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AUTOMATIC SPRINKLER PERFORMANCE TABLES

TABLE 3 — CONDENSED *

Number of Sprinklers Operating	Number of Fires		Percentage Extinguished or Controlled	
	Total	Cumulative	Total	Cumulative
1	3809	3809	66.56%	66.56%
2	901	4710	15.56	82.12
3	337	5047	5.89	88.01
4	184	5231	3.22	91.23
5	91	5322	1.58	92.81
6	71	5393	1.24	94.05
7	50	5443	0.87	94.92
8	45	5488	0.78	95.70
9	25	5513	0.44	96.14
10	31	5544	0.54	96.68
10 or more	176	5720	3.08%	99.76%

TOTAL	NUMBER	PERCENT
Fires Extinguished or Controlled	5720	99.76%
Unsatisfactory Performance	14	00.24%
TOTAL	5734	100.00%

Source – *Automatic Sprinkler Performance In Australia, 1886-1969 9 p 84) by – H. W. Marryatt, Australian Fire Protection Association (April, 1971)*

Source: 242 National Automatic Sprinkler and Fire Control Association, Inc.; News Bulletin, p. 25-28, January-March, 1973

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type of occupancy, this is an indispensable reference source.

If you delight in "the laws of large numbers", statistics, this text is the ultimate source of information about sprinklers, originating from Australia and New Zealand, where statistical research into sprinkler behavior stands out as an example for the world to emulate.

Marryatt has evaluated 5,734 fires, virtually every instance of sprinkler operation of which a known record exists in the nation's down under. His conclusion: 5,720 extinguishments out of a possible 5,734. 99.76% of all recorded fires: successfully extinguished by sprinklers.

Marryatt has wrung every conceivable drop of information out of the statistics he has developed: operating temperatures of sprinklers, types of sprinkler (link and lever, bulb, pendant, upright, etc.), response time of the "fire brigade" (department), time of day at which fires occurred, month of year, construction type (fire resistive — non-fire resistive), floors of buildings in which fires occurred, the height above the floor of sprinklers in operation. He makes extensive

AUSTRALIA - NEW ZEALAND
WHY UNSATISFACTORY PERFORMANCE?

	No. of Fires	Percent of Unsatisfactory Performance
• Severe external exposure	4	28.6%
• Partial sprinkler protection	4	28.6%
• Explosions Systems destroyed by blast	3	21.5%
• Fire loading too high for water supply	1	07.1%
• Inadequate water supplies	1	07.1%
• Roof surface destroyed	1	07.1%
TOTAL	14	100.0%

Source: 242 National Automatic Sprinkler and Fire Control Association, Inc.; News Bulletin, p. 25-28, January-March, 1973 commentaries on water supplies, flowing pressures, gallonage consumed, and a detailed analysis with illustrative case histories on the behavior of fires in nearly one hundred types of occupancies.

His analysis of incendiary fires, even cases where as many as seven fires were set by an arsonist, have given sprinklers a 100% record in controlling 120 out of a possible 120 fires set by arsonists.

Marryatt's five years of research into 5,734 fires discovered only 14 cases where sprinklers failed to extinguish or control fires. That's only 0.24% compared to a record of 99.76% of the total fires successfully managed by sprinklers.

In 82 years, 14 unsuccessful operations is a little short of unbelievable.

The most amazing fact to emerge from the book was the small number of sprinklers needed to control fires. 66.56% of all fires were controlled by one sprinkler. 82.12%, by two or less sprinklers. 91.23%, by four or less sprinklers. Only 176 fires opened more than ten sprinklers out of a possible 5,734. That's 3.08%.

If you really want to know the story on sprinklers, this book is a must.

You can order it directly from the National Fire Protection Association.

60 Batterymarch Street
Boston, Massachusetts 02110
Attention: Doris Sheldon

Enclose a check or money order made payable to NFPA ($15.50).

Source: 242 National Automatic Sprinkler and Fire Control Association, Inc.; News Bulletin, p. 25-28, January-March, 1973

PART III

STATISTICS

HOW MUCH WATER SHOULD A CITY
HAVE AVAILABLE FOR FIGHTING FIRES

1. ISO Guide for Determination of Required Fire Flow
2. Municipal Grading Schedule Description

WATER SUPPLY REQUIREMENTS FOR FIRE PROTECTIO.!

This chapter gives information on the quantities of water needed for fire protection purposes. The components of a water system are discussed in other chapters in this section. No distinction is made for ownership of a system, whether public or private, as quantities of water needed for fire protection are not based on ownership of the system but rather on experience and engineering analysis of fire protection requirements for the property to be protected. Supply requirements for automatic sprinklers or other fixed systems using water are discussed in appropriate chapters of Sections 14 and 15.

A. The Two Uses of Water Systems

Water systems designed today for municipal use have dual functions; they supply potable water for domestic consumption, and they supply water for fire protection. Domestic consumption means more than just water for human consumption. It includes water used for sanitation, industrial processes, lawn sprinkling, air conditioning and similar water-consuming purposes. Sometimes industrial sites will provide separate systems for supplying process water and water for fire protection. Any dual-purpose system must be able to supply enough water for fire protection while at the same time meet the maximum anticipated consumption for other purposes.

B. Rates of Consumption

There are three rates of consumption that are considered in designing water systems. They establish a base to which required fire flows can be added in designing a system or determining its adequacy. The rates are:

1. Average daily consumption—the average of the total amount of water used each day during a 1-year period.
2. Maximum daily consumption—the maximum total amount of water used during any 24-hour period in a 3-year period. (Unusual situations which may have caused an excessive use of water, such as refilling a reservoir after cleaning should not be considered in determining the maximum daily consumption.)
3. Peak hourly consumption—the maximum amount of water that can be expected to be used in any given hour of a day.

The maximum daily consumption is normally about 1.5 times the average daily consumption. The peak hourly rate will vary from two to four times a normal hourly rate. The effect these varying consumption rates will have on the ability of the system to deliver required fire flows will vary with the system design. But both maximum daily consumption and peak hourly consumption should be considered to ensure that water supplies and pressures do not reach dangerously low levels during these periods, and that adequate water will be available in the event of a fire.

C. Water for Fire Fighting

Historically, water systems for cities and towns were developed with needs other than fire protection in mind. However, it was found that in a large city which had to have a lot of water for drinking, sanitation, and other purposes, there was usually sufficient water to provide a useful supply for fire fighting purposes. On the other hand, waterworks designed on the basis of ordinary water needs of a small city would be able to deliver only a fraction of the water which might be needed for fire fighting.

All this led to inquiries into the cost in a given city for a waterworks that could provide water for fire fighting purposes as well as for other uses. A number of distinguished engineers associated with individual waterworks examined the problem and their findings were discussed in technical papers presented at engineering society meetings. Papers by J. Herbert Shedd (1889),[1] J. T. Fanning (1892),[2] and Emil Kuichling (1897)[3] should be consulted for details of the discussions in which standards now followed in American and Canadian waterworks practice developed (Table 11-1A).

Table 11-1A. Estimates of Fire Flow

Populations Thousands	Shedd 1889	Fanning 1892	Freeman 1892	Kuichling 1897	NBFU 1910
	Number of Fire Streams Required Simultaneously				
1			2–3	3	4
4		7		6	8
5	5		4–8	6	9
10	7	10	6–12	9	12
20	10		8–15	12	17
40	14		12–18	18	24
50		14		20	26
60	17		15–22	22	28
100	22	18	20–30	28	36
150		25		34	44
180	30			38	48
200			30–50	40	48

Sources (these authorities define streams slightly differently as described in accompanying text, but the streams were of the order of 200 gpm to 300 gpm):

Shedd, J. Herbert, discussion on a paper by Shorman, William B., *Ratio of Pumping Capacity to Maximum Consumption.*[1]

Fanning, J. T., *Distribution Mains and the Fire Service.*[2]

Kuichling, E., *The Financial Management of Water Works.*[3]

Freeman, John R., *The Arrangement of Hydrants and Water Pipes for the Protection of a City Against Fire.*[4]

Figures furnished by National Board of Fire Underwriters, and presented in a paper by Metcalf, Leonard, et al.[5]

The Number of Hose Streams

The starting point for considering the cost of water for fire protection was an estimate of the number of hose streams that a fire department might need for fire fighting. This was usually estimated on the basis of the central portion of the city where the largest buildings were located and where there was the greatest building congestion. The number of streams was found to be related, in a very rough way, to the population. Shedd's proposal, the first, was on the basis of hose streams discharging 200 gpm. He suggested that a community of 5,000 population, as a rule, would need about five such streams and that the needs of

Source: National Fire Protection Association; Fire Protection Handbook, pp. 11-2 through 11-6 14th edition 1976

other cities could be graduated up to thirty streams in a city of 180,000. Fanning proposed streams requiring about 54 psi pressure as the basis. His figures were of the same general order as Shedd's, beginning at seven streams for a community of 4,000 and going up to twenty-five streams for a city of 150,000.

Kuichling suggested a formula where the number of streams required would be the square root of the population in thousands multiplied by a factor of 2.8. There were arithmetical differences as to how these estimates worked out for individual cities, but they were of the same general order (Table 11-1A). Most important, they did provide a basis from which the waterworks designers could make some estimates of the cost factors which fire demands imposed on various details of the system.

During this period of consideration of waterworks design features to provide fire protection, the most important paper on the subject, *The Arrangement of Hydrants and Water Pipes for the Protection of a City Against Fire*, was presented (1892) by John R. Freeman.[4] He had done the fundamental work on flow of water through hose and nozzles, so he was able to pin down the definition of a standard fire stream to one with a discharge of 250 gpm at 40 to 50 psi pressure. He said that the relationships suggested by Shedd and Fanning between population and the number of streams required were of the right order, but he did not think the needs of individual cities could be quite so definitely pinned down. He suggested two to three streams as a minimum at 1,000 population graduated up to thirty to fifty at 200,000 (Table 11-1A). Most significantly, he warned: "Ten streams, or as large a proportion thereof as the financial consideration will permit, may be recommended for a compact group of large, valuable buildings, irrespective of a small population."

Engineering: Distributing Network, Hydrant Spacing, Storage

Freeman noted a fundamental difference in purpose between a system designed for supplying ordinary water needs and one for water for fire protection. Fire draft required concentration of the water, whereas domestic draft was a matter of distribution.

Freeman sought to secure recognition of the fact that if a water system was to supply fire protection needs, the distribution system should be designed to concentrate the needed amounts of water. Small pipes were sufficient for distribution, but larger ones were needed for concentration of supply to fire streams. He suggested 6-in. diameter pipe as the minimum for residential districts, and he noted that 8-in. pipe was adequate only where it formed part of a network of distributing pipes whose intersections were not far apart.

Another important point Freeman made was that hydrants should be placed where they could concentrate streams at specific blocks or groups of buildings to be protected rather than on an arbitrary basis of a certain number of feet apart on the street mains. His work on hose streams had shown how long hose lines reduced the water that can be delivered promptly on a fire. He therefore suggested a working rule for hydrant spacing of 250 ft between hydrants in compact mercantile and manufacturing districts, and 400 to 500 ft in residential districts. These working rules can still be used as guides for good design. (Hydrant spacing is discussed in greater detail in Chapter 2 of this Section.)

Freeman further insisted that fire supply should be in addition to maximum domestic consumption and laid the foundation for eventual recognition of this principle. He also indicated how much water should be stored in standpipes or elevated reservoirs in the application of the principle. He expressed the judgment that flow for all of the hose streams required should be supplied from a reliable source, such as an elevated storage reservoir, for a period of not less than 6 hrs during a period when the system was also furnishing maximum demands for domestic and other uses. His judgment also was that to supply the combined fire and domestic needs in a system provided with reliable pump capacity, a 1-hr supply in a standpipe or elevated reservoir would be acceptable.

The Insurance Grading Schedule

As early as 1889, the NBFU (National Board of Fire Underwriters) began to make fire protection surveys of municipalities. This work was intensified in 1904 after a conflagration in Baltimore. Today the larger cities countrywide and the smaller communities in all but seven states are surveyed by the ISO (Insurance Services Office), successor to the NBFU. The survey includes an evaluation of a municipality's water system in all its details, and a map is usually prepared of the system itself. Actual hydraulic tests are made to determine the fire flow available in various parts of the community.

From the examination of the water supply, as well as other factors affecting fire defenses, the community is provided with recommendations expressing an engineering judgment on what the community should consider in its decisions on its public fire protection program. Engineers use as a yardstick the latest edition of ISO's *Grading Schedule for Municipal Fire Protection*,[6] that considers a municipality as a whole, and no longer places more emphasis on protection for downtown districts than on other important districts as did earlier editions of the grading schedule. (For a more complete discussion of the insurance grading schedule see ~~Section 9, Chapter 6.)~~ III-18 — III-21).

D. Fire Protection Requirements in Water Systems

The capacity of a water system is determined by the total amount of water it must furnish. This is the sum of: (1) water required for domestic or industrial uses, and (2) water required for fire service. In small towns, the requirements for fire protection exceed other requirements.

In North American cities, a public water system is expected to furnish water for a great variety of purposes. In individual cities, there may be a heavy industrial demand, but demands for air conditioning and lawn sprinkling are examples of regular uses which can also affect the required capacity of the system. The adequacy of a public water system for fire protection cannot be taken for granted. These other demands on the system must be determined to estimate their effects on the capacity of the system for fire protection.

A joint report (1951) of committees of the American Society of Civil Engineers, the American Water Works Association and others,[7] suggested that the maximum general service demand on a waterworks system be taken as the peak hourly demand during a test year. This, they noted, was the only figure which can fairly be compared with the maximum fire flow requirement.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 11-2 through 11-6 14th edition 1976

Evaluating System Capacity

ISO engineers evaluate the ability of a water system to meet the maximum daily consumption rate plus the needed fire flow. In most large cities, the peak hourly rate exceeds the maximum daily consumption rate plus fire flow, and therefore, is the controlling factor in system design. However, in the smaller communities the reverse is true with the maximum daily consumption rate plus fire flow being the controlling factors. For many years water consumption has been increasing in most municipalities resulting in increased peak hourly rates. One result of this trend has been an increase in the number of municipalities in which the peak hourly rate controls design.

Pressure Characteristics of Systems

The pressure for which systems are normally designed reflect several practical considerations. They attempt to provide pressures that are adequate for water supplies both for domestic consumption and for fire protection. If either type of service demands special ranges of pressure, they too can be provided. Pipe and related fittings and methods of using them will allow almost any desired range.

San Francisco, for example, has a separate system, designated the "high pressure system," under the control of the fire department. All of the pipe is extra-heavy cast iron, tar-coated and lined, and tested on installation and repair to 450 psi. Two steam-operated pump stations can pump water from San Francisco Bay into the system, and 20,000 gpm at 250 psi can be delivered to most of the principal mercantile district. San Francisco provided this system primarily because an earthquake might put the regular public water system out of service. A number of other cities have provided similar "high pressure" systems.

Modern motorized fire department pumping apparatus make heavy streams and high pressures available from ordinary water systems where adequate volume is provided. Cities that formerly had separate systems of fire mains, operating at so-called high pressures, now generally have these operating at what would be normal public water pressures. They retain the advantages of an extra system of water mains.

Public water systems reflect a compromise on the question of pressures. Pressures in the range of 65 to 75 psi are best in most systems. This range is adequate for ordinary consumption in buildings up to about ten stories. It will provide sufficient water for automatic sprinkler systems in buildings of four to five stories. Where pressures of this order are provided, there is a reasonable margin to make it relatively easy to compensate for local fluctuations in draft at various times.

It is generally recommended that a minimum residual pressure of 20 psi be maintained at hydrants when delivering the required fire flow. Pumpers can be operated where hydrant pressures are less, but with difficulty. Where hydrants are well distributed and of the proper size and type (so that friction losses in the hydrant and suction line may not be excessive), it may be possible to set 10 psi as the minimum pressure. Sufficient suction pressure should be maintained to prevent developing a negative pressure in the street mains, which might result in the collapse of the mains or other water system components, or back-siphonage of polluted water from some interconnected source. The use of residual pressures of less than 20 psi is not permitted by most state health departments.

Pressures in a public water system may be considered excessive as they approach 150 psi. As pressures increase, they tend to cause leaks in domestic plumbing, and special attention is required to restrain the mains in the ground. Pipe and fittings used in the ordinary public water system are designed for maximum working pressures of 150 psi. This does not mean that it is good practice to run pressures up that high. Pressure-reducing valves can be used in some sections of a system where the topography would produce excessive pressures, and individual water services to buildings may require pressure reducing valves to keep the pressure on domestic piping at safe levels.

Systems for Higher Elevations

When water must be supplied to an area of a community on high ground, the usual practice is to provide a separate water distribution system for the elevated section so that a normal range of pressures is provided. In such cases, the elevated area should be provided with its own water storage facility, and pumps may be provided to boost the water from the rest of the system. Likewise, the upper stories of a high building should be provided with water systems in the building itself. These systems will have the same requirements as for an area on a hill. A very tall building would have to be divided into a number of pressure zones. Zones of more than twelve stories tend to get outside the normal pressure ranges. In any case, each pressure zone must have storage of water in amounts needed for the sprinkler service or hose streams to be provided, and a system of pumps so that each zone is supplied from the zone below. Care should be taken to ensure that the pumps will be able to operate even during times of power failures.

E. Calculating Fire Flows

For many years the NBFU formula (see Table 11-1A) was commonly used as a guide in determining the fire flow required in the downtown business districts of municipalities. The formula

$$G = 1020\sqrt{P}\ (1 - 0.01\sqrt{P})$$

gave the fire flow, G, in gallons per minute as a function of the population, P, in thousands.

In making fire protection surveys, the fire flow requirements in the sections of the municipalities outside the downtown business district were estimated by the engineers of the NBFU and insurance bureaus.

As cities became more decentralized, the formula based on population became less reliable as a guide for the fire flow needed in the downtown district. In addition, it became more apparent that a guide to engineering judgment was needed for the other sections of the cities. In 1948, a paper by A. C. Hutson,[8] assistant chief engineer of the NBFU, provided some specific suggestions for estimating fire flow requirements in these sections.

The latest developments in estimating fire flow requirements are found in the *Guide for Determination of Required Fire Flow*[9] published by ISO in 1972. It provides guidance for estimating fire flow requirements in all parts of a municipality. The basic formula in the guide is:

$$F = 18\,C\,(A)^{0.5}$$

where F is the required fire flow in gallons per minute, C is the coefficient related to the type of construction, and A is the total floor area of the building considered.

The values for C are: 1.5 for wood frame construction, 1.0 for ordinary construction, 0.8 for noncombustible con-

Source: National Fire Protection Association; Fire Protection Handbook, pp. 11-2 through 11-6 14th edition 1976

struction, and 0.6 for fire resistive construction. Interpolation is used if the type of construction does not fall into one of the four categories.

To the result obtained by application of the formula, a credit or surcharge is applied for occupancy, a credit for complete automatic sprinkler protection when provided, and a surcharge for exposures.

The maximum fire flow required is 12,000 gpm for any one location. The practical reason for this top figure is that manual fire fighting methods using men with hose streams and heavy stream appliances are not likely to develop a larger supply considering the general arrangement of buildings and the availability of hydrants. However, the possibility of a second simultaneous fire in the largest cities is considered, for which an allowance of 2,000 to 8,000 gpm additional may be made. This sets a practical maximum fire flow demand of 20,000 gpm for any city.

For groupings of one-family and small two-family dwellings not exceeding two stories in height, the short method of determining required fire flow given in Table 11-1B may be used. The required fire flow should be available with consumption at the maximum daily rate (see Part B of this chapter). The number of hours during which the required fire flow should be available varies from 2 to 10 hours as indicated in Table 11-1C.

Table 11-1B. Fire Flows for Groups of Dwellings

Exposure Distances Feet	Suggested Required Fire Flow* Gallons per minute
Over 100	500
31 to 100	750–1,000
11 to 30	1,000–1,500
10 or less	1,500–2,000†

* Where wood shingles could contribute to spreading fires, add 500 gpm.

† If the buildings are continuous use a minimum of 2,500 gpm.

Table 11-1C. Duration of Required Fire Flow (U.S. Gallons)

Required Fire Flow			Required Fire Flow		
Gallons per minute	Million gallons per day	Duration hours	Gallons per minute	Million gallons per day	Duration hours
1,000	1.44	2	4,500	6.48	4
1,250	1.80	2	5,000	7.20	5
1,500	2.16	2	5,500	7.92	5
1,750	2.52	2	6,000	8.64	6
2,000	2.88	2	7,000	10.08	7
2,250	3.24	2	8,000	11.52	8
2,500	3.60	2	9,000	12.96	9
3,000	4.32	3	10,000	14.40	10
3,500	5.04	3	11,000	15.84	10
4,000	5.76	4	12,000	17.28	10

There are fires where quantities of water in excess of the required fire flow are used. Water supplies of 50,000 gpm or greater have been used in fire suppression, but to design systems capable of delivering flows of that magnitude in the average community for a possible unusual situation is not good economic practice.

F. Adequacy and Reliability of Supply

The adequacy of any given water system can be determined by engineering estimates. The source, including storage facilities in the distribution system, must be sufficient to furnish all the water that combined fire and domestic needs may call for at any one time. Arrangement of the supply works and details of the pumping facilities may limit the adequacy of the supply or affect its reliability. The various components of a water system are discussed in other chapters of this Section.

In a "pumping" system, a common arrangement is to have one set of pumps that takes suction from wells or from a river, lake, or other body of water. If the water does not have to be filtered, the pumps may discharge directly into the distribution system. Where filtration is necessary, the pumps take suction from the primary source and discharge the water into settling reservoirs and filter beds. After processing, the water flows to clear water reservoirs from which a second set of pumps takes suction and discharges the water directly into the water main system. Unfortunately, failure of any part of the equipment may put the supply works out of commission. This is usually taken care of by duplication of units and by arrangement of the plant so as to facilitate repairs.

In considering the reliability of the supply works, features taken into account include: minimum yield, frequency and duration of droughts, condition of intakes, earthquakes, floods, forest fires, ice formations, silting up or shifting of river channels, and absence of watchmen where needed or the possibility of physical injury to them. Reliability is also affected by reservoirs out of service for cleaning and interdependence of parts of waterworks. The condition, arrangement, and reliability of individual units of plant equipment, such as pumps, engines, generators, electric motors, fuel supply, electric transmission facilities and similar items are also factors. Pumping stations of combustible construction are subject to destruction by fire unless equipped with automatic sprinklers.

Duplication of pumping units and storage facilities, and arrangement of mains and distributors so that water may be supplied to them from more than one direction, are measures that can assure continuous operation. The importance of duplicate facilities is shown by the frequency of their use.

G. Future Requirements for Determining Fire Flow

The amount of water needed to control and extinguish a fire in a given property cannot be established currently in precise terms. Differences in fire fighting tactics and variations in conditions which may exist at the time of a fire, as compared with the conditions existing when fire flow requirements were established, are variables that cannot be adequately measured at the present time. Better fire experience data basis should make it possible to tailor fire flows more specifically to conditions that might be expected at the time of a fire. Better analysis may indicate a need to increase fire flow beyond what is presently required, or it may result in a water system design based upon a balance between the risk involved and the economics of maintaining the water system.

The Role of Codes and Ordinances

Fire prevention codes can effectively limit hazards and ignition sources within buildings which in turn will not only help to limit the number of fires, but the size of fires through

Source: National Fire Protection Association; Fire Protection Handbook, pp. 11-2 through 11-6 14th edition 1976

the control of combustibles in a fire area. A good building code further reduces the chance for a serious fire by requiring construction materials and building assemblies which will contain a developing fire to a given area. These two factors alone will reduce considerably the amount of water needed for fire fighting. Zoning ordinances that establish distances between properties can be effective in controlling exposure situations.

The Role of Fire Detection and Extinguishing Systems

The increased use of automatic extinguishing systems, whether they use water or some other agent, will affect the quantities of water required. However, until more widespread use is made of early warning systems and automatic extinguishing systems, it will not be possible to equate the effect of these systems to required fire flow. Consideration is now given in the ISO *Guide for Determination of Required Fire Flow* for the presence of automatic sprinklers.

Water supply requirements are just one factor in a complex system that in total determines what the potential for a [illegible] [illegible] extensive the fire will be, and the measures nee[illegible] [illegible]press it. Research will someday equate all [illegible] permit establishing fire flows on the basis o[illegible] [illegible]ghly researched, and documented principles.

SI Units

The following conversion factors are given as a convenience in converting to SI units the English units used in this chapter.

1 ft = .305 m
1 psi = 6894.757 Pa
1 gpm = 3.785 litres/min

Bibliography

References Cited

[1] Shedd, J. Herbert, discussion on a paper by Sherman, William B., "Ratio of Pumping Capacity to Maximum Consumption," *Journal of New England Water Works Association*, Vol. 3, 1889, p. 113.

[2] Fanning, J. T., "Distribution Mains and the Fire Service," *Proceedings of the American Water Works Association*, Vol. 12, 1892, p. 61.

[3] Kuichling, E., "The Financial Management of Water Works," *Transactions of the American Society of Civil Engineers*, Vol. 38, 1897, p. 16.

[4] Freeman, John R., "The Arrangement of Hydrants and Water Pipes for the Protection of a City Against Fire," *Journal of the New England Water Works Association*, Vol. 7, 1892, p. 49.

[5] Metcalf, L., Huichling, E., and Hawley, W. C., "Some Fundamental Considerations in the Determination of a Reasonable Return for Public Fire Hydrant Service," *Proceedings of the American Water Works Association*, Vol. 31, 1911, p. 55.

[6] *Grading Schedule for Municipal Fire Protection*, Insurance Services Office, New York, 1974.

[7] "Fundamental Considerations in Rates and Rate Structures for Water and Sewage Works," a joint report of Committees of the American Society of Civil Engineers and the Section of Municipal Law of the American Bar Association and of Representatives of the American Water Works Association, National Association of Railroad and Utilities Commissioners, Municipal Finance Officers Association, Federation of Sewage Works Association, American Public Works Association, and Investment Bankers Association of America (reprinted from Ohio State Law Journal, Spring, 1951). ASCE Bulletin No. 2, American Society of Civil Engineers, New York, 1951. See also parts of the report presented in "Water Works Revenue for Fire Protection," *NFPA Quarterly*, Vol. 45, No. 1, July 1952, p. 93.

[8] Hutson, A. C., "Water Works Requirements for Fire Protection," *Journal of the American Water Works Association*, Vol. 40, No. 9, Sept. 1948, p. 936. Also reprinted in Special Interest Bulletin No. 266, National Board of Fire Underwriters (now American Insurance Association), New York, May 4, 1948.

[9] *Guide for Determination of Required Fire Flow*, Insurance Services Office, New York, June, 1972.

Additional Readings

Babbit, Harold E., and Doland, James J., *Water Supply Engineering*, 6th ed., McGraw-Hill, New York, 1962.

Blake, Nelson M., *Water for the Cities*, Syracuse University Press, Syracuse, 1956.

Carl, Kenneth J., Young, Robert A., and Anderson, Gordon C., "Guide for Determining Fire Flow Requirements," *American Water Works Association Journal*, Vol. 65, 1973, pp. 335-344.

Carl, Kenneth J., and Anderson, Gordon C., "The 1973 Grading Schedule for Municipal Fire Protection," *American Water Works Association Journal.*

Fair, G. M., Geyer, J. C., and Okum, D. A., *Water and Wastewater Engineering, Water Supply and Wastewater Removal*, Vol. 1, John Wiley & Sons, New York, 1966.

Hudiburg, Everett, and McCoy, Carl E., ed., *Water Supplies for Fire Protection*, 2nd ed., Fire Protection Publications, Oklahoma State University, Stillwater, 1971.

Engineering and Design—Water Supply for Fire Protection, Office of the Chief of Engineers, Department of the Army, Washington, D.C., 1958.

Source: National Fire Protection Association; <u>Fire Protection Handbook</u>, pp. 11-2 through 11-6 14th edition 1976

HOW THE ISO ESTIMATES FIRE-FLOW REQUIREMENTS

Insurance Services Office

Guide for Determination Of Required Fire Flow

1. 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

= 0.8 for noncombustible construction

= 0.6 for fire-resistive construction

Note: For types of construction that do not fall within the categories given, use a coefficient reflecting the differences. Such coefficients shall not be greater than 1.5 nor less than 0.6 and may be determined by interpolation.

A = the total floor area (including all stories, but excluding basements) in the building being considered. For fire-resistive buildings consider the 6 largest successive floor areas if the vertical openings are unprotected; if the vertical openings are properly protected, consider only the 3 largest successive floor areas.

The fire flow as determined by the above shall not exceed

8,000 gpm for wood frame construction

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972.

8,000 gpm for ordinary construction

6,000 gpm for noncombustible construction

6,000 gpm for fire-resistive construction

except that for a normal 1-story building of any type of construction the fire flow shall not exceed 6,000 gpm.

The fire flow shall not be less than 500 gpm.

For 1-family and small 2-family dwellings not exceeding 2 stories in height see note 10.

2. The value obtained in No. 1 above may be reduced by up to 25% credit for occupancies having a light fire loading or may be increased by up to a 25% surcharge for occupancies have a high fire loading. As a guide for determining low or high fire loadings, lists of light hazard and extra hazard occupancies as given in National Fire Protection Association Standard No. 13 are included in the Appendix.

The fire flow shall not be less than 500 gpm.

3. The value obtained in No. 2 above may be reduced by up to 25% credit for complete automatic sprinkler protection. For building of fire-resistive or noncombustible construction having a light fire loading the reduction may be up to 50%. The percentage reduction that can be made for an automatic sprinkler system will depend upon the extent to which the automatic sprinkler system is

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972.

judged to reduce the probability of fires spreading within and beyond the fire area. Normally this reduction will not exceed 25 percent.

4. To the value obtained in No. 2 above a surcharge should be added for structures exposed within 150 feet by the fire area under consideration. The degree of this charge shall depend upon the height, area, and construction of the building(s) being exposed, the separation, openings in the exposed buidings(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.

The charge for any one side generally should not exceed the following limits for the separations shown:

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

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

5. The value obtained in No. 2 above is reduced by the

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972.

credit (if any) determined in No. 3 above and increased by the surcharge (if any) determined in No. 4 above.

The fire flow shall not exceed 12,000 gpm nor be less than 500 gpm.

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 as 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, an occupancy surcharge 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 an occupancy credit may be warranted.

Note 7: If a building is exposed within 150 feet, normally some surcharge 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 an 0.8 coefficient.

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972.

Note 10: Dwellings: For groupings of 1-family and small 2-family dwellings not exceeding 2 stories in height, the following short method may be used. (For other residential buildings, the regular method should be used.)

Exposure distances	Suggested required fire flow
Over 100'	500 gpm
31-100'	750-1000
11-30'	1000-1500
10' or less	1500-2000*

*If the buildings are continuous, use a minimum of 2500 gpm.

Also consider Note 8.

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 Appendix, determine required fire flow to the nearest 250 gpm.

E. Determine the credit or surcharge for occupancy and apply to the value obtained in D above. Do not round off the answer.

F. Determine the credit, if any, for automatic sprinkler protection. Do not round off the value.

G. Determine the total surcharge 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.

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972.

Round off the final answer to the nearest 250 gpm if less than 2500 gpms 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 gound 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.

EXAMPLES:

a. Given: A 3-story building of ordinary construction of 7300 square feet (ground area). Using the table C = 1.0, in the 3-story column, 7300 square feet falls between 7100 and 8500 square feet and the corresponding fire flow is 2750 gpm.

b. Given: A 3-story building of ordinary construction of 7300 square feet (ground area) communicating to a 5-story building of ordinary construction of 9700 square feet (ground area) for a total ground area of 17,000 square feet. Determine the total floor area which equals 3 (7300) + 5 (9700) = 70,400 square feet. Using the table C = 1.0, under the one story column for 70,400 square feet the corresponding fire flow is 4750 gpm.

c. Given: A 3-story wood frame building of 7300 square feet (ground area) communicating with a 5-story building of ordinary construction of 9700 square feet (ground area) for a total ground area of 17,000 square feet.

Determine the total floor area for each type of construction and for the fire area which is 3 (7300) = 21,900 square feet of wood frame construction, 5 (9700) =

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972.

48,500 square feet of ordinary construction, and a total area of 70,400 square feet with 31% being of wood frame construction and 69% being of ordinary construction. Under the one-story column in the wood frame construction table (C = 1.5), an area of 70,400 square feet has a corresponding fire flow of 7250 gpm. Similarly, under the one-story column in the ordinary construction table (C = 1.0), an area of 70,400 square feet has a corresponding fire flow of 4750 gpm. In this case, the fire flow will be 31% (7250) + 69% (4750) = 2250 + 5530 gpm or, to the nearest 250 gpm, = 5500 gpm.

d. Given: A 2-story building of ordinary construction of 105,000 square feet (ground area) communicates with a 1-story building of noncombustible construction of 80,000 square feet (ground area). Normally the required fire flow would be determined by proportioning as in "c" above. This would result in a required fire flow of 7460 gpm, or 7500 gpm. However, it is to be noted that the total area of the 2-story building alone results in a fire flow of 8,000 gpm and, of course, the logical answer would be 8,000 gpm. Any time the total area results in the use of an upper limit for fire flow, the possibility of a portion of the fire area justifying the upper limit must be investigated.

e. Given: A normal 1-story building of ordinary construction of 210,000 square feet (ground area). The table gives a required fire flow of 8,000 gpm, however, since this is a normal 1-story building, the maximum fire flow is 6,000 gpm.

f. Given: A normal 1-story building of ordinary construction of 80,000 square feet communicates with a normal 1-story building of noncombustible construction of 85,000 square feet. Normally the required fire flow would be determined by proportioning as in "c" above. This would result in a required fire flow of 6480 gpm, or 6500 gpm. However, since these are normal 1-story buildings the maximum fire flow is 6,000 gpm.

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972.

APPENDIX

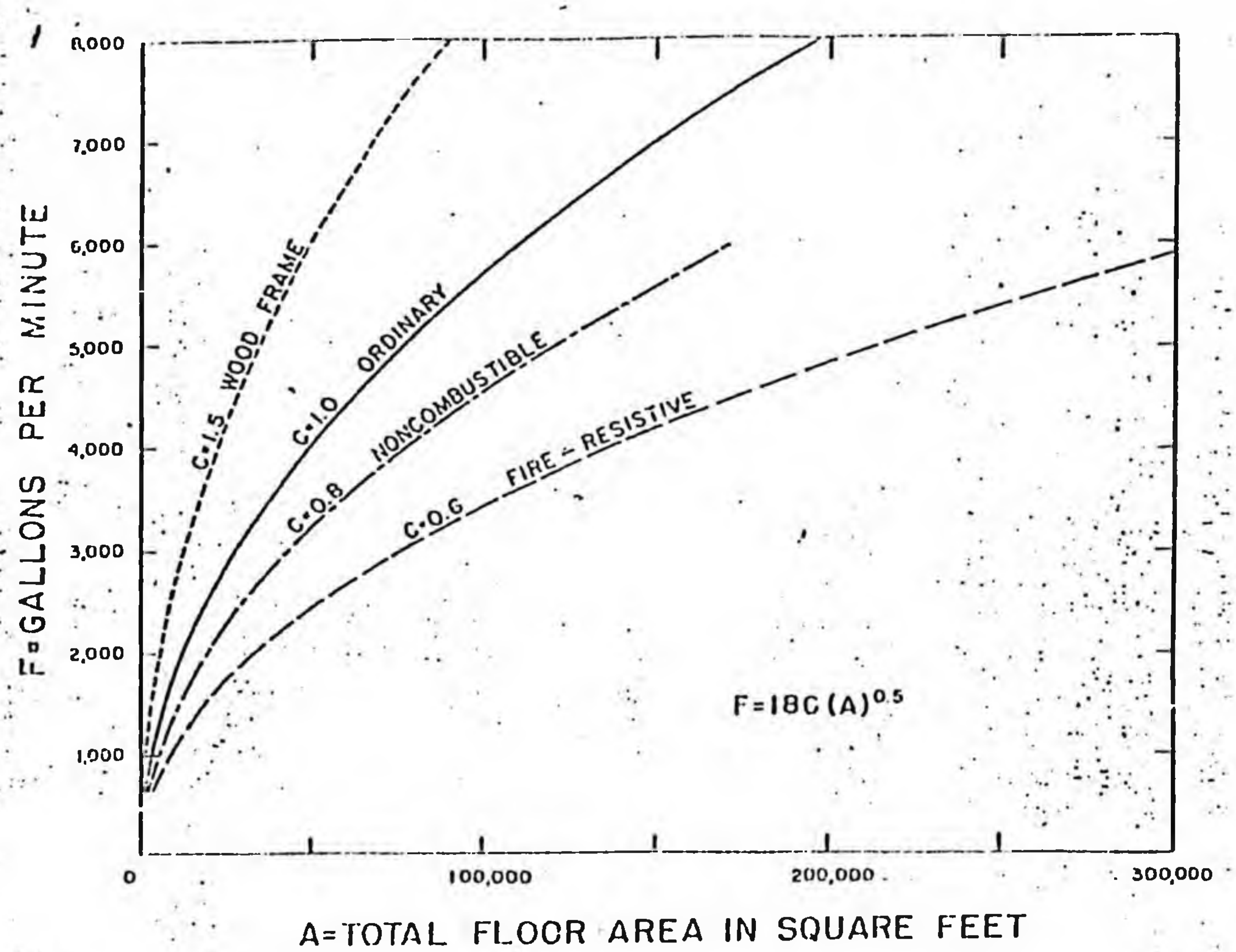
NFPA No. 13-1971, Paragraph 1311. Light Hazard Occupancies:

Apartments	Libraries, except Large Stack Room Areas
Asylums	Museums
Churches	Nursing, Convalescent & Care Homes
Clubs	Office Buildings
Colleges & Universities	Prisons
Dormitories	Public Buildings
Dwellings	Rooming Houses
Hospitals	Schools
Hotels	Tenements
Institutions	

NFPA No. 13-1971, Paragraph 1331. Extra Hazard Occupancies:

Aircraft Hangers
Chemical Works - Extra 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
Oil Refineries
Paint Shops
Pyroxylin Plastic Manufacturing & Processing
Shade Cloth Manufacturing
Solvent Extracting
Varnish Works
and other occupancies involving processing, mixing, storage and dispensing flamable and/or combustible liquids.

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972.



Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972.

C=1.5

WOOD FRAME

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FIRE FLOW VS GROUND AREA

Wood Frame Construction

(ground area in square feet)

F=18C(A)[0.5]

F=gpm; C=1.5

A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
500	500	300	200	100	100	100
750	1,100	600	400	300	200	700
1000	1,700	300	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	2,800	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	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						

C=1.5

INSURANCE SERVICES OFFICE

FIRE FLOW VS GROUND AREA

Wood Frame Construction

(ground area in square feet)

F=18C(A)[0.5]

F=gpm; C=1.5

A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
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	21,600	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						

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972

INSURANCE SERVICES OFFICE

C=1.0

FIRE FLOW VS GROUND AREA
Ordinary Construction
(ground area in square feet)

$F=18C(A)^{0.5}$
F=gpm; C=1.0
A=area in sq. ft.

gpm	1	2	3	4	5	6 Stories
500						
	1,200	600	400	300	200	200
750						
	2,400	1,200	800	600	500	400
1000						
	3,900	2,000	1,300	1,000	800	700
1250						
	5,800	2,900	1,900	1,500	1,200	1,000
1500						
	8,200	4,100	2,700	2,100	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	8,800
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	14,700	12,200
5000						
	81,100	40,600	27,000	20,300	16,200	13,500
5250						
	89,200	44,600	29,700	22,300	17,800	14,900
5500						
	97,700	48,900	32,600	24,400	19,500	16,300
5750						
	106,500	53,300	35,500	26,600	21,300	17,800
6000						

ORDINARY

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C=1.0

FIRE FLOW VS GROUND AREA
Ordinary Construction
(ground area in square feet)

$F=18C(A)^{0.5}$
F=gpm C=1.0
A=area in sq. ft.

gpm	1	2	3	4	5	6 Stor
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	29,500
7750						
	191,400	95,700	63,800	47,900	38,300	31,900
8000						

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June 1972

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INSURANCE SERVICES OFFICE

C=0.8

FIRE FLOW VS GROUND AREA
Non-combustible Construction
(ground area in square feet)

$F = 18C(A)^{0.5}$
F=gpm; C=0.8
A=area in sq. ft.

NONCOMBUSTIBLE

gpm	1	2	3	4	5	6 Stories
500	1,900	1,000	600	500	400	300
750	3,700	1,900	1,200	900	700	600
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	6,600
3000	47,100	23,600	15,700	11,800	9,400	7,900
3250	54,900	27,300	18,300	13,700	11,000	9,200
3500	63,400	31,700	21,100	15,900	12,700	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	51,600	34,400	25,800	20,600	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	139,400	69,700	46,500	34,900	27,900	23,200
5500	152,600	76,300	50,900	38,200	30,500	25,400
5750	166,500	83,300	55,500	41,600	33,300	27,800
6000						

INSURANCE SERVICES OFFICE

C=0.8

FIRE FLOW VS GROUND AREA
Fire Resistive Construction
(ground area in square feet)

$F = 18C(A)^{0.5}$
F=gpm; C=0.8
A=area in sq. ft.

FIRE-RESISTIVE

gpm	1	2	3	4	5	6 Stories
500	3,300	1,700	1,100	800	700	600
750	6,600	3,300	2,200	1,700	1,300	1,100
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,[illegible]	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	15,100	12,100	9,700	8,100
2500	59,000	29,500	19,700	14,000	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	164,300	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	6[illegible]900	50,900	40,700	34,000
5000	225,200	112,600	75,100	56,300	45,000	37,600
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						

Source: Insurance Services Office, Guide for Determination of Required Fire Flow, New York, June, 1972

B. Insurance Grading Schedule

The "Grading Schedule for Municipal Fire Protection"[2] is published and copyrighted by the Insurance Services Office.* The schedule provides a yardstick for ISO insurance grading engineers in classifying municipalities with reference to their fire defenses and physical conditions. Gradings obtained under the schedule are used throughout the United States in establishing base rates for fire insurance purposes. A similar schedule is used in Canada by the Insurers' Advisory Organization to evaluate municipal fire defenses in that country.

The Insurance Grading Schedule originally was developed by the National Board of Fire Underwriters and was continued by its successor, the American Insurance Association, prior to the organization of ISO. It has had a profound influence upon the level of municipal fire protection provided in many communities. While ISO never assumes to dictate the level of fire protection services provided by a municipality, reports of surveys made by its Municipal Survey Office generally do contain recommendations for correcting any serious deficiencies found, and over the years have been accepted as guides by many municipal officials in planning improvements in their services. It is generally appreciated that removal of deficiencies can result in a more favorable fire insurance classification which has certain economic rewards as well as a general satisfaction that the community is providing its citizens with an improved level of service, or is holding a favorable classification where already obtained. While from time to time communities may want to employ independent consultants to evaluate their fire departments, water supplies, and building regulations, the fact is that over the past sixty odd years underwriters' surveys have provided a uniform measurement of municipal fire defenses involving many millions of dollars of engineering time and talent at no cost to the local communities which may choose to follow the recommendations. It has been observed, for example, that American communities enjoy the most adequate and reliable water systems in the world. This has been due in large measure to the engineering evaluations and recommendations of underwriter survey teams.

The Municipal Grading Schedule is subject to change with the state of the art and references in this text are to the 1974 edition. With the organization of ISO, application of the Grading Schedule has tended to be more uniform throughout the country. Under NBFU and AIA the larger communities, generally those over 40,000 population, were surveyed directly by teams of engineers from the national organization while smaller communities generally were graded by state or regional rating associations some of which used their own systems of grading municipal fire defenses. Most of the latter now have been consolidated into regional ISO offices insofar as municipal surveys are concerned although state associations have essential functions in filing rates and performing other duties as may be required by law.

The Grading Schedule is based upon a deficiency point system with a possible 5,000 points of deficiency representing a community totally unprotected against fire. The 5,000

* Available from Insurance Services Office, 160 Water St., New York, N.Y. 10038.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 9-77 through 9-80 14th edition 1976

Table 9-6B. Relative Class as Determined by Points of Deficiency

Points of Deficiency	Relative Class of Municipality
0– 500	First
501–1,000	Second
1,001–1,500	Third
1,501–2,000	Fourth
2,001–2,500	Fifth
2,501–3,000	Sixth
3,001–3,500	Seventh
3,501–4,000	Eighth
4,001–4,500	Ninth*
More than 4,500	Tenth*

* A ninth class municipality is one (a) receiving 4,001 to 4,500 points of deficiency or (b) receiving less than 4,001 points but having no recognized water supply.

* A tenth class municipality is one (a) receiving more than 4,500 points of deficiency, or (b) without a recognized water supply and having a fire department grading over 1/55 points, or (c) with a water supply and no fire department, or (d) with no fire protection.

points are divided into 10 classes, and every 500 points eliminated places the community in a more favorable class. Table 9-6B shows the relative class as determined by points of deficiency. However, a ninth class municipality may be one receiving 4,001 to 4,500 points of deficiency, or receiving less than 4,001 points but having no recognized water supply. A tenth class municipality may be one receiving over 4,500 points of deficiency, or without a recognized water supply, or with a water supply but no fire department, or without a water supply with a fire department grading over 1,755 points, or no fire protection at all. In many rural areas there are subclasses of Class 9 recognizing the value of properly organized and equipped rural fire departments serving communities without a recognized water supply. Such fire departments are required to have stipulated water tanker capacity as well as pumping engines.

The 5,000 possible deficiency points are divided between 4 main subject areas or features. Water supply and fire department each account for a possible 1,950 points, or 39 percent. Fire service communications account for another 450 points, or 9 percent. Fire safety control, including fire prevention and building regulations, counts for 650 points, or 13 percent. Where there is a divergence of more than 500 points between water supply and the fire department, additional deficiency points may be assessed on the grounds that a good water supply requires an adequate fire department to apply it in fire fighting, and a good fire department without an adequate water supply is less effective. If either of these essentials is lacking, up to 900 additional deficiency points may be charged.

Water Supply

It is important to understand that a principal basis for the Grading Schedule's evaluation of fire protection is the ability to provide needed "fire flow" of water measured in gpm. In years past schedule requirements were based largely upon population protected which, while having some validity, was not entirely equitable because some of the smaller communities may contain properties with serious fire potentials that could require large flows of water, whereas a larger community might not require as much water to control its fires. An example might be a very large unsprinklered shopping complex in a suburban residential community. In both water supply and fire department service, reliability factors get considerable attention in the schedule.

Required fire flow is the rate of flow needed for fire fighting to confine a major fire to the buildings within a block or group. The determination of this flow depends upon construction, occupancy, size of buildings, and exposure hazards. Required flow is determined for each section of a municipality and may vary from a minimum of 500 gpm to a maximum of 12,000 gpm for a single fire. Where consideration must be given to simultaneous fires, an additional 2,000 to 8,000 gpm is required. Actual flow tests are made in each section of the municipality and the results obtained are compared with the flow required in each neighborhood to deal with the hazards found.

For purposes of grading under the standard, a "basic fire flow" is used which is indicative of the quantities of water needed for handling fires in important districts. Among the items considered under water supply are: adequacy of supply works; reliability of source of supply; reliability of pumping capacity and of power supply; the condition, arrangement, operation, and reliability of system components; adequacy and reliability of mains and their installation; arrangement of the distribution system; distribution of hydrants and their size, type, installation, and condition; and various miscellaneous factors.

A minimum recognized water supply for grading purposes must be able to deliver at least 250 gpm for 2 hours, or 500 gpm for 1 hour for fire protection plus consumption of water at the maximum daily rate. Any water supply which cannot meet this requirement is not graded, and the full 1,950 deficiency points are assigned.

Fire Department

Items considered under the fire department include: pumpers, ladder trucks, distribution of companies and types of apparatus, pumper capacity, design and condition of apparatus, number of officers, manning, master and special stream devices, equipment for pumpers and ladder trucks (including elevating platforms), hose and its condition, training, response to alarms, fire operations, special protection such as fireboats, and miscellaneous factors.

A minimum recognized fire department under the schedule must have a permanent organization under applicable state and local laws, and be headed by one person responsible for the operation of the department. There must be sufficient membership to provide a response of at least 4 members to alarms, with training conducted for all active members. There must be at least one piece of suitable fire apparatus with housing and maintenance for the apparatus. Means must be provided for 24-hr receipt of alarms and immediate notification of members. Any fire department that cannot meet these requirements is not graded, and a full 1,950 deficiency points are assigned.

Under the schedule the number of engine and ladder companies must be at least equal to the number required for the basic fire flow. Engine and ladder companies must be located so that travel distances for first due, for first alarm companies, and for the maximum number of companies needed to apply required fire flows meet recommended travel distances. Structural conditions and hazards in the municipality may call for more companies than needed to apply basic fire flow. The probability of simultaneous fires, the number and extent of runs, and the need for placing additional companies in service or for relocating companies during periods of high frequency of alarms are factors considered. Consideration is given to providing protection for all areas during multiple alarms and simultaneous fires.

Where the required fire flow is 4,500 gpm or less, response

Source: National Fire Protection Association; Fire Protection Handbook, pp.9-77 through 9-80 14th edition 1976 pany manning is a practical requirement based upon the work that must be done by engine and ladder companies. Where fewer men are provided, it is often necessary to obtain additional manpower from other companies.

While the standard calls for a 6-man level of company manning, credit is given for chiefs' aides who participate in fire fighting. Credit also is given for manpower responding on other units, such as rescue squads and fire department ambulance crews, to the extent that these assist in fire fighting, but not to exceed credit of one man per company. Credit is given also for the regular response of off-duty or volunteer fire fighters. In the schedule, 3 off-duty or volunteer members are counted as equal to one paid man on duty, up to ½ of the required on-duty strength. Thus a fire company with 3 men on duty and 9 off-duty or volunteer members assigned to respond can be counted as a full 6-man crew. However, records of such off-duty response must be kept for both day and night alarms to substantiate the actual value of such manning. If proper records are not kept, call or volunteer response may be taken on the basis of 6 men on call equaling one on duty. In many small fire departments, small outside fires may be handled by the paid men on duty on still alarms without call assistance, but full standard response should be made immediately to all alarms for structural fires and other alarms that present a hazard to life and property.

Under the schedule a fully volunteer or call department with no paid men on duty ready to immediately answer alarms but with good call response would be charged 40 points of deficiency, as compared with an identical fire department having standard 6-man fire companies on duty or the equivalent under the schedule. This amounts to only 80 percent of all the possible deficiency points in a municipal grading. This would appear to be a small deficiency as compared with the advantage of immediate response by on-duty fire companies. If the volunteer or call department has paid apparatus operators on duty, the deficiency might be only 20 points out of 5,000 in the grading, all other things being equal.

Manpower responding on automatic mutual aid is credited up to ½ of the required strength, but may not reduce the point charge by more than 75 percent or 90 percent as may be applicable. Credit also is given for outside aid, but may not reduce the point charge remaining after automatic aid and off-shift response credit has been applied by more than 33 percent. Credit also is given for off-shift response based upon past experience when called.

Deficiency charges are determined by comparing the total required manning of the fire companies being graded with the on-duty strength of these companies as determined by the schedule. Any deficiency divided by the number of companies equals the average deficiency per company. An average deficiency per company of one man results in only 10 points, two men 20 points, three men 40 points, four men 80 points, and five men 160 points. Thus, a fire department that maintains 5 men on each required engine and ladder company assisted by rescue squads, ambulance crews, and chiefs' aides may not be considered deficient in manpower under the standard. Likewise, a fire department that has an average on-duty manning of 3 men per required company plus response of off-duty or call men may not be considered deficient if the record of response is satisfactory. Thus, the manpower requirements are flexible and reasonable. Places that should expect poor grading on manpower are those with 2- and 3-man engine companies and 1- or 2-man ladder companies without satisfactory arrangements for prompt response of off-shift members or other men on call and without well-scheduled automatic mutual aid. Such departments obviously are too badly undermanned to effectively apply required fire flow when serious fires occur. On the other hand, a small community requiring 2 engines and a ladder and having 6 paid men on duty supplemented by good off-shift and call response plus automatic mutual aid may have a minimum deficiency charge for manning.

Fire Service Communications

As fire service communications are an essential element in the fire defenses of any community, the Grading Schedule evaluates the following: the communications center; the communications center equipment and current supply; fire alarm boxes; alarm circuits and facilities including current supply at fire stations; material, construction, condition, and protection of circuits; fire department radio; fire department telephone service; conditions adversely affecting use and operations of facilities; fire alarm operators; and the handling of alarms. While alarm boxes are not required in residential districts, a credit of up to 20 points is given for such boxes depending upon coverage.

Determination of deficiencies under the various communications items are based upon the degree of compliance with the intent of applicable provisions of NFPA No. 73, Standard for Public Fire Service Communications. This Standard is discussed in further detail in Chapter 3 of this Section of the HANDBOOK.

Some persons in the fire service have often felt that the Grading Schedule placed undue emphasis on water supply at the expense of the fire department. In earlier editions of the schedule this may, to some extent, have been true. However, in recent editions items under fire department control including fire service communications and control of hazards amount to up to 58.5 percent of the 5,000 possible deficiency points. The one area in which water supply still has an advantage over the fire department service is the requirement that without a recognized water system, no community can have a classification better than Class 9. Hundreds of fire departments serving areas without water systems are organized to exceed the minimum requirements for fire flow from water systems by using fleets of tankers, and by the use of large diameter water supply hose supplied from pumpers at suction sources prepared and maintained by the fire department. With the water supply equipment responding with the attack pumpers, no delay is involved. Many rural fire departments believe that their ability to apply required fire flow should be recognized because it has proven successful in the control of major fires, including fires in communities recognized as having inadequate water supplies.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 9-77 through 9-80 14th edition 1976

PART IV

INSURANCE STATISTICS AND INFORMATION CONCERNING SPRINKLERS AND FIRE PROTECTION

INSURANCE SAVINGS CAUSED BY AUTOMATIC SPRINKLERS

Installation of automatic sprinklers reduce fire insurance premiums by an approximate average of seventy-five percent (75%) when they are installed in a building. The insurance savings will vary from this percentage by:

1. Type of construction;
2. Occupancy hazard class;
3. Quality of construction (combustible to fire resistive); and,
4. Quality of sprinkler equipment installation

In a building of fire-resistant construction, the insurance premium reduction is less since the sprinkler system is merely an addition to a building which already has fire protection qualities.

Source: Insurance Services Office, Anchorage, Alaska. The above information is subject to particular circumstances of each individual risk being evaluated, and is not conclusive or binding for any particular risk or other building.

PART V

S T A T I S T I C S

SPRINKLER WATER CONSUMPTION CHARACTERISTICS

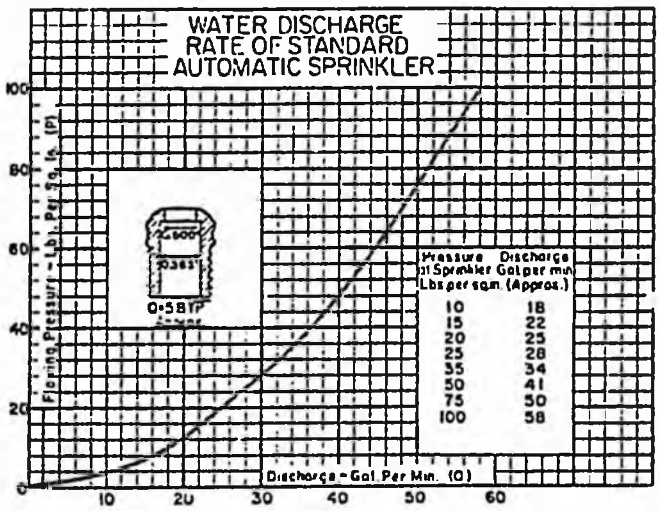

Fig. 14-3G. Water discharge rate of standard automatic sprinkler.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 14-42 through 14-48, 14th edition 1976

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WATER SUPPLIES FOR SPRINKLER SYSTEMS

It is vital that every automatic sprinkler system have a water supply of adequate pressure, capacity, and reliability. Both the rate of flow and the total volume that may be needed must be considered.

A. Types of Supplies

Sprinkler systems may be supplied with water from one or a combination of sources, such as street mains, gravity tanks, reservoirs, fire pumps, pressure tanks, rivers, lakes, wells, etc. (see Fig. 14-1F).

In theory, a single water supply would seem to be all that is necessary for satisfactory protection. However, that single supply may at times be temporarily out of service; it may be disabled at the time of a fire or before a fire is completely extinguished; or the pressure or the capacity may be below normal during an emergency. Therefore, a secondary supply may be necessary, depending on the strength and reliability of the primary supply, the value and importance of the property, the area, height and construction of the building, the occupancy, and the outside exposures. Occasionally, three supplies are needed, especially where neither the primary nor a single secondary supply is judged wholly satisfactory or reliable.

Connections to Public Water Works Systems

A connection from a reliable public water works system of adequate capacity and pressure is the preferred single or primary supply for automatic sprinkler systems. In determining its adequacy, consideration has to be given not only to the normal capacity and pressure of the system, but also to the probable minimum pressures and flows available at unfavorable times such as during summer months, during heavy demand on the system, or during impairment caused by flood or by winter conditions.

The size and arrangement of street mains and feeders from public water supplies are also important. Connections from large mains fed two ways or from two mains on a gridiron system may provide an excellent supply. Street mains less than 6 in. in diameter are usually inadequate and unreliable. Feeds from dead-end mains are also undesirable.

Water meters, if required by the water supply authority, should be of types approved for fire service (see Sec. 11, Chap. 2).

Flow and pressure tests under varying conditions of demand are generally necessary to determine the amount of public water available for fire protection. The proper method of making such tests is described in Section 13, Chapter 5.

Cross-connections Between Public and Private Supplies

Where a secondary supply is needed to supplement the public water supply, public and private supplies can be connected so as to feed into a single fire protection system. These systems are commonly referred to as being "cross-connected."

In some localities, cross-connections may be prohibited by health authorities.

Where they are not prohibited, regulations and sound practices must be complied with in order to avoid the possibility of public health being endangered by water of questionable potability entering the public system.

In general, cross-connections are permitted if carefully supervised precautions, such as a special double check valve, or other accepted devices for preventing backflow, are provided. In cases where one sprinkler supply is from public mains, health authorities usually permit, as a secondary source, either well constructed and well maintained covered steel tanks or concrete reservoirs that are filled with public water only.

Gravity Tanks

Gravity tanks of adequate capacity and elevation make a good primary supply and may be acceptable as a single supply. Details of the construction, heating, and maintenance of gravity tanks are given in NFPA No. 22, Standard for Water Tanks for Private Fire Protection, hereinafter in this chapter referred to as the NFPA Water Tank Standard (see also Sec. 11, Chap. 3 of this HANDBOOK). In determining tank size and elevation, consideration should also be given to the number of sprinklers expected to operate, duration of operation, the arrangement of underground supply piping, and the provision of hose standpipes, hydrants, and fire department connections.

Fire Pumps

A fire pump having both a reliable source of power and a reliable suction water supply provides a good secondary supply and in some instances is acceptable as a primary supply. With ample water a fire pump is capable of maintaining a high pressure over a long period of time, and may be a necessary part of some installations requiring greater water pressure than would otherwise be available.

For details of power sources, pump construction, installation, and methods of control and operation, NFPA No. 20, Standard for Centrifugal Fire Pumps, should be consulted (see also Sec. 11, Chap. 3 of this HANDBOOK).

Manually controlled pumps may be used if the primary water supply will last long enough to allow dependable starting of the fire pump, and if there is an automatic waterflow signal to make known the need for fire pump operation.

Automatic control of fire pumps is usually needed where a high water demand may occur immediately, as with a deluge system; or where a competent pump operator is not continuously present. Automatic fire pumps should have their suction under a positive head to avoid the delays and uncertainties of priming.

Under favorable circumstances of moderate property values and hazards, dependable power, and a dependable suction supply under a head, an electrically driven, automatically controlled fire pump supervised from a central station may be accepted as the primary supply for automatic sprinklers.

The automatic control of electrically driven centrifugal pumps must be arranged to prevent frequent repeated starting of the motor, either by initiating continuous running until stopped manually, or by a timing device that will stop the motor automatically only after a predetermined period of operation.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 14-42 through 14-48 14th edition 1976

Pressure Tanks

Pressure tanks have several possible uses in automatic sprinkler protection. An important limitation is the small volume of water which can be stored in such tanks. Where a small pressure tank is accepted as the water supply, the system is classed as a Limited Supply System.

In situations where an adequate volume of water can be supplied by a public or private source but where the pressure is not sufficient to serve a sprinkler system directly, the pressure tank gives a good starting pressure for the first sprinklers that operate; the flow from it may be used while the fire pumps start automatically to increase the supply pressure.

In tall buildings where the public water pressure is too low for effective water distribution from the highest sprinklers, pressure tanks may be used to supply such sprinklers during the time required for a public fire department to begin supplying water through fire department connections.

Each proposed use of pressure tanks calls for special consideration and analysis of water capacity, location, and arrangement of the connection to the sprinkler system. Each installation is usually required to have specific approval. Details on the construction, installation, and maintenance of pressure tanks are given in the NFPA Water Tank Standard (see also Sec. 11, Chap. 3 of this HANDBOOK).

Fire Department Connections

Under fire conditions which result in a considerable number of sprinklers operating, public water or tank supplies may not provide water at sufficient pressure for effective discharge and distribution. Also, the pressure in many public water supplies to sprinkler systems may be materially reduced by hose streams from hydrants. In such cases, a connection through which the public fire department can pump water into the sprinkler system provides an important auxiliary supply. Fire department connections are therefore a standard part of sprinkler systems.

Fire department connections should be of approved type, readily accessible, and properly marked. Each connection should be fitted with a check valve, but not with a gate valve. There should be a proper drain, and an approved drip device between the check valve and the outside hose coupling. Figures 14-4A and 14-4B show the main features of a fire department connection. Other details of installation and pipe size are given in NFPA No. 13, Standard for the Installation of Sprinkler Systems, hereinafter referred to in this chapter as the NFPA Sprinkler Standard.

Fig. 14-4A. Fire fighters attaching hose lines to a fire department (siamese) connection supplying a sprinkler system. The inset shows typical siamese connections for sprinkler systems and standpipes. A check valve allows the use of a single hose line.

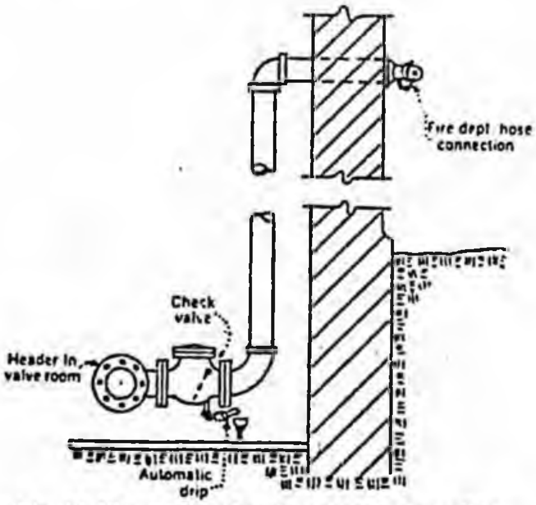


Fig. 14-4B. Typical fire department connection.

Where a sprinkler system has a single riser, the fire department connection should be attached to the system side of the controlling gate valve for a wet system, and between the dry-pipe valve and the gate valve for a dry system. This makes it possible to pump water into the system even if the gate valve is closed.

If there are two or more sprinkler system risers connected to a public main, each system must have its own fire department connection. If more than one riser is connected to a yard system, the fire department connection should feed into the yard system on the supply side of all riser shutoff valves, and there must be a check valve in all other water supply connections into the yard system to prevent backflow and loss of water supplied through the fire department connection. If one riser is shut off, the fire department connection can still supply all other risers.

In an emergency, a fire department can pump water from public hydrants or other sources of water into a sprinkler system through its hose and a yard hydrant or other hose connection using a double female hose coupling, if other supply connections have a check valve or a gate valve that can be closed.

B. Water Supply Requirements

The water supply needed for sprinkler systems raises questions that defy specific answers except with sprinkler systems where it is planned that all sprinklers in the fire area will discharge water. Such systems include deluge and water spray systems utilizing open sprinklers where the design must provide water supply for all the sprinklers in any fire area, systems employing closed automatic sprinklers in hazardous areas where the simultaneous operation of all sprinklers is usually assumed, and multiple open sprinkler systems in a single fire area where one or more systems can be expected to operate. With such sprinkler systems (largely used for special hazard situations) the water supply requirement resolves itself mainly into a matter of hydraulic and mathematical calculations. The answer to the water supply requirement with the majority of sprinkler systems, how-

Source: National Fire Protection Association; <u>Fire Protection Handbook</u>, pp. 14-42 through 14-48 14th edition 1976

ever, is not so definite. If a water source that could supply all the sprinklers is available, there would be no problem, but such a water supply is seldom practical except in the case of small systems. The water supply requirement for any sprinkler system is directly related to the number of sprinklers expected to operate, but this depends on so many variables and uncertain factors that no exact mathematical solution is possible.

The NFPA Sprinkler Tables show that in 93 percent of all fires in sprinklered buildings, twenty or less sprinklers opened. Experience shows that with adequate water supply the percentage of unsatisfactory sprinkler performance is extremely small. Thus, water supply is a significant problem, particularly with large sprinkler systems and with systems protecting greater than ordinary hazards.

The answer to the water supply requirement for any particular sprinkler system lies mainly in experienced engineering judgment, based on consideration of the factors for or against sprinkler control. Where the cooling effect from the water discharged by sprinklers is greater than the heat liberated by the fire, the sprinklers can gain control. When the reverse situation occurs, as from an overtaxed water supply, the sprinklers cannot control the fire and the sprinkler system may fail. Where all conditions are favorable, the control of fire should be accomplished by the operation of only a small number of sprinklers. As conditions vary, however, in different classes of occupancy, areas, and types of buildings, the number of sprinklers expected to operate in order to control a fire may range up to possibly the total number in the area, and the water supply should be provided accordingly. (See Fig. 14-1D for cumulative data for the various numbers of sprinklers operating in fires.)

C. Influence of Various Factors on Water Supply Need

The primary factors affecting the number of sprinklers which might open in a fire, and therefore to be considered in determination of the water supply requirement, include the following:

Hazard of Occupancy, Including Flash Fire Hazard and Potential Rate of Heat Liberation: This is the most important factor, and one involving experienced judgment to evaluate. Where the flash fire hazard is present, it is usually necessary to provide water sufficient for the operation of all the sprinklers in any individual fire area.

Initial Water Pressure: At a pressure of 15 psi, a standard sprinkler will discharge about 22 gpm, or an average of 0.17 gal per sq ft per min on an area of 130 sq ft. At 30 psi, the discharge is 33 gpm; at 50 psi, 41 gpm; and at higher pressures the discharge is correspondingly greater, also with a greater area of coverage. With a greater discharge and greater area of coverage, there is a better chance of fire control with a small number of sprinklers, and less need for large volumes of water to supply a large number of sprinklers.

Obstructions to Distribution of Water from Sprinklers, such as High-piled Stocks, Bale Tiering, Pallets, Racks, and Shelving: With obstruction, there is less likelihood that fire will be controlled in its initial stages, and a greater chance of opening a large number of sprinklers needing large water supplies.

High Ceilings and Draft Conditions: With ceilings of unusual height, there is greater chance that drafts will carry heat away from the sprinklers immediately over a fire, resulting not only in delay in the application of water but also in the opening of sprinklers remote from the place of origin of the fire. More water is usually needed under such conditions. The same situation exists wherever there are drafts, such as in areas open to the weather on the sides, where winds can divert heat from sprinklers over the fire.

Unprotected Vertical Openings: Sprinkler systems in multistory buildings are usually designed on the assumption that fire will be controlled on the floor of origin. Where there are unprotected openings up which heat and fire may spread, it may be expected that more sprinklers will open, particularly in the case of a fire originating near the vertical opening. In case of high combustibility, the interconnected floors may need to be considered as one fire area. This means more water and larger pipe sizes in risers and supply main.

Wet or Dry System: Owing to the delay due to exhausting air from dry-pipe systems, more sprinklers open on dry-pipe systems than on wet systems. This may call for greater water supplies.

Size of Undivided Areas: A large undivided area has a greater number of sprinklers, with a possibility of a greater maximum number of sprinklers operating, and a consequently greater water demand than with a small area.

Configuration and Type of Ceiling Construction: These influence water demand, including such factors as curtain boards, or beams affording curtain board effects to retard fire spread, and the possibility that fire may spread under a combustible ceiling out of reach of sprinklers or burn through.

Extent of Coverage and Exposures: Any fire in an unsprinklered space extending to an area with automatic sprinklers places an abnormal demand on the sprinkler system, and requires increased water supplies for effective functioning of the system.

The preceding factors must be considered individually and collectively, and it is not feasible to derive any general formula or simple method of arriving at water supply requirements.

There are, however, certain general statements on this subject that may be made. One is that any situation may be effectively protected with much less water where the water is applied automatically rather than manually. Another is that it is good practice to provide more water, at higher pressure, than will probably be needed to extinguish any fire. Hose streams may be used to supplement sprinklers, even when not necessary, and an ample supply of water provides a margin of safety.

With a very large fire area of low to moderate hazard it is not reasonable to expect to supply all sprinklers simultaneously. Actually, the pipe sizes are not large enough to do so, except where very high supply pressures can produce a high discharge rate from sprinklers near the source of supply as well as effective discharge from the most remote sprinkler. This situation is aggravated where sprinkler supply is from an end or side of the system. The most effective piping pattern calls for sprinkler risers at the center.

The managers of large properties under sprinkler protection may, by "shopping," secure insurance coverage predicated on water supplies that are "shaded" for economy. Obtaining the desired coverage does not mean that, measured in terms of true fire safety, the property is sufficiently protected. Property owners who realize that any fire may cause indirect losses far beyond any insurance indemnity will consider full protection essential.

D. Water Supply Requirements for Pipe Schedule Sprinkler Systems

Notwithstanding the general problems involved in arriving at water supply requirements, the hazard of occupancy, being the factor of major importance, has made it

Source: National Fire Protection Association; <u>Fire Protection Handbook</u>, pp. 14-42 through 14-48 14th edition 1976

possible to establish "Guides to Water Supply Requirements for Sprinkler Systems" using this factor as the primary consideration with latitude allowed for the contributing factors.

The established "Guide" tables contained in the NFPA Sprinkler Standard divide hazards of occupancy, for the purpose of determining water supplies, into several groups with specified minimum water supplies for each group (see Table 14-4A).

Where fire pumps contribute to the water supply, standard sizes of pumps should be used with adequate rate of discharge, as outlined in Section 11, Chapter 4. A suction supply for the pump should preferably be large enough for continuous operation, as outlined in Section 11, Chapter 4.

Where pressure tanks furnish the water supply, the provisions for pressure tanks in Section 11, Chapter 3, should be followed.

Where a combination of different water supplies is provided in the interest of reliability, it is good practice to have the rate of supply from each source at least equal to the minimum requirement for the system.

The "Guide" should be used only with experienced judgment, but it can serve for all cases qualifying in the Light Hazard and Ordinary Hazard, Groups 1 and 2, occupancy classifications which constitute the larger percentage of sprinkler installations. The other occupancy classifications usually involve more complex factors, and therefore require special consideration.

Light Hazard Occupancies

Examples of Light Hazard Occupancies are apartment buildings, dormitories, office buildings, seating areas of restaurants, and hospitals. In these occupancies the potential rate of heat liberation is low, areas are usually subdivided, and a small number of sprinklers should normally control any fire. Under these conditions, 500 gpm should generally be sufficient, with an upward range to 750 gpm where conditions are less favorable.

Ordinary Hazard, Group 1, Occupancies

The Ordinary Hazard, Group 1 classification includes occupancies where the combustibility of contents is generally low, such as in garages, bakeries, laundries, and canneries, but is greater than for the Light Hazard classification. In this group the water supply requirement may be as low as 700 gpm where small areas, noncombustible construction, and very limited hazards are encountered; it can range up to 1,000 gpm as these conditions become more adverse.

Ordinary Hazard, Group 2, Occupancies

Ordinary Hazard, Group 2 classification includes occupancies such as clothing factories, mercantiles, pharmaceutical manufacturing, and shoe factories. With this group the features of combustibility of contents, ceiling heights, and obstruction are generally unfavorable, separately or jointly, and as indicated the water supply requirements may range as high as 1,500 gpm. It will be noted, however, that an 850 gpm minimum is retained for this group and this, of course, would be applicable only under very favorable conditions.

Water supply requirements for the three classes mentioned, as in all cases, call for a careful consideration of all factors concerned, but the figures given in Table 14-4A are of value in placing lower and upper limits for the classes concerned. While it is never advisable to provide less than the lower limit indicated, the upper limit will usually be sufficient for all situations within the group classification.

Ordinary Hazard, Group 3, Occupancies

Ordinary Hazard, Group 3, consists of occupancies where standard sprinkler spacing and pipe schedules are considered satisfactory, but where more than ordinary water supplies are advisable. This group includes certain woodworkers and other occupancies such as flour and feed mills, paper mills, piers and wharves, and tire storage.

Table 14-4A. Guide to Water Supply Requirements for Pipe Schedule Sprinkler Systems

Occupancy Classification	Residual Pressure Required (See Note 1)	Acceptable Flow at Base of Riser (See Note 2)	Duration in Minutes (See Note 4)
Light Hazard	15 psi	500–750 gpm (See Note 3)	30–60
Ordinary Hazard (Group 1)	15 psi or higher	700–1000 gpm	60–90
Ordinary Hazard (Group 2)	15 psi or higher	850–1500 gpm	60–90
Ordinary Hazard (Group 3)	Pressure and flow requirements for sprinklers and hose streams to be determined by authority having jurisdiction.		60–120
Warehouses	Pressure and flow requirements for sprinklers and hose streams to be determined by authority having jurisdiction. Also see Chapter 7 of NFPA 13, NFPA 231, and NFPA 231 C.		
High-Rise Buildings	Pressure and flow requirements for sprinklers and hose streams to be determined by authority having jurisdiction. Also see Chapter 6 of NFPA 13.		
Extra Hazard	Pressure and flow requirements for sprinklers and hose streams to be determined by authority having jurisdiction.		

NOTES:

1. The pressure required at the base of the sprinkler riser(s) is defined as the residual pressure required at the elevation of the highest sprinkler plus the pressure required to reach this elevation.
2. The lower figure is the minimum flow including hose streams ordinarily acceptable for pipe schedule sprinkler systems. The higher flow should normally suffice for all cases under each group.
3. The requirement may be reduced to 250 gpm if building area is limited by size or compartmentation or if building (including roof) is noncombustible construction.
4. The lower duration figure is ordinarily acceptable where remote station water-flow alarm service or equivalent is provided. The higher duration figure should normally suffice for all cases under each group.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 14-42 through 14-48 14th edition 1976

Extra Hazard Occupancies

Extra Hazard occupancic .onsist of properties where flash fires opening all the sprinklers in a fire area are probable, and call for close sprinkler spacing and larger pipe sizes. Such occupancies include explosives manufacturing, extra hazard chemical works, pyroxylin plastic manufacturing, cotton picking and opening operations, and other occupancies with a flash fire hazard.

It is not possible to lay down any general rules for these last two groups, and their water supply needs can be evaluated only on an individual basis by engineers with broad background experience. For this reason, the NFPA Sprinkler Standard refers to determination by the authority having jurisdiction as the only possible answer to the problem. It is in such occupancies that hydraulic calculations are most often needed to determine water supplies.

In any treatment of hazards by general groups of occupancy, it must be noted that individual properties differ markedly, and that buildings of the same nominal occupancy classification may show widely different individual hazards which should be considered in any determination of water supply.

E. Water Supply Requirements for Hose Stream Protection

The values given in Table 14-4A include hose stream requirements. In considering water requirements for hose streams, it should be realized that if sprinklers perform effectively little hose stream assistance is required. Although this is generally the case, a realistic viewpoint must be taken of possible contingencies and the amount of water that might be needed for hose stream protection under adverse conditions.

In evaluating hose stream requirements, possibilities should be considered such as the amount of water necessary for final extinguishment or clean-up operations, or in the event that sprinklers are retarding fire spread but are not fully effective in gaining control and extinguishment.

F. Water Supply Requirements for Hydraulically Designed Sprinkler Systems

A fire protection engineer planning new water supplies or evaluating existing supplies for sprinkler systems must have some information regarding the hydraulic behavior of sprinkler piping systems.

Hydraulic Calculations

A hydraulically designed sprinkler system is one in which pipe sizes are selected on a pressure loss basis to provide a prescribed density (gallons per minute per square foot) distributed with a reasonable degree of uniformity over a specified area. This permits the selection of pipe sizes in accordance with the characteristics of the water supply available. The stipulated design density and area of application will vary with occupancy hazard.

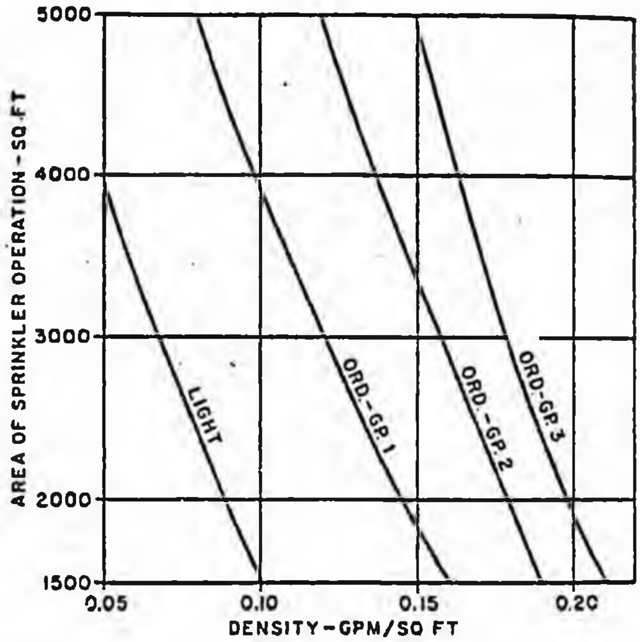
Table 14-4B is used to determine density, area of sprinkler operation, and water supply requirements for hydraulically designed sprinkler systems. Systems must be calculated to satisfy a single point on the appropriate design curve, and interior piping must be based on this design point. It is not necessary to meet all points on the selected curve. Total water supply available to the system at the base of the riser at the residual pressure required by the design must be not less than shown in Table 14-4B; this total water supply need not be calculated through the overhead piping.

Table 14-4B. Density, Area of Sprinkler Operation, and Water Supply Requirements for Hydraulically Designed Sprinkler Systems

Minimum Water Supplies

Hazard Classification	Sprinklers GPM	Combined Inside & Outside Hose—GPM	Duration in Minutes
Light	150	100	30
Ord.—Gp. 1	400	250	*60–90
Ord.—Gp. 2	600	250	*60–90
Ord.—Gp. 3	750	500	*60–120

NOTES: The lower duration figure is ordinarily acceptable where remote station water-flow alarm service or equivalent is provided.



NOTES:

For dry systems increase area of sprinkler operation by 30 percent.

For combustible construction with wet or dry systems the minimum area of application is 3,000 sq ft

For hazard classifications other than those indicated see appropriate NFPA Standards for design criteria.

Calculations shall be based upon the area of sprinkler operation selected from Table 14 or upon the area of the largest room being considered, whichever is smaller. Such rooms must be enclosed by construction having a fire resistance rating at least equal to the water supply duration indicated in Table 14-4B, and wall openings must be protected in an approved manner. For areas of sprinkler operation less than 1,500 sq ft, the density for 1,500 sq ft is used.

The same hazard occupancy classifications apply to hydraulically designed sprinkler systems as apply to pipe schedule sprinkler systems as mentioned in Part D of this Chapter. The recommended water supply figures are, however, somewhat lower due to the greater efficiency of a calculated system.

The water allowances for inside hose and for outside hydrants may be combined and added to the system requirement at the system connection to the underground main. The total water requirement must be calculated through the underground main to the point of supply.

With deluge systems and water spray systems having open orifices, calculations are essential. (See NFPA No. 15, Standard for Water Spray Fixed Systems.) Automatic sprinkler systems protecting high piled storage situations require a specific water density for fire control. (See NFPA No. 231, Standard for Indoor Storage, and NFPA No. 231C, Standard for Rack Storage of Materials.) Hydrau-

Source: National Fire Protection Association; Fire Protection Handbook, pp. 14-42 through 14-48 14th edition 1976

lically calculated systems can, however, be used for all types of occupancies.

Methods of making flow calculations for sprinkler systems are given in the following: (1) the NFPA Sprinkler Standard, (2) NFPA No. 15, Standard for Water Spray Systems for Fire Protection, (3) *"Automatic" Sprinkler Hydraulic Data* published by "Automatic" Sprinkler Corp. of America,[1] (4) Factory Mutual Corporation's *Handbook of Industrial Loss Prevention*,[2] and (5) an address "Water Flow Characteristics of Sprinkler Systems" reported in the Proceedings of the 58th Annual Meeting of the NFPA.[3]

The design area for the system is the hydraulically most remote area, and usually includes sprinklers on both sides of the cross main. Each sprinkler in the design area must discharge at a flow rate at least equal to the stipulated minimum water application rate (density). Begin calculations at the sprinkler hydraulically farthest from the supply connection. With common system configurations this will be the end sprinkler on the end branch line. The minimum operating pressure for any sprinkler must not be less than 7 psi.

The Most Remote Sprinkler

Assuming a minimum pressure of 10 psi at the most remote sprinkler and a discharge coefficient of 0.75 for a standard ½-in. orifice sprinkler (the coefficient varies—0.78 is used elsewhere in this HANDBOOK), we will have a discharge of 17.7 gpm calculated from the formula $Q = 29.8\ cd^2\sqrt{P}$ (see Sec. 11, Chap. 6), used in calculating flows through orifices and short tubes. The value for 29.83 cd^2 in this instance is 5.6, a figure commonly used as the sprinkler discharge constant K in the simplified formula $Q = K\sqrt{P}$. Velocity pressure is not a factor at the more remote sprinkler, but it is considered at all the other sprinklers in the example that follows. Some organizations ignore velocity pressure in their calculations. The error introduced is on the safe side. NFPA No. 15, Standard for Water Spray Fixed Systems, recommends considering velocity only when it is more than 5 percent of the total pressure.

Assuming sprinklers 10 ft apart on branch lines, with the end section of pipe 1 in. nominal diameter, the friction loss at 17.7 gpm flow, with a Hazen and Williams formula coefficient of 120 (value for black steel pipe) will be 1.0 psi (see Fig. 11-6L in Sec. 11, Chap. 6 and change friction loss values in that graph, which are based on $C = 100$, to values based on $C = 120$ by multiplying by 0.714).

Second Sprinkler from the End

The total pressure at the second sprinkler will be 10.0 + 1.0 = 11.0 psi. Of this, velocity pressure based on a flow of 17.7 gpm will be 0.3 psi (see Fig. 11-6A, Sec. 11, Chap. 6). The normal pressure (pressure acting perpendicular to the pipe wall) acting on the second sprinkler is the total pressure of 11.0 psi less the velocity pressure of 0.3 or 10.7 psi. On all sprinklers except the end sprinkler, only normal pressure is considered as acting on the sprinklers.

The discharge from the second sprinkler, at a pressure of 10.7 psi, will be 18.3 gpm.

The pipe between the second and third sprinkler, also 1 in. diameter, 10 ft long, and with a flow of 17.7 + 18.3 = 36.0 gpm, will have a friction loss of 3.8 psi, and a velocity pressure of 1.2 psi. Total pressure at the third sprinkler equals 10.7 + 3.8 + 1.2 or 15.7 psi.

Other Sprinklers on a Branch Line

Up to this point, velocity pressure has been based on flow downstream from the sprinkler being considered; this has been confirmed by tests.[3] It has also been shown by those tests that beyond the second sprinkler velocity pressure should be figured from the flow on the upstream side of the sprinkler being considered. This is done by trial and error, assuming a flow from the sprinkler, calculating the velocity pressure from the total flow, determining a normal pressure, and calculating a flow from the normal pressure. If the calculated flow is not reasonably close to the assumed flow, assume a different flow and repeat the procedure until the two are close.

Assume a flow from the third sprinkler of 19.0 gpm, and also assume that the pipe between the third and fourth sprinkler is 1¼ in. Total flow is 36.0 + 19.0 = 55.0 gpm. Velocity pressure is 0.9 psi and normal pressure at the third sprinkler is therefore 15.7 − 0.9 or 14.8 psi. Corrected flow then becomes 21.6 gpm, which is not close enough to the 19 gpm assumed. Try an assumed flow of 21.4 gpm. Velocity pressure at 57.4 gpm is 1.0; normal pressure is 14.7 psi and the new corrected flow is 21.5 gpm. Total flow at the third head then becomes 36.0 + 21.5 = 57.5 gpm. The calculating procedure for the other sprinklers on the branch line is the same as for the third sprinkler.

At this point it will be seen that we have exceeded the 15 psi minimum riser pressure, unless, as is quite probable, the pressure with 57.5 gpm flow is substantially higher than that with 500 gpm flow. Whether or not the pressure with 57.5 gpm flow is higher than 15 psi depends on the characteristics of the water supply. However, in any case it appears that with not many more sprinklers open the pressure at the most remote sprinkler will be less than the 10 psi selected in this example.

Branch Lines, Cross Mains, Risers, and Fittings

Cross Main Pressure at the Branch Line Connection: This is the normal pressure at the nearest open sprinkler increased by the friction loss and the velocity pressure in the intervening pipe. If the branch line is fed through a tee and nipple, additional friction loss allowances must be made except that the friction loss in nipples less than 6 in. long is customarily neglected.

Two Branches in One Line of Sprinklers: These may have the same or different numbers of sprinklers. The pressure at the entrance to the two branches will always be the same. The computations starting at the end sprinklers will be duplicated for the number of open sprinklers.

After the discharge from any number of sprinklers on a branch line has been computed and the pressure to produce the flow has been determined, the entire branch line can be considered to have the discharge characteristics of a single orifice and the discharge constant K in the formula $Q = K\sqrt{P}$ can be determined, P being the net pressure where flows are taken from tees in the cross main.

Branches on Opposite Sides of a Cross Main: These branches may have different numbers of sprinklers open, in which case the cross main pressure must be the higher of the two computed values. This increases the discharge from the branch giving the lower computed pressure, and the actual discharge must be calculated for the higher pressure using the equation:

$$\frac{Q_1}{Q_2} = \sqrt{\frac{P_1}{P_2}}$$

in which P_2 is taken as the higher pressure, Q_2 the corresponding increased discharge to be determined, and P_1 and Q_1 the pressure and corresponding discharge from the branch requiring only the lower pressure.

After the appropriate increased discharge has been deter-

Source: National Fire Protection Association; Fire Protection Handbook, pp. 14-42 through 14-48 14th edition 1976

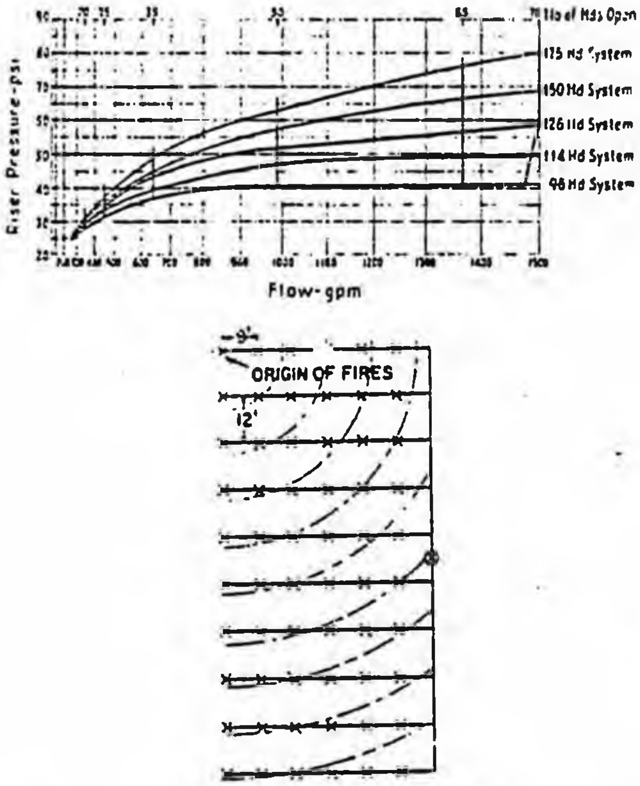


Fig. 14-4C. A flow curve for a side-central feed to sprinklers on a system having six sprinklers on each branch line is shown on the above graph. Below is the pattern of sprinklers opening on a side-central feed system. (Factory Mutual System)

mined, the two rates of flow can be combined and *K* for the combined branches calculated.

When sprinklers on the second branch line are assumed to have opened, starting at the cross main sprinkler, the opened sprinkler most remote from the cross main is considered as the end head in the branch line computation, the next opened is the second, etc., regardless of nonoperating sprinklers on the outer end of the branch.

Cross Main Pressures: Cross main pressures are calculated by the same procedure as used for sprinklers on a single branch line, except that it is not necessary to use the trial and error procedure for the third and additional branch lines since the effect of change in velocity pressure with flows passing through tees in the cross main is usually negligible. The net head producing the flow in successive branch lines is taken as the normal pressure at the end branch line increased by the friction loss in the pipe between the branches.

Riser Pressure: Riser pressure is taken as the normal pressure at the nearest flowing branch increased by the total friction loss between this branch and the riser and by the velocity pressure in the cross main at the riser connection.

Friction Loss in Fittings: This is generally included in calculations only when the fitting involves a change in direction of flow. An exception to this is the fitting immediately preceding the sprinkler.

Friction loss in control, gate and check valves, strainers, meters, and similar devices is always included.

The friction loss in piping between the source of supply and the opened sprinklers must obviously be included in all calculations.

Where there are differences in elevation, these must be allowed for on the basis that each foot of height represents 0.434 psi. In multistory buildings, this may be a substantial factor.

Feed mains, cross mains, and branch lines within the same system may be looped or gridded to divide the total water flowing to the design area.

Sprinkler System Water-flow Curves

To avoid repetition of laborious computation of water flows and pressures when such information is needed in cases involving standard sprinkler, spray, or open head systems, it is possible to prepare diagrams or "water-flow curves" from which riser pressures and corresponding total sprinkler flows may be determined for different numbers of opened sprinklers. One such series of curves, as developed by the Factory Mutual Engineering Corporation, and the piping arrangement and assumed pattern of opened sprinklers is shown in Figure 14-4C.

SI Units

The following conversion factors are given as a convenience in converting to SI units the English units used in this chapter.

$1\ ft^2 = 0.0929\ m^2$
1 in. = 25.400 mm
1 ft = 0.305 m
1 psi = 6.895 kPa
1 gpm = 3.785 litre/min

Bibliography

References Cited

[1] Wood, C. M., Automatic Sprinkler Hydraulic Data, 1961 ed., "Automatic" Sprinkler Corporation of America, Cleveland, Ohio, (reprinted 1964).

[2] Factory Mutual Engineering Corporation, "Hydraulics of Sprinkler Systems," *Handbook of Industrial Loss Prevention*, 2nd ed., McGraw-Hill, New York, pp. 23-1–23-13.

[3] Nickerson, Malcolm H., "Water Flow Characteristics of Sprinkler Systems," *Proceedings* of The Fifty-Eighth Annual Meeting, National Fire Protection Association, May 17-21, 1954, Washington, D.C., pp. 140-152.

NFPA Codes, Standards, and Recommended Practices (see the latest *NFPA Publications and Visual Aids Catalog* for availability of current editions of the following documents)

NFPA 13, Standard for the Installation of Sprinkler Systems.
NFPA 15, Standard for Water Spray Fixed Systems.
NFPA 20, Standard for Centrifugal Fire Pumps.
NFPA 22, Standard for Water Tanks for Private Protection.
NFPA 231, Standard for Indoor General Storage.
NFPA 231C, Standard for Rack Storage of Materials.

Additional Readings

Gomberg, Alan, and Cote, A. E., "The Computer Approach to Fire Protection Problems," *Fire Technology*, published by the National Fire Protection Association, Vol. 3, No. 3, Aug. 1967, pp. 202-212.

Merry, J. T., and Schillhauser, "Hydraulic Sprinkler Systems Design—A Computer Approach," *Fire Technology*, published by the National Fire Protection Association, Vol. 2, No. 2, May 1966, pp. 95-107.

Patton, R. M., "Engineered Sprinkler Protection," *Fire Journal*, National Fire Protection Association, Vol. 60, No. 1, Jan. 1966, pp. 5-8, 18.

Wood, C. M., *Study Guide for Automatic Sprinkler Hydraulic Data*, "Automatic" Sprinkler Corp. of America, Cleveland, Ohio, 1964, 64 pp.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 14-42 through 14-48 14th edition 1976

PART VI

S T A T I S T I C S

METERS ARE AVAILABLE WHICH CAN MEASURE WATER
CONSUMED FOR FIRE PROTECTION AND CITIES WHICH HAVE
UTILIZED METERS FOR DETERMINING PRIVATE FIRE PROTECTION CHARGES

H. Meters for Fire Connections

Fire flow meters are devices capable of measuring small and large flows with a minimum loss of head for heavy

Source: National Fire Protection Association; <u>Fire Protection Handbook</u>, pp. 11-21 through 11-25 14th edition 1976

demands. They are offered in two types: (1) detector check valve-type meters that detect only small rates of flow and (2) so-called full registration meters that measure the entire flow throughout the line in which they are installed. Meters of types other than the fire flow type have been found to be unsatisfactory for fire protection water supplies.

Detector Checks

These devices consist of a check valve with a weighted clapper in the main passage and a disc meter in a bypass around the check. In operation the smaller flows pass through the disc meter in the bypass and are accurately registered. Disc meters may be furnished up to 3 in. in size to serve specific needs. For heavy flows the check valve opens and a free unmetered waterway is provided. Beyond the point where the weighted check valve lifts, the bypass meter registers only a small part of the flow. In many situations the detector checks should give the water works the assurance desired as to the proper use of water.

Figure 11-2BB shows a representative detector check valve.

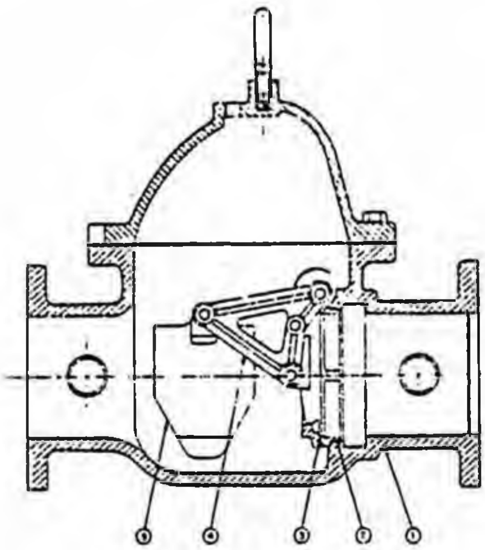


Fig. 11-2BB. A detector check valve. Photo shows view from top of weighted check valve and meter in bypass. Section view shows clapper in closed position. (The Viking Corporation)

Full Registration Meters

These devices are of three general types, each produced by a different manufacturer, and they have been designed for small friction loss with large flows and for a main passageway practically unobstructed when open. The three types are: (1) proportional type meters, (2) meters of the displacement type in a bypass and (3) turbine-type meters.

Proportional Type, Hersey Detector Meter, Model FM: This meter is a special meter of the compound type in which a "proportional meter" and an automatic valve in the main line of the meter are combined with a disc or compound meter in a bypass (see Fig. 11-2CC).

In the Model FM, the smaller flows pass through and are measured by the bypass meter. When the demand for water reaches a rate of flow which causes a difference in pressure

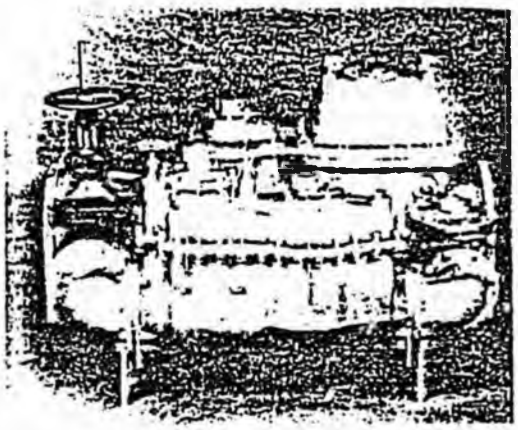


Fig. 11-2CC. A detector meter of the proportional type. (Hersey-Sparling Meter Company)

of 4 psi in the bypass, the automatic check valve opens and provides a practically free waterway through the main line. When water begins to flow through the line in which the automatic valve has opened, it is slightly retarded by a restricting orifice placed a little upstream from the automatic valve, and a part of the water is diverted through a metering unit. This diverted flow is a fixed percentage of the total flow through the restricting orifice. The metering unit is calibrated to record the total quantity through the line, the sum of the readings of the bypass meter and the main line metering unit gives the total flow.

Displacement Type, Neptune Trident Protectus Meter: This meter has all of the working parts in one casing. A disc meter is installed in a bypass on one side and a current meter on the other side of the main waterway. Small flows pass through the disc meter and are recorded when the check valve is closed. With larger flows the main check valve opens and gives a free waterway. The opening of the check valve stops the flow through the disc meter and opens the bypass to the current meter so that the flow through the open waterway is measured proportionately. The sum of the readings gives the total flow (see Fig. 11-2DD).

Turbo Type, Rockwell W-2000 Turbo Meter: This meter is based on the turbine principle of measurement. The meter is composed of two principal assemblies, the main case and the measuring chamber. The main case contains the flow straightening vane assembly. The measuring chamber includes rotor, adjusting vane, pulse amplifier chart and terminal strip for attaching the connecting cable. The function

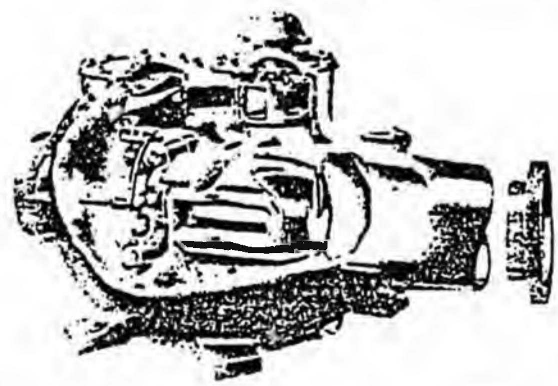


Fig. 11-2DD. A fire flow meter of the displacement type. (Neptune Meter Company)

Source: National Fire Protection Association; <u>Fire Protection Handbook</u>, pp. 11-21 through 11-25 14th edition 1976

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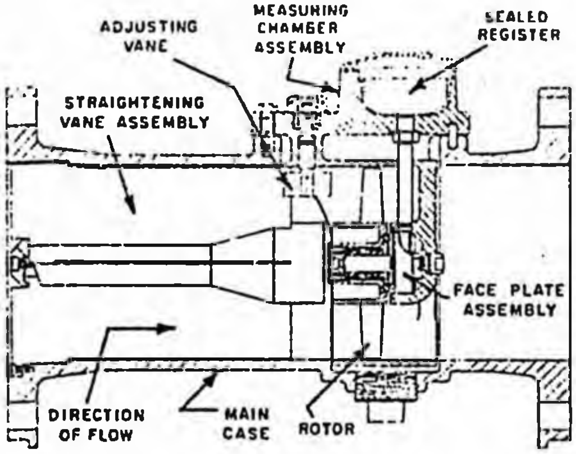

Fig. 11-2EE. A fire flow meter of the turbo type. (Rockwell Mfg. Co.)

of a printed circuit card is to electronically count revolutions and transmit intelligence to a register. The meter should be installed with a 6-in. Rockwell strainer placed immediately upstream of the meter. If the strainer is not used, a minimum of 15 diameters of straight pipe must be immediately upstream of the meter to assure valid registration (see Fig. 11-2EE).

Friction Loss in Fire Flow Meters and Detector Check Valves

The standard specifications for cold water meters adopted by both the American Water Works Association and the New England Water Works Association limit the friction loss for fire flow meters to 4 psi at rated flow capacities. Table 11-2H gives friction loss values for the three currently available types of fire flow meters.

Friction loss values for meters of the disc, current and compound type that are used commonly in waterworks systems for general purposes are relatively high and not suited for fire protection purposes. AWWA limits their friction loss values to 20 psi.

Detector Check Valves: The friction loss in detector check valves listed and approved by recognized testing laboratories is less than 3 psi for the following flows:

Size (in.)	Flow (gpm)
4	750
6	1,500
8	3,000
10	4,500
12	6,500

The pressure required to open the clapper is less than 20 psi.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 11-21 through 11-25 14th edition 1976

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Table 11-2H. Friction Loss in Fire Flow Meters

Compiled from data supplied by manufacturers

Meter Name and Type	Size of Meter Inches	Loss of Pressure Caused by Meter Pounds per Square Inch — Gallons per Minute Flowing							
		250	500	750	1000	1250	1500	2000	2500
roportional Type (ersey-FM)	4	2.2	1.9	4.0					
	6	3.8	2.7	1.4	1.8	2.2	2.9	3.9	
	8	3.0	3.7	1.9	1.0	0.8	0.8	1.3	2.2
	10	1.6	3.6	4.0	3.7	2.6	1.4	0.8	1.1
ifferential Type (noent Protectus)	4	2.2	2.0	3.9					
	6	2.9	1.9	1.8	1.8	1.8	1.8	2.2	3.3
	8	3.2	1.8	1.5	1.5	1.5	1.6	1.8	2.2
	10	3.0	2.3	1.8	1.3	1.2	1.1	1.1	1.2
urbo Type (ockwell W-2000 Turbo)	6	0.2	0.3	0.6	0.85	1.2	1.6	3.5	

Source: National Fire Protection Association; Fire Protection Handbook, pp. 11-21 through 11-25 14th edition 1976

Bibliography

NFPA Codes, Standards and Recommended Practices (see the latest *NFPA Publications and Visual Aids Catalog* for availability of current editions of the following documents)

NFPA No. 24, Standard for Outside Protection.

NFPA No. 26, Standard for the Supervision and Care of Valves Controlling Water Supplies for Fire Protection.

NFPA No. 291, Recommendations for Uniform Marking of Fire Hydrants.

NFPA No. 292M, Water Charges for Private Fire Protection.

Other Codes and Standards

AWWA Handbooks, and Standards, American Water Works Association, 2 Park Avenue, New York, NY 10016 (see also USASI A21 listings).

AWWA C201, Standard for Fabricated Electrically Welded Steel Pipe, 1966.

AWWA C202, Standard for Mill-type Steel Water Pipe, 1964.

AWWA C203, Standard for Coal-Tar Enamel Protection Coatings for Steel Water Pipe, 1966.

AWWA C205, Standard for Cement-Mortar Protective Lining and Coating for Steel Water Pipe, 1971.

AWWA C300, Standard for Reinforced-Concrete Water Pipe—Steel Cylinder Type, Not Prestressed, 1964.

AWWA C301, Standard for Reinforced-Concrete Water Pipe—Steel Cylinder Type, Prestressed, 1964.

AWWA C302, Standard for Reinforced-Concrete Water Pipe—Noncylinder Type, Not Prestressed, 1964.

AWWA 303, Standard for Reinforced-Concrete Water Pipe—Steel Cylinder Type, Pretensioned, 1970.

AWWA C400, Standard for Asbestos-Cement Water Pipe, 1972.

AWWA C401-64, Standard Practice for the Selection of Asbestos-Cement Water Pipe, 1964.

AWWA C500, Standard for Gate Valves for Ordinary Water Works Service, 1971.

AWWA C502, Standard for Fire Hydrants for Ordinary Water Works Service, 1964.

AWWA C503, Standard for Wet-Barrel Fire Hydrants for Ordinary Water Works Service, 1970.

AWWA 506, Standard for Backflow Prevention Devices—Reduced Pressure Principle and Double Check Valve Types, 1969.

AWWA C600, Standard for Installation of Cast Iron Water Mains, 1964.

AWWA C603, Standard for Installation of Asbestos-Cement Water Pipe, 1965.

AWWA C703, Standard for Cold Water Meters—Fire Service Type, 1970.

Canadian Government Specification, Canadian Government Specification Board, National Research Council, Ottawa, Ontario.

No. 34-GP-1a, Specification for Pipe; Asbestos-Cement, Pressure, 7 March 1957.

ULC Standards, Underwriters' Laboratories of Canada, 7 Crouse Road, Scarborough, Ontario.

No. C-246, Hydrants, January 1958.

No. C-262 (a), Inside Screw Valves for Underground Work, March 1950.

No. C-312, Swing Check Valves for Fire Protection Service, Nov., 1964.

No. C-789, Indicator Posts, June 1966.

No. C-888, Steel Pipe for Underground Water Service, May 1950.

UL Standards, Underwriters' Laboratories, Inc., 207 East Ohio Street, Chicago, IL 60611.

No. 107, Asbestos-Cement Pipe and Couplings, April 1973.

No. 246, Hydrants for Fire Protection Service, May 1973.

No. 262, Gate Valves for Fire Protection Service, May 1973.

No. 312, Swing Check Valves for Fire Protection Service, 1964.

No. 385, Play Pipes for Water Supply Testing, May 1973.

No. 789, Indicator Posts for Fire Protection Service, May 1971.

No. 888, Steel Pipe for Underground Water Service, Oct. 1972.

No. 194, Performance of Gasketed Joints for Cast Iron Pressure Pipe and Fittings, May 1973.

No. 753, Alarm Accessories for Automatic Water Supply Control Valves for Fire Protection Service, July 1971.

American National Standards Institute, Sectional Committee A21. This committee is sponsored jointly by American Gas Association, American Society for Testing and Materials, American Water Works Association, and New England Water Works Association.) The following Manuals and Standards are published by American Water Works Association, 2 Park Avenue, New York NY 10016:

AWWA C101-67, ANSI A21.1—1967, Standard for Thickness Design of Cast Iron Pipe.

AWWA C150-71, ANSI A21.50—1971, Standard for the Thickness Design of Ductile-Iron Pipe.

AWWA C104-71, ANSI A21.4—1971, Standard for Cement-Mortar Lining for Cast Iron Pipe and Fittings for Water.

AWWA C106-70, ANSI A21.6-1970, Standard for Cast Iron Pipe Centrifugally Cast in Metal Molds, for Water and Other Liquids.

AWWA C108—1970, ANSI A21.8—1970, Standard for Cast Iron Pipe, Centrifugally Cast in Sand-Lined Molds, for Water and Other Liquids.

AWWA C110-71, ANSI A21.10-71, Standard for Cast-Iron Fittings, 2 in. through 48 in., for Water and Other Liquids.

AWWA C111-72, ANSI A21.11-72, Standard for Rubber Gasket Joints for Cast-Iron Pressure Pipe and Fittings.

AWWA C151-70, ANSI A21.51-71, Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids. American National Standards Institute Sectional Committee B16 (This committee is sponsored jointly by the Mechanical Contractors Association of America, Manufacturers Standardization Society of the Valve and Fittings Industry and the American Society of Mechanical Engineers). The following Standards are published by the American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017.

ANSI B16.1-1967, Cast-iron Pipe Flanges and Flanged Fittings, 25, 125, 250 and 800 lb.

ANSI B16.5-1973, Steel Pipe Flanges and Flanged Fittings, 150, 300, 400, 600, 900, 1500 and 2500 lb., Including Reference to Valves.

U.S. Federal Supply Service, General Services Administration, the following Federal Specifications published by U.S. Superintendent of Documents, Washington, DC 20402.

No. SS-P-351C, Pipe, Asbestos-Cement, August 12, 1968.

No. SS-P-381, A(z), Pipe; Pressure, Reinforced Concrete, Pretensioned Reinforcement (Steel Cylinder Type), May 3, 1972.

No. SS-P-385A(1), Pipe, Steel (Cement-Mortar Lining and Reinforced Cement-Mortar Coating), February 27, 1968.

No. WW-P-406D, Pipe, Steel (Seamless and Welded) (For Ordinary Use), February 8, 1973.

No. WW-P-421C, Pipe, Cast-Iron, Pressure (For Water and Other Liquids), Sept. 11, 1967.

No. WW-P-521F, Pipe Fittings, Flanged Fittings, and Flanges, Ferrous and Steel (Screwed and Butt-Welded), 150 Pound, November 22, 1968.

U.S. Interdepartmental Screw-Thread Committee, Screw-Thread Standards for Federal Services, U.S. Superintendent of Documents, Washington, DC 02402, National Bureau of Standards Handbook H28. Part I, Unified and Unified Miniature Screw Threads, 1970. Part II, Pipe Threads, including Dryseal Pipe Threads; Gas Cylinder Valve Outlet and Inlet Threads; Hose Couplings, including Fire-Hose Coupling Threads; and Hose Connections for Welding and Cutting Equipment, 1966.

Additional Readings

AWWA Committee on Financial Aspects of Fire Prevention and Protection, A Business-like Approach to Fire Protection Changes, New York, AWWA, 1971.

Angele, G. J., "Backflow Prevention and Cross-Connection Control," *American Water Works Association Journal*, Vol. 62, No. 6, June 1970.

Babbit, Harold E., Cleasby, John L., and Doland, James, J., *Water Supply Engineering*, 6th ed., McGraw-Hill, New York, 1962.

Blake, Nelson M., *Water for the Cities*, N.Y., Syracuse University Press, Syracuse, 1956.

Engineering and Design—Water: Distribution Systems, Washington, D.C., Office of the Chief of Engineers, Department of the Army, January 31, 1963.

Factory Mutual Engineering Corporation, *Handbook of Industrial Loss Prevention*, Chapter 18, "Public Water Systems" 2nd ed., McGraw-Hill, New York, 1967.

Ibid., Chapter 15, "Underground Fire Service Mains."

FM Loss Prevention Data Sheets, Cross Connections, DS 3-3, 1971; Underground Fire Service Mains, DS 3-33, 1970; Water Demand for Private Fire Protection, DS 3-26, 1974; Factory Mutual System, Norwood, Mass.

Fair, G. M., Geyer, J. C., and Okum, D. A., Water and Wastewater Engineering, Vol. I, Water Supply and Wastewater Removal, John Wiley & Sons, New York, 1966.

Handbook of Cast Iron Pipe, Cast Iron Pipe Research Association, Chicago, 1952.

King, Reno C., ed., *Piping Handbook*, 5th ed., McGraw-Hill, New York, 1967.

"Meter Manual," AWWA M6, 1962, American Water Works Association, New York.

Peckworth, Howard F., *Concrete Pipe Handbook*, American Concrete Pipe Association, Chicago, March 1965.

Sweitzer, Robert J., *Basic Water Works Manual*, American Concrete Pressure Pipe Association, Chicago, 1958

Source: National Fire Protection Association; Fire Protection Handbook, pp. 11-21 through 11-25 14th edition 1976

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PART VII

P L A N N I N G

FIRE PROTECTION CAN BEST BE ACHIEVED THROUGH FORESIGHT AND COOPERATION OF ALL CITY DEPARTMENTS INCLUDING THE FIRE DEPARTMENT AND WATER DEPARTMENT

C. Planning

The following information has been extracted in whole and in part from "America Burning," the report of the National Commission on Fire Prevention and Control[1], and is considered appropriate for inclusion in this portion of the HANDBOOK.

Planning

Fire protection has been largely a local responsibility, and for good reasons it is destined to remain so. Each community has a set of conditions unique to itself, and a system of fire protection that works well for one community cannot be assumed to work equally well for other communities. To be adequate, the fire protection system must respond to local conditions, especially to changing conditions. Planning

Source: National Fire Protection Association; Fire Protection Handbook, pp. 9-80 through 9-82 14th edition 1976

A major section of a community general plan of land use should be a *Master Plan for Fire Protection*, written chiefly by fire department managers. This plan should, first of all, be consistent with and reinforce the goals of the city's overall general plan. For example, it should plan its deployment of manpower and equipment according to the kind of growth, and the specific areas of growth, that the community foresees. It should set goals and priorities for the fire department. Not only is it important to set objectives in terms of lives and property to be saved, but also to decide allocations among fire prevention inspection, fire safety education, and fire suppression as the best way to accomplish the objectives.

Having established goals, the plan should seek to establish "management by objectives" within the fire department. This operates on the principle that management is most effective when each person is aware of how his tasks fit into the overall goals and has committed himself to getting specific jobs done in a specified time.

Because fire departments exist in a real world where a variety of purposes must be served with a limited amount of money, it is important that every dollar be invested for maximum payoff. The fire protection master plan should not only seek to provide the maximum cost-benefit ratio for fire protection expenditures, but should also establish a framework for measuring the effectiveness of these expenditures.

Lastly, the plan should clarify the fire protection responsibility for other groups in the community, both governmental and private.

Devising a Fire Protection Plan

The following can serve as guidelines to fire department administrators for developing and presenting a master plan for fire protection:

Phase I

1. Identify the fire protection problems of the jurisdiction.
2. Identify the best combination of public resources and built-in protection required to manage the fire problem, within acceptable limits:
   - (a) Specify current capabilities and future needs of public resources;
   - (b) Specify current capabilities and future requirements for built-in protection.
3. Develop alternative methods that will result in tradeoffs between benefits and risks.
4. Establish a system of goals, programs, and cost estimates to implement the plan:
   - (a) The process of developing department goals and programs should include maximum possible participation of fire department personnel, of all ranks;
   - (b) The system should provide goals and objectives for all divisions, supportive of the overall goals of the department;
   - (c) Management development programs should strive to develop increased acceptance of authority and responsibility by all fire officers, as they strive to accomplish established objectives and programs.

Phase II

1. Develop, with the other government agencies, a definition of their roles in the fire protection process.
2. Present the proposed municipal fire protection system to the city administration for review.
3. Present the proposed system for adoption as the fire protection element of the jurisdiction's general plan. The standard process for development of a general plan provides the fire department administrator an opportunity to inform the community leaders of the fire protection goals and system, and to obtain their support.

Phase III

In considering the fire protection element the governing body of the jurisdiction will have to pay special attention to:

1. Short- and long-range goals,
2. Long-range staffing and capital improvement plans,
3. The code revisions required to provide fire loss management.

Phase IV

The fire loss management system must be reviewed and updated as budget allocations, capital improvement plans, and code revisions occur. Continuing review of results should concentrate on these areas:

1. Did fires remain within estimated limits?
2. Should limits be changed?
3. Did losses prove to be acceptable?
4. Could resources be decreased or should they be increased?

SI Units

The following conversion factors are given as a convenience in converting to SI units the English units used in this chapter.

1 gal (U.S.) = 3.785 litres
1 gpm = 3.785 litres/min

Bibliography

References Cited

[1] National Commission of Fire Prevention and Control, *America Burning: The Report of the National Commission on Fire Prevention and Control*, Government Printing Office, Washington, D.C., 1973.

[2] *Grading Schedule for Municipal Fire Protection*, Insurance Services Office, New York, 1974.

NFPA Codes, Standards, and Recommended Practices (see the latest *NFPA Publications and Visual Aids Catalog* for availability of current editions of the following documents)

NFPA No. 4, Organization for Fire Services.

NFPA No. 4A, Recommendations for Organization of a Fire Department.

NFPA No. 73, Standard for Installation, Maintenance and Use of Public Fire Service Communications.

NFPA No. 197, A Training Standard on Initial Fire Attack.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 9-80 through 9-82 14th edition 1976

CORRECTION

THIS DOCUMENT
HAS BEEN REPHOTOGRAPHED
TO ASSURE LEGIBILITY

C. Planning

The following information has been extracted in whole and in part from "America Burning," the report of the National Commission on Fire Prevention and Control[1], and is considered appropriate for inclusion in this portion of the HANDBOOK.

Planning

Fire protection has been largely a local responsibility, and for good reasons it is destined to remain so. Each community has a set of conditions unique to itself, and a system of fire protection that works well for one community cannot be assumed to work equally well for other communities. To be adequate, the fire protection system must respond to local conditions, especially to changing conditions. Planning

Source: National Fire Protection Association; Fire Protection Handbook, pp. 9-80 through 9-82 14th edition 1976

is the key: Without local-level planning, the system of fire protection is apt to be ill-suited to local needs and lag behind the changing needs of the community.

Excellent fire protection (for example, in the form of automatic extinguishing systems) lies within technical grasp, and certainly lies within the resources of most communities to provide. Even with considerable public support, this protection would require many years to accomplish. In the meantime, in every fire jurisdiction (whether a municipality, county, or region) standards aiming at a significant increase in fire protection must be set. Among the concepts to be defined:

Adequate Level of Fire Protection: The question of "adequacy" addressed itself not only to day-to-day normal needs, but to major contingencies that can be anticipated and to future needs as well. What is needed is a definition of "optimal" protection—in contrast to "minimal" protection, which fails to meet contingencies and future needs, and "maximal" protection, which is more than the community can afford.

Reasonable Community Costs: Fire, both as threat and reality, has its costs: property losses, deaths, injuries, hospital bills, lost tax revenues, plus the costs of maintaining fire departments, paying fire insurance premiums, and providing built-in fire protection. Each community must decide on an appropriate level of investment in fire protection. Some costs beyond the public's willingness to bear should be transferred to the private sector (as when buildings over a certain size or height or with a certain occupancy are required to have automatic extinguishing systems).

Acceptable Risk: A certain level of losses from fire must be accepted as tolerable simply because of limited resources of the community. Conditions that endanger the safety of citizens and fire fighters beyond the acceptable risk must be identified as targets for reduction.

Consideration of these matters helps to determine what functions and emphasis should be assigned to the fire department, other municipal departments, and the private sector, both now and in the future. It helps to define new policies, laws, or regulations that may be needed. Most important, consideration of these matters makes clear that fire safety is a responsibility shared by the public and private sectors. Because the fire department cannot prevent all fire losses, formal obligations fall on owners of certain kinds of buildings to have built-in fire protection. For the same reason, private citizens have an obligation to exercise prudence with regard to fire in their daily lives. But prudence also requires education in fire safety, and the obligation to provide that education appropriately falls in the public sector, chiefly the fire department. The public sector (again, chiefly the fire department) also has an obligation to see that requirements for built-in protection in the private sector are being met.

A fire department, then, has more than one responsibility. Nor are the responsibilities just mentioned exhaustive. At least 8 important functions for fire departments can be identified:

Fire Suppression: Fire fighters need proper training and adequate equipment for saving lives and putting out fires quickly, and also for their own safety.

Life Safety-paramedical Services: Capabilities needed during fires and other emergencies include first aid, resuscitation, and possibly paramedical services. (By "paramedical services" we mean emergency treatment beyond ordinary first aid, performed by fire service personnel under supervision (through radio communication, for example) of a physician.)

Fire Prevention: This includes approving building plans and actual construction, inspecting buildings, their contents, and their fire protection equipment, public education, and investigating the causes of fires to serve as a guide to future priorities in fire prevention.

Fire Safety Education: Fire departments have an obligation to bring fire safety education not only into schools and private homes, but also into occupancies with greater than average fire potential or hazard to people, such as restaurants, hotels, hospitals, and nursing homes.

Deteriorated Building Hazards: In coordination with other municipal departments, fire departments can work to abate serious hazards to health and safety caused by deteriorated structures or abandoned buildings.

Regional Coordination: Major emergencies can exceed the capabilities of a single fire department, and neighboring fire jurisdictions should have detailed plans for coping with such emergencies. But effectiveness can also be improved through sharing of day-to-day operations—as, for example, an area-wide communication and dispatching network.

Data Development: Knowledge of how well a fire department is doing, and of how practices should change to improve performance, depends on adequate record-keeping.

Community Relations: Fire departments are representative of the local community that supports them. The impression they make on citizens affects how citizens view their government. Volunteer departments dependent on private donations must, of course, also be concerned with their community relations. Moreover, since fire stations are strategically located throughout the community, they can serve as referral or dispensing agencies for a wide range of municipal services.

As communities set out to improve their fire protection, it is not the fire department alone they must consider. The police have a role in reporting fires and in handling traffic and crowds during fires. The cooperation of the building department is needed to enforce the fire safety provisions of building codes. The work of the water department in maintaining the water system is vital to fire suppression. In the realm of fire safety education, the public schools, the department of recreation, and the public library can augment the work of the fire department. Future development and planning will influence the location of new fire stations and how they will be equipped.

These are just the obvious examples of interdependence. So seemingly trivial a matter as the manner in which house numbers are assigned and posted can affect the ability of fire departments to respond quickly and effectively to emergencies.

Master Planning

Fire protection is only one of many community services. Not only must it compete for dollars with other municipal needs, such as the education system and the police department, but, in planning for future growth, the fire protection system must take into account the changes going on elsewhere in the community. For example, if a slum area is to be torn down and replaced with high-rise apartment buildings, that will change the fire protection needs of the area. Changes in zoning maps will also change the fire protection needs in different parts of the community.

To cope with future growth, local administrators are turning increasingly to the concept of *master planning* of municipal functions. Such plans include an examination of existing programs, projection of future needs of the community, and a determination of methods to fill those needs. They seek the most cost-effective allocations of resources to help assure that the needs will be met.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 9-80 through 9-82 14th edition 1976

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NFPA No. 73, Standard for Installation, Maintenance and Use of Public Fire Service Communications.

NFPA No. 197, A Training Standard on Initial Fire Attack.

Source: National Fire Protection Association; Fire Protection Handbook, pp. 9-80 through 9-82 14th edition 1976

71

Original

HB 648

SB 370

THE LEGISLATURE OF THE STATE OF ALASKA
ELEVENTH LEGISLATURE

FISCAL NOTE

I. REQUEST
Bill/Resolution No. HB 648 & SB 370
Title An Act Relating to Fire Prevention.
Requested by ______ Date ______

II. FISCAL DETAIL
Agency Affected Dept. of Commerce & Economic Development
Program Category Affected Development
BRU, Program, or Subprogram(s) Affected Division of Business Loans
(Note: If more than one budget component is affected, separate line-item amounts and funding for each component in the analysis section.)

EXPENDITURES (Thousands of Dollars)

	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85
100 PERSONAL SERVICES		55.2	60.7	66.8	73.4	80.7
200 TRAVEL		5.5	6.1	6.7	7.4	8.1
300 CONTRACTUAL		12.4	13.6	15.0	16.5	18.2
400 COMMODITIES		.5	.6	.7	.8	.9
500 EQUIPMENT		3.6	-	-	-	-
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS, ETC.						
TOTAL		77.2	81.0	89.2	98.1	107.9

FUNDING (Thousands of Dollars)

	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85
GENERAL FUND		77.2	81.0	89.2	98.1	107.9
FEDERAL FUNDS						
OTHER (Specify Fund Source)						

POSITIONS

	FY 80	FY 81	FY 82	FY 83	FY 84	FY 85
FULL TIME		2.0	2.0	2.0	2.0	2.0
PART TIME						
TEMPORARY						

III. ANALYSIS (See Fiscal Note Preparation Instructions, Section III)

Additional staff needed to give preferential treatment to fire prevention related loans.
See attached fiscal note detail.

Sharon R Traylor

IV. DATE February 19, 1980 PREPARED BY Sharon R. Traylor, Director
AGENCY Div. of Business Loans/ Dept. of Commerce & Eco Dev.
PHONE 465-2510

Original: Legislative Finance
cc: Budget and Management
Prime Sponsor (First Legislator Named)

33-001 (Rev. 12/79)

FISCAL NOTE DETAIL, HB648 & SB370

Fire Prevention Related Loans

			12 Months
100.	1 Loan Examiner I/II (flex) @2,289/mo.		$27.5
	1 Clerk Typist III @1,277/mo.		15.3
			$42.8
	Standard Benefits (Wages x.1529)		6.5
	Supplemental Benefits (Wages x.0665)		2.8
	Health Insurance (Man months X $127)		3.1
	Total Personal Services		$55.2
200.	Trips to inspect collateral and close loans:		
	10 Trips @430	$4.3	
	20 Days per diem @60	1.2	5.5
300.	Telephone, postage, printing	$10.0	
	Additional office space @200/mo.	2.4	12.4
400.	Office supplies		.5
	12 Months Operating Costs		$73.6
500.	2 Desks @278	$ .6	
	1 Credenza	.3	
	1 Typist's extension	.4	
	1 Executive chair	.2	
	1 Secretarial chair	.1	
	2 Side chairs @125	.3	
	2 File cabinets @202	.4	
	2 Calculators @225	.5	
	1 Typewriter	.8	3.6
	Total		$77.2

10% Inflation for succeeding years.

Original sponsors: Malone and Duncan

IN THE HOUSE BY THE FINANCE COMMITTEE

CS FOR HOUSE BILL NO. 648 (Finance)

IN THE LEGISLATURE OF THE STATE OF ALASKA

ELEVENTH LEGISLATURE - SECOND SESSION

A BILL

For an Act entitled: "An Act relating to fire prevention."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

* Section 1. AS 29.53.060(a) is amended to read:

(a) The assessor shall assess property at its full and true value as of January 1 of the assessment year, except as provided in this section and AS 29.53.030, 29.53.035, and 29.53.160. The full and true value is the estimated price which the property would bring in an open market and under the then prevailing market conditions in a sale between a willing seller and a willing buyer both conversant with the property and with prevailing general price levels. <u>The assessor may not include the value of a fire protection system in the assessment of the full and true value of a building.</u>

* Sec. 2. AS 29.53.060 is amended by adding a new subsection to read:

(d) In this section, "fire protection system" means a fire protection system as defined in the National Fire Codes published by the National Fire Protection Association.

* Sec. 3. AS 42.05.381 is amended by adding a new subsection to read:

(d) A utility may not charge a fee or surcharge for standby water for fire protection systems which use hydraulic sprinklers.

* Sec. 4. AS 42.05.701 is amended by adding a new paragraph to read:

(9) "fire protection systems" means fire protection systems as defined in the National Fire Codes published by the National Fire Protection Association.

* Sec. 5. AS 45.95.020(a) is amended to read:

(a) The commissioner shall, under regulations and policies adopted by him, make small business loans to acquire, finance or refinance or equip businesses, including farming equipment, <u>fire protection equipment,</u> mining and fishing, not exceeding $500,000. The loans shall be secured by acceptable collateral and may not exceed 75 percent of the appraised value of the collateral offered as security. The rate of interest may not exceed nine and one-half percent a year on the unpaid balance.

* Sec. 6. AS 45.95.020 is amended by adding a new subsection to read:

(e) The commissioner may not disqualify an applicant for, or prejudice an applicant's privilege to receive, a loan to purchase and install fire protection equipment because of a loan already made to the applicant under this chapter.

* Sec. 7. AS 45.95.080 is amended by adding a new paragraph to read:

(2) "fire protection equipment" means fire protection or fire alarm systems as defined in the National Fire Codes published by the National Fire Protection Association.

* Sec. 8. AS 44.33.170 is amended by adding new subsections to read:

(b) Tourist attraction development matching money may also be obtained for the purpose of purchasing and installing fire protection equipment for a building used or to be used for the purposes described in (a) of this section.

(c) In (b) of this section, "fire protection equipment" means fire protection or fire alarm systems as defined in the National Fire Codes published by the National Fire Protection Association.

THE LEGISLATURE OF THE STATE OF ALASKA
ELEVENTH LEGISLATURE

FISCAL NOTE

I. REQUEST
Bill/Resolution No. S. B. 370 and H. B. 648
Title An Act Relating to Fire Prevention
Requested by Legislative Finance Date 2-6-80

II. FISCAL DETAIL
Agency Affected Department of Community & Regional Affairs
Program Category Affected Development
Budget Request Unit(s) Affected Local Government Assistance

EXPENDITURES (Thousands of Dollars)

	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84
100 PERSONAL SERVICES						
200 TRAVEL						
300 CONTRACTUAL						
400 COMMODITIES						
500 EQUIPMENT						
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS, ETC.						
TOTAL	0	0	0	0	0	0

FUNDING (Thousands of Dollars)

GENERAL FUND						
FEDERAL FUNDS						
OTHER (Specify)						

POSITIONS

FULL TIME						
PART TIME						
TEMPORARY						

III. ANALYSIS (See Fiscal Note Preparation Instructions, Section III)

No fiscal impact to this agency. There may be fiscal impact to Department of Commerce and Economic Development.

IV. DATE 2/5/80 PREPARED BY LaDonna Brown [signature]
AGENCY Local Government Assistance Division
PHONE 465-4739

Original: Legislative Finance
cc: Budget and Management
Prime Sponsor (First Legislator Named)

33-001 (Rev. 10/78)

THE LEGISLATURE OF THE STATE OF ALASKA
ELEVENTH LEGISLATURE

FISCAL NOTE

I. REQUEST
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Requested by Legislative Finance Date 2-6-80

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Program Category Affected Development
Budget Request Unit(s) Affected Local Government Assistance

EXPENDITURES (Thousands of Dollars)

	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84
100 PERSONAL SERVICES						
200 TRAVEL						
300 CONTRACTUAL						
400 COMMODITIES						
500 EQUIPMENT						
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS, ETC.						
TOTAL	0	0	0	0	0	0

FUNDING (Thousands of Dollars)

GENERAL FUND						
FEDFRAL FUNDS						
OTHER (Specify)						

POSITIONS

FULL TIME						
PART TIME						
TEMPORARY						

III. ANALYSIS (See Fiscal Note Preparation Instructions, Section III)

No fiscal impact to this agency. There may be fiscal impact to Department of Commerce and Economic Development.

IV. DATE 2/5/80 PREPARED BY LaDonna Brown LaDonna Brown
AGENCY Local Government Assistance Division
PHONE 465-4739

Original: Legislative Finance
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Prime Sponsor (First Legislator Named)

33-001 (Rev. 10/78)

CORRECTION

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	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84
100 PERSONAL SERVICES						
200 TRAVEL						
300 CONTRACTUAL						
400 COMMODITIES						
500 EQUIPMENT						
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS, ETC.						
TOTAL	0	0	0	0	0	0

FUNDING (Thousands of Dollars)

GENERAL FUND						
FEDERAL FUNDS						
OTHER (Specify)						

POSITIONS

FULL TIME						
PART TIME						
TEMPORARY						

III. ANALYSIS (See Fiscal Note Preparation Instructions, Section III)

No fiscal impact to this agency. There may be fiscal impact to Department of Commerce and Economic Development.

IV. DATE 2/5/80 PREPARED BY LaDonna Brown *LaDonna Brown*
AGENCY Local Government Assistance Division
PHONE 465-4739

Original: Legislative Finance
cc: Budget and Management
Prime Sponsor (First Legislator Named)

33-001 (Rev. 10/78)

CATEGORY: DEVELOPMENT **AGENCY:** COMMUNITY AND REGIONAL AFFAIRS

PROGRAM: COMMUNITY DEVELOPMENT **BRU(s):** LOCAL GOVERNMENT ASSISTANCE

The Local Government Assistance BRU assists communities in attaining or sustaining viable units of local government according to established criteria. Particular emphasis is given to communities having local governments that are organized under state law with population less than 2,000. Components include Training and Development, State Assessor, Local Boundary Commission (Administration), Revenue Sharing (Administration) and Coastal Energy Impact Program.

The Training and Development Component provides local government officials with an opportunity to learn or improve skills needed to administer local government. Offices in Juneau, Anchorage, Nome and Bethel provide individual technical assistance for specific needs. Included in this program is the administration of Rural Development Assistance grants which, in FY 80, was in the Community and Rural Development BRU.

The State Assessor assists local government with procedures for determining local property taxes based on full and true value. This component also administers property relief programs, and researches economic data relating to property tax assessments and municipal financing.

The Local Boundary Commission component reviews and makes recommendations on requests for changes to or establishment of municipal boundaries. The intent is to ensure that the proposed changes will facilitate improvements in municipal services. This program also administers a grant program which makes grants of up to $25,000 for newly incorporated municipalities or those assuming special new powers such as police and fire protection.

The Community Legal Assistance Component provides grants to local governments for the purpose of bolstering their legal capabilities by enabling them to purchase appropriate resources to resolve legal issues. These grants may not exceed $20,000.

The Revenue Sharing Administration Component provides the personnel and expertise required to determine eligibility of municipalities to receive revenue sharing grants as well as determine their program allocation.

The Coastal Energy Impact Program is designed to assist those coastal communities, through federal grants from the U.S. Department of Commerce, who expect to be impacted by off-shore energy projects. Two positions will be federally funded in FY 81 to monitor existing grants and bond guarantees and to make future determinations on awarding bond guarantees from CEIP funds obligated to the Alaska Municipal Bond Bank.

COMPONENT DESCRIPTION	79 AUTH	79 FINAL	79 ACT	80 AUTH	80 SUPL	80 RP	GOVERNOR
TRAINING, DEVELOP, & RDA	473.4	515.3	471.6	488.9			740.9
STATE ASSESSOR	247.7	258.9	210.1	235.9			283.8
LOCAL BOUND. COMM-ADMIN	87.2	91.2	84.9	86.0			91.7
REVENUE SHARING ADMINISTRATION	85.4	89.9	77.8	72.5			73.7
COAST ENERGY IMPACT PROGRAM	364.7	886.4	585.2	376.9			585.2
ADMINISTRATION	592.9	625.2	578.5	598.5			
** TOTAL	1851.3	2466.9	2008.1	1858.7			1775.3
** CHANGE VERSUS 80 AUTH							-4.4%
OBJECT DESCRIPTION							
PERS. SERV.	1144.1	1184.9	1105.6	1179.8			952.9
TRAVEL	210.4	214.4	170.5	180.9			120.3
CONTRACTUAL	191.6	216.2	188.8	182.3			157.3
COMMODITIES	17.7	16.2	10.9	14.9			12.5
EQUIPMENT	6.5	8.5	8.4	2.1			29.1
LANDS/BLDGS	3.0	3.0	2.9	4.0			3.2
GRANTS, CLMS	278.0	823.7	521.0	294.7			500.0
FUNDING SOURCE							
FED. RECEIPT	648.7	1226.4	856.9	660.9			585.2
G. F. MATCH	71.0	77.3	67.9	71.0			
GENERAL FUND	1131.6	1163.2	1083.3	1126.8			1190.1
** GENERAL FUND CHANGE VS. 80 AUTH							-0.6%
POSITIONS							
FULL-TIME	34.0	34.0	34.0	34.0			25.0
PART-TIME	7.0	7.0	7.0	7.0			9.6
STAFF MONTHS	450.0	450.0	450.0	450.0			357.6

THE LEGISLATURE OF THE STATE OF ALASKA
ELEVENTH LEGISLATURE

FISCAL NOTE

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Program Category Affected Development
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EXPENDITURES (Thousands of Dollars)

	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84
100 PERSONAL SERVICES						
200 TRAVEL						
300 CONTRACTUAL						
400 COMMODITIES						
500 EQUIPMENT						
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS, ETC.						
TOTAL	0	0	0	0	0	0

FUNDING (Thousands of Dollars)

GENERAL FUND						
FEDERAL FUNDS						
OTHER (Specify)						

POSITIONS

FULL TIME						
PART TIME						
TEMPORARY						

III. ANALYSIS (See Fiscal Note Preparation Instructions, Section III)

No fiscal impact to this agency. There may be fiscal impact to Department of Commerce and Economic Development.

IV. DATE 2/5/80 PREPARED BY LaDonna Brown LaDonna Brown
AGENCY Local Government Assistance Division
PHONE 465-4739

Original: Legislative Finance
cc: Budget and Management
Prime Sponsor (First Legislator Named)

33-001 (Rev. 10/78)

CATEGORY: DEVELOPMENT **AGENCY:** COMMUNITY AND REGIONAL AFFAIRS

PROGRAM: COMMUNITY DEVELOPMENT **BRU (s):** LOCAL GOVERNMENT ASSISTANCE

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COMPONENT DESCRIPTION	79 AUTH	79 FINAL	79 ACT	80 AUTH	80 SUPL	80 RP	GOVERNOR
TRAINING, DEVELOP, & RDA	473.4	515.3	471.6	488.9			740.9
STATE ASSESSOR	247.7	258.9	210.1	235.9			283.8
LOCAL BOUND. COMM-ADMIN	87.2	91.2	84.9	86.0			91.7
REVENUE SHARING ADMINISTRATION	85.4	89.9	77.8	72.5			73.7
COAST ENERGY IMPACT PROGRAM	364.7	886.4	585.2	376.9			585.2
ADMINISTRATION	592.9	625.2	578.5	598.5			
** TOTAL	1851.3	2466.9	2008.1	1858.7			1775.3
** CHANGE VERSUS 80 AUTH							-4.4%
OBJECT DESCRIPTION							
PERS. SERV.	1144.1	1184.9	1105.6	1179.0			952.9
TRAVEL	210.4	214.4	170.5	180.9			120.3
CONTRACTUAL	191.6	216.2	188.8	182.3			157.3
COMMODITIES	17.7	16.2	10.9	14.9			12.5
EQUIPMENT	6.5	8.5	8.4	2.1			29.1
LANDS/BLDGS	3.0	3.0	2.9	4.0			3.2
GRANTS, CLMS	278.0	823.7	521.0	294.7			500.0
FUNDING SOURCE							
FED. RECEIPT	648.7	1226.4	856.9	660.9			585.2
G. F. MATCH	71.0	77.3	67.9	71.0			
GENERAL FUND	1131.6	1163.2	1083.3	1126.8			1190.1
** GENERAL FUND CHANGE VS. 80 AUTH							-0.6%
POSITIONS							
FULL-TIME	34.0	34.0	34.0	34.0			25.0
PART-TIME	7.0	7.0	7.0	7.0			9.6
STAFF MONTHS	450.0	450.0	450.0	450.0			357.6

THE LEGISLATURE OF THE STATE OF ALASKA
ELEVENTH LEGISLATURE

FISCAL NOTE

I. REQUEST
Bill/Resolution No. S. B. 370 and H. B. 648
Title An Act Relating to Fire Prevention
Requested by Legislative Finance Date 2-6-80

II. FISCAL DETAIL
Agency Affected Department of Community & Regional Affairs
Program Category Affected Development
Budget Request Unit(s) Affected Local Government Assistance

EXPENDITURES (Thousands of Dollars)

	FY 79	FY 80	FY 81	FY 82	FY 83	FY 84
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200 TRAVEL						
300 CONTRACTUAL						
400 COMMODITIES						
500 EQUIPMENT						
600 LAND & STRUCTURES						
700 GRANTS, CLAIMS, ETC.						
TOTAL	0	0	0	0	0	0

FUNDING (Thousands of Dollars)

GENERAL FUND						
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OTHER (Specify)						

POSITIONS

FULL TIME						
PART TIME						
TEMPORARY						

III. ANALYSIS (See Fiscal Note Preparation Instructions, Section III)

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IV. DATE 2/5/80 PREPARED BY LaDonna Brown LaDonna Brown
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PHONE 465-4739

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TOTAL	0	0	0	0	0	0

FUNDING (Thousands of Dollars)

GENERAL FUND						
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OTHER (Specify)						

POSITIONS

FULL TIME						
PART TIME						
TEMPORARY						

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IV. DATE 2/5/80 PREPARED BY LaDonna Brown *LaDonna Brown*
AGENCY Local Government Assistance Division
PHONE 465-4739

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FULL-TIME	34.0	34.0	34.0	34.0			25.0
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STAFF MONTHS	450.0	450.0	450.0	450.0			357.6

BILL ANALYSIS

ASSIGNMENT DATE 2-1-80

UNASSIGNED ____________

DEPARTMENT	SPONSOR (PRINCIPAL)	BILL NO.
Public Safety	Malone and Duncan	HB 648

DEPARTMENT POSITION

Support

DIVISION DIRECTOR	DATE	COMMISSIONER	DATE
Ronald A. Hendrie	2-13-80	William R. Nix	2/14/80

GOVERNOR'S OFFICE USE

☐ POSITION NOTED ☐ POSITION APPROVED ☐ POSITION DISAPPROVED

BY: DATE:

SUMMARY

(1) RELATED BILLS (SIMILAR OR CONFLICTING)
(2) OTHER AGENCIES AFFECTED BY BILL

(1) Identical to SB 370 introduced 1/31/80
(2) Department of Commerce & Economic Development

(2) a. ORGANIZATIONAL SUPPORT FOR BILL

Alaska Fire Chiefs Association
Alaska State Firefighters Association

(2) b. ORGANIZATIONAL OPPOSITION TO BILL

Unknown

(3) PROGRAM EFFECTS OF BILL

The incentive aspects of the bill (voluntary or regulated installation of private fire protection systems) will favorably affect fire prevention and protection programs and efforts at the state and local levels.

(4) FISCAL IMPACT: ☐ NONE ☐ FISCAL ANALYSIS ATTACHED

(5) AMENDMENTS PROPOSED:

None

(6) COMMENTS:

The provisions in this bill provide the incentive and means and methods for the installati of private fire protection systems in private property which will in turn enhance and support the public fire protection systems and capabilities of communities throughout Alas

Many communities are being faced with providing additional fire protection services and with the costs associated with providing those services. A community fire protection incentive program can provide an alternative to the increasing costs of fire protection.

A long term affect of such a program would be in the area of security of a communities assets, e.g. private fire protection systems protect the economics of the community by providing security for the businesses that provide the tax base and employment of those within the community. Both the direct and indirect socioeconomic impacts, from fire, would be reduced.

Alaska State Legislature

House of Representatives

Committee on

Community & Regional Affairs

Official Business

Pouch V
State Capitol
Juneau, Alaska 99811

Proposed CS for HB 648 relating to fire protection would include a definition of fire protection equipment as follows:

p. 2 line 13
(c) In (b) of this section, "fire protection equipment" means fire protection or fire alarm systems as defined in the current edition of National Fire Codes published by the National Fire Protection Association.

Appropriate reference to this definition will be made as needed throughout the bill.

DEFINITIONS OF FIRE PROTECTION SYSTEMS

Fire protection and fire alarm systems are those systems as defined in the National Fire Codes, current edition, published by the National Fire Protection Association.

These systems include, but are not limited to the following: Foam Extinguishing systems, High Expansion Foam systems, Carbon Dioxide systems, Halon 1301 systems, Halon 1211 systems, Dry Chemical systems, Water Spray Fixed systems, Foam/Water Sprinkler and Spray systems, Standpipe and Hose systems, Hydraulic Sprinkler systems, and associated pumps & tanks as required for the foregoing systems.

Fire Alarm systems include, but are not limited to: Central Station signaling systems, Local Protective signaling systems, Auxiliary systems, Remote Station signaling systems, Propietary signaling systems, Automatic Fire Detection systems.

STATE OF ALASKA

JAY S. HAMMOND, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

OFFICE OF THE COMMISSIONER

POUCH M — JUNEAU 99811

ANNUAL REPORT ON THE FIRE SUPPRESSION FUND

Prepared for the Alaska State Legislature

While the 1978 fire season was the mildest on record, the 1979 fire season was one of the worst on record for the State.

In accordance with AS 41.15.240 the following report of income and expenses of the fire suppression fund is submitted for the 1979 fire season.

The fund was established at $750,000 by the 1978 Legislature. During the 1978 fire season $75,955.75 was expended on fire suppression work. The 1979 Legislature did not appropriate funds to bring the suppression fund back to its original level. Due to this fact the sum of $674,044.25 was available at the start of the 1979 fire season.

The 1979 fire season started with a few inconsequential fires near Fairbanks and in the Mat-Su Valley. On May 10, 1979 a fire was started within the Delta Barley project, the agricultural clearing project near Delta Junction. Under existing weather conditions of high wind and low humidity, the fire could not be controlled and grew to 2000 acres the first night. A project fire organization was initiated and the fire declared controlled on May 19, 1979 at 4200 acres. By May 25, the fire had been totally demanned. No new evidence of fire was observed until June 4, 1979.

June 4 was another day of high wind and low humidity. It has never been satisfactorily determined whether a new fire start was made or buried fire within the perimeter blew across and started in unburned fuels. A project fire organization was again ordered to attempt to control the fire. Fire control personnel stayed on the fire at various levels until the summer was ended. The fire made runs on June 24, July 4 and in August.

Late season problems continued to appear from the Delta Barley Project. During the fall some individuals started their berm piles with no effort to control fire spread. On October 16 an individual started his berm piles and under ideal fire conditions, made a run of six miles during the night.

The accompanying fire statistics indicate that state fire fighters were suppressing other fires through the area of state responsibility at the same time the Delta Barley fire was being fought.

To illustrate some of the major costs, the following items of expenditures are given. These are firm figures only through August but are indicative of the ration of major cost items on any project fire.

Class of Expenditure	Costs
Emergency Firefighter wages	$1,091,572.36
Helicopter charter	305,259.88
Tractor rental	470,046.16
Other vehicle rental	190,714.06

These costs, along with the accompanying attachments indicate the Fires Suppression Fund must be better aligned with state fire responsibility. BLM predicts that by 1985 Alaska will have its full entitlement of land. Along with the land, the State's fire workload will increase many times over. By 1985 it is estimated 75 million acres of state land will be under fire protection.

Future Demands

Land will be transferred at the rate of 10-15 million acres per year; and will result in the State having 75% of the total fire cost on state lands by 1985. Total statewide fire cost in 1979 dollars is $20,000,000 per year, therefore state funds must be able to support expenditures of $14-15 million per year, with about $5 million of this in project fire costs.

Attachment A:	Fire Cause - State Responsibility Lands
Attachment B:	Projected Fire Occurrance Through 1985
Attachment C:	Problem Fire Identification State Lands Through 1985
Attachment D:	Statewide Fires by Cause - State and Federal Lands
Attachment E:	Fire Suppression Funds - Receipts and Expenditures Calendar Year 1979

JANUARY 22, 1980

STATE RESPONSIBILITY LANDS

1979 FIRE SEASON

CAUSE	DISTRICT	FIRES		ACRES	
		NO.	%	NO.	%
LIGHTNING	NCD	22	7.8	458	1.1
	SCD	1	0.4	9	0.0
MAN CAUSED	NCD	127	44.8	41,697	98.1
	SCD	133	47.0	336	0.8
SUB-TOTAL		283		42,500	

1978 FIRE SEASON

CAUSE	DISTRICT	FIRES		ACRES	
		NO.	%	NO.	%
LIGHTNING	NCD	3	2.0	2	0.3
	SCD	1	0.6	-0-	0.0
MAN CAUSED	NCD	36	23.5	61	10.7
	SCD	113[1]	73.9	509[1]	89.0
SUB-TOTAL		153		572	

1. INCLUDES 2 FIRES IN SE & 100 ACRES

Attachment A

PROJECTED* FIRE OCCURRENCE THRU 1985

	Lightning		Man-Caused		False Alarm		Total	%	Average
	No.	%	No.	%	No.	%			
State Responsible Land	681	50	1,144	85	338	75	2,163	69%	432.6
Fed. Responsible Land	659	50	195	15	107	25	961	31%	192.2
Total (5 Years)	1,340		1,339		445		3,124		
Annual Average	248		267.8				625		

*Based on 1972 - 1976 Fire History

Lands transferred to the State at 14 million acres per year.

Attachment B

PROBLEM FIRE* IDENTIFICATION
STATE LANDS PROJECTED TO 1985

	Problem Fires		Percent		Total Fires	
	No.	Cost	No.	Cost	No.	Cost
State	62	$7,405,039	33	44	2163	$9,527,000
Federal	127	9,512,014	67	56	961	12,126,000
Total	189	16,917,051			3124	21,653,000
Average	37.8	$3,383,006			625	$4,330,000

*Problem Fire: Fires over 300 Acres and fires costing over $100,000
Based on Fire Histroy, 1972 to 1976 (5 years)
Problem Fires accounted for 78% of the total suppression cost.
Dollar costs are actual expenditures, not adjusted for inflation.

Attachment C

JANUARY 22, 1980

1979 FIRE SEASON

NO. OF FIRES BY CAUSE

STATE RESPONSIBILITY LANDS

CAUSE	DISTRICT	FIRES NO.	FIRES %	ACRES NO.	ACRES %
LIGHTNING	NCD	22	3.6	458	0.1
	SCD	1	0.2	9	0.0
MAN CAUSED	NCD	127	20.7	41,697	9.6
	SCD	133	21.5	336	0.1
SUB TOTAL		283	46.0	42,500	9.8

FEDERAL RESPONSIBILITY LANDS

CAUSE	DISTRICT	FIRES NO.	FIRES %	ACRES NO.	ACRES %
LIGHTNING	FAIRBANKS	164	26.7	384,534	89.2
	ANCHORAGE	24	3.9	787	0.2
MAN CAUSED	FAIRBANKS	74	12.0	2,249	0.5
	ANCHORAGE	70	11.4	1,444	0.3
SUB TOTAL		332	54.0	389,014	90.2
STATEWIDE TOTAL		615		431,514	

Attachment D

JANUARY 22, 1980

1979 FIRE SEASON

NO. OF FIRES BY CAUSE

STATE RESPONSIBILITY LANDS

CAUSE	DISTRICT	FIRES		ACRES	
		NO.	%	NO.	%
LIGHTNING	NCD	22	3.6	458	0.1
	SCD	1	0.2	9	0.0
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	ANCHORAGE	70	11.4	1,444	0.3
SUB TOTAL		332	54.0	389,014	90.2
STATEWIDE TOTAL		615		431,514	

Attachment D

FIRE SUPPRESSION

RECEIPTS AND EXPENDITURES FOR CALENDAR YEAR 1979

RECEIPTS	10-42-9-500	10-42-9-505
January 1, 1979 Fire Suppression Fund	674,044.25	
June 5, 1979 Revised Program		315,000.00
June 3, 1979 Governor's Disaster Fund		395,000.00
August 7, 1979 Debt Service Lapse	86,900.00	513,100.00
August 7, 1979 Agricultural Loan Fund		1,200,000.00
	760,944.25	2,423,100.00
EXPENDITURES (1)		
January - June 1979 (attachment 1 minus 2)	760,856.98	
July - December 1979 (attachment 3)	707,429.53	
January - June 1979 (attachment 4)		661,855.40
July - December 1979 (attachment 5)		1,407,775.11
Total Expenditures	1,468,286.51	2,069,630.51
Adjustment (Prior year obligations decrease current and prior year authorizations)		46,826.72
December 31, 1979 Balance	⟨707,342.26⟩	*306,642.77

*This balance is the total of prior year and current year (119,417.88 + 187,224 89)

(1) See attachments numbers 1 thru 5 for line items allocations.

Attachment E

RECOMMENDATIONS

FROM THE

ALASKA FIRE CHIEF'S ASSOCIATION
ALASKA STATE FIREFIGHTER ASSOCIATION

FOR

ADOPTION OF THE

COMMUNITY FIRE PROTECTION INCENTIVE PROGRAM

Set bill drafted
change loan para.

Material Prepared By:
Robert R.Shirnberg
Fire Marshal
Nikiski Fire Dept.
Chairman Ad-Hoc Committee
ASFA/AFCA
December-2-1979

The Alaska State Firefighters Association and the Alaska Fire Chief's Association, at their respective annual meetings in October of 1979 in Petersburg, Alaska, were presented a program entitled, "Community Fire Protection Incentive Program".

Both the Alaska State Firefighters Association and the Alaska Fire Chief's Association submitted to their respective memberships a resolution calling for support in the preparation of program material to enact the Community Fire Protection Incentive Program during the 1980 session of the Alaska State Legislature. Both bodies passed unanimously this resolution.

A joint AD-HOC committee was formed, comprised of members of the ASFA and the AFCA to prepare the necessary material and to carry out the legislative program presentation.

The State of Alaska has the honor of being Number #1 in many catagories. We are by far the largest state in the Union. Our fisheries and resources from the sea are Number #1 in value. Our resources on oil and gas production are approaching Number #1. Our mineral potential is the greatest of all states.

Our state also has the dubious honor of being Number #1 by some margin in the loss of life per capita by fire and the property dollar loss per capita. It appears that the growth of our state is assured with projections of ship building facilities, processing and support facilities for a bottom fishing industry, oil and gas production with related petrochemical industrial plants, mineral development, etc. With the population and constructions that will come with this growth and with our present methods of providing fire protection, we will retain the dubious honor of being Number #1 in per capita loss of life and property damage as a result of fire.

We in the fire service recognize that a new approach in providing for both public and private fire protection needs must be developed. We recognize that the Community Fire Protection Incentive Program does offer the method to redirect fire protection systems and combine the best features of both public and private fire protection in a manner that will improve and better the community against the ravages of fire. It provides a method whereby the costs for public fire protection can be controlled as the community expands and grows.

The Community Fire Protection Incentive Program provides a method whereby the private property owner and businessman will have the incentive and support necessary to provide for the installation of private fire protection systems in their property. This incentive is created through a three-part program as follows:

~~Permanent Revolving Loan Fund~~ Include in Small Business Loans Program

This loan fund will provide loans to private property owners and businessmen at an interest rate and such terms that will create an incentive to install private fire protection systems such as hydraulic sprinkler systems.

The terms of the loan will be such that the direct insurance saving received for the installation of the sprinkler system will be calculated in the repayment schedule. It is the intent that the peoperty owner will realize a real dollar return on the installation of the sprinkler system. An example would be that if the net insurance saving was $6,000 annually, the loan terms would require a $4,000 annual payment, resulting in a net return to the property owner of $2,000 annually until the loan has been paid off, at which time the property owner would receive the entire $6,000 benefit.

Tax Incentive

Remove from the property tax rolls the assessed value of the private fire protection system. There is no question of the roll that the private fire protection has in supporting the public fire protection system. It is taken into consideration in the I.S.O. rating schedule, it has a decided effect on reducing the overall insurance rating of a community's fire defenses. It protects the community's tax base. It protects the jobs and the economy of the community.

With our present policy of taxing private fire protection systems, we discourage the property owners from installing such voluntary systems.

Again, the private property owner and business man will be encouraged to install private fire protection systems if we remove the tax burden that is placed on such systems.

Water Standby Surcharge for Sprinkler Connections

Some water utilities have placed an excessive standby water rate to property owners that have installed hydraulic sprinkler systems in their property. In many cases these special rates have eliminated or exceeded any dollar saving the property owner may have enjoyed because he has installed a sprinkler system.

In some cases the owners of property equipped with sprinkler systems have shut the sprinkler system down and discontinued its use and accepted the higher insurance rate because there was a dollar saving between the water standby rate and the increased insurance premiums.

As can be seen, the excessive water rate charge is a direct attack on the incentive to install private fire protection systems.

Therefore, it is necessary that special water rates for properties equipped with sprinkler systems be reduced to a very nominal fee or eliminated altogether.

This program intent is to provide for the property owners and businesses the incentive and assistance to install fire protection systems. The program is to be made available to property owners in all areas of the state of Alaska, from the larger municipalities to the smaller communities and very rural areas. To those communities with full-time paid fire departments to those with volunteer fire departments, and also those areas without any fire protection at all. The program makes assistance available to areas that are isolated, such as remote cannery locations, and a method to provide for fire protection of such facilities.

With such a program in effect and within a few short years, we will see a decided reduction in our property fire loss and loss of life from fire. We will realize a direct saving in the cost of our public fire protection systems. We will be able to better meet the fire protection needs of our expanding and growing communities, and be able to control the costs of this expansion.

Fewer jobs will be lost through catastrophic fires, the economy better protected, the tax base of the community better assured, and those public programs that are supported by the tax base better protected.

Private Fire Protection

Serves A

Public Purpose

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Stand-By Charges

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Meter Requirements

and

Houston Shows 'Em How!

By Edward J. Reilly *Director of Information*

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