustible, or Slow-Burning Communications				Communications with Combustible Construction					
	Open	Enclosed			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	++	0.30	0.20	0.30	0.20	0.10	++	++	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 Passageway	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 Passageway	0	0.10	0.05	0	0	0	0	0.15	0.10	0

\+ For over 50 feet, P = 0.

++ For unprotected passageways of this length, consider the 2 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. Where communications are protected by a recognized water curtain, the value of P is 0.

Part 4

1. Determine the Non-Automatic Sprinkler NFF Using the Formula Below and Values Obtained for C, O, X and P in Parts 1, 2 and 3 of This Worksheet.

Needed Fire Flow **NFF = (C)(O)(1+(X+P))**

Needed Fire Flow			
		Example	Actual
Inputs:		Value	Value**
C	Construction Factor	1500	
O	Occupancy Factor	1.15	
X	Exposure Factor	0.17	0.00
P	Communication Factor	0.1	0.00

** These cells are linked values from Parts 1, 2 and 3 on previous sheets

Calculated Fire Flow =	2,191	gpm
Needed Fire Flow =	2,250	gpm <<< NFF Rounded to nearest 250 gpm if < 2500 gpm and to the nearest 500 gpm if > 2500 gpm

Part 5

1. Fill in the Required Sprinkler System Flow and Total Dynamic Head Values.

If building sprinkler system(s) are proposed, indicate the needed design flow for such in the space below. (If multiple sprinkler systems are proposed for a site, indicate the needed flow for the highest demanding system or zone)		
Automatic Sprinkler System Flow Requirement		gpm
If a fire pump is required, please provide the additional design points		gpm
		TDH

Other Considerations for Determining Needed Fire Flow (NFF)

- When the subject building or exposure buildings have a wood-shingle roof covering and ISO determines that the roof can contribute to spreading fires, ISO adds 500 gpm to the needed fire flow.
- The maximum needed fire flow is 12,000 gpm. The minimum is 500 gpm.
- ISO rounds the final calculation of needed fire flow to the nearest 250 gpm if less than 2,500 gpm and to the nearest 500 gpm if greater than 2,500 gpm.

Needed Fire Flow Summary

Non-Residential and Residential Buildings Greater Than 2 Stories		
Needed Fire Flow (Calculated) No Automatic Sprinkler Credit Applied		gpm

OR if project has a Sprinkler System

Automatic Sprinkler System Flow (ASSF) Requirement	0	gpm
Additional Outside Hose Allowance (per Fire Official if desired) This is in addition to the ASSF Requirement		gpm
Total Needed Fire Flow When Automatic Sprinkler System is Proposed (= ASSF + Additional Outside Hose Allowance) ***500 gpm Minimum***	500	gpm

Residential		
Needed Fire Flow (Insert from Table A)		gpm
Total Needed Fire Flow (If Higher Flow Amount Requested By Township Fire Official)		gpm

Table A

For 1 and 2 family dwellings not exceeding 2 stories in height, ISO uses the following needed fire flows:

DISTANCE BETWEEN BLDGS	NEEDED FIRE FLOW
More than 100'	500 gpm
31-100'	750 gpm
11-30'	1,000 gpm
10' or less	1,500 gpm

Note: Both Signatures Required

Project Name: _____

Project Address: _____

_____

Prepared By: _____

Signature: _____

Title: _____

Date: _____

Phone #: _____

Signing this sheet is only an **acknowledgement** of the NFF calculations. It **does not** imply a review and approval of the calculations.

Municipal Fire Official

or Delegate:

(Print Name): _____

Municipality: _____

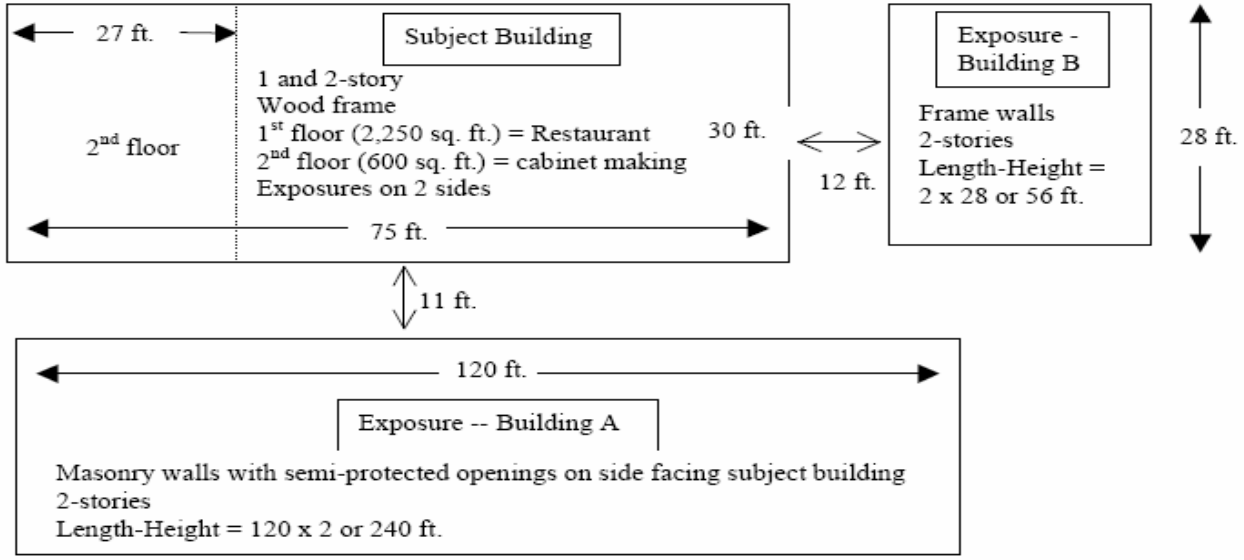
Signature: _____

Title: _____

Date: _____

Phone #: _____

Example



CONSTRUCTION TYPE

Construction Class 1 (wood-frame construction)
Construction type coefficient (F) = 1.5
Effective area (A) = 2,655 (ground floor + ½ of second floor area)

$C = 18F\ (A)^{0.5}$
$C = 18(1.5)\ (2{,}655)^{0.5}$
$C = 27(51.53)$
$C = 1{,}391.31$
C = 1,500 (rounded to the nearest 250 gpm)

OCCUPANCY TYPE

Cabinet making (occupies over 25% of the total floor of the building)
Occupancy combustibility class C-4 (free-burning)
Occupancy factor (O) = 1.15

EXPOSURES AND COMMUNICATIONS

Exposure charge for Building A = 0.14
Exposure charge for Building B = 0.17
The building with the highest charge is Building B.
Exposure factor (X) = 0.17
Communication (P) charge = none
Exposure and communication factor (X + P) = 0.17

CALCULATION

NFF = (C)(O)(1+(X+P))
NFF = (1,500)(1.15)(1+(0.17))
NFF = (1,500)(1.15)(1.17)
NFF = 2,018
NFF = 2,000 gpm