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NFPA 291 Fire Flow Testing and Marking of Hydrants 1988 Edition

National Fire Protection Association Batterymarch Park, Quincy, MA 02269

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The Board of Directors reaffirms that the National Fire Protection Association recognizes that the toxicity of the products of combustion is an important factor in the loss of life from fire. NFPA has dealt with that subject in its technical committee documents for many years.

There is a concern that the growing use of synthetic materials may produce more or additional toxic products of combustion in a fire environment. The Board has, therefore, asked all NFPA technical committees to review the documents for which they are responsible to be sure that the documents respond to this current concern. To assist the committees in meeting this request, the Board has appointed an advisory committee to provide specific guidance to the technical committees on questions relating to assessing the hazards of the products of combustion.

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MGR AM-88

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NATIONAL FIRE PROTECTION ASSOCIATION

NFPA 291

Recommended Practice for

Fire Flow Testing and Marking of Hydrants

1988 Edition

This edition of NFPA 291, *Recommended Practice for Fire Flow Testing and Marking of Hydrants*, was prepared by the Technical Committee on Private Water Supply Piping Systems, released by the Correlating Committee on Water Extinguishing Systems, and acted on by the National Fire Protection Association, Inc. at its Annual Meeting held May 16-18, 1988, in Los Angeles, California. It was issued by the Standards Council on June 8, 1988 with an effective date of June 28, 1988, and supersedes all previous editions.

The 1988 edition of this document has been approved by the American National Standards Institute.

Changes other than editorial are indicated by a vertical rule in the margin of the pages on which they appear. These lines are included as an aid to the user in identifying changes from the previous edition.

Origin and Development of NFPA 291

The NFPA Committee on Public Water Supplies for Private Fire Protection presented the idea of indicating the relative available fire service water supply from hydrants in its 1934 report. The Committee felt then and feels now that such an indication is of substantial value to water and fire departments. The following recommendations were initially adopted in 1935. The Committee agreed that tests of individual hydrants did not give as complete and satisfactory results as group testing but expressed the opinion that tests of individual hydrants did have sufficient value to make the following recommendations worthy of adoption. This was reconfirmed with minor editorial changes in 1974.

The 1977 edition was completely rewritten and a chapter on the flow testing of hydrants was added.

The 1982 edition had been reconfirmed by the committee. This edition of the document notes several changes which will help to clarify and reinforce certain recommendations. Specific guidance has been added on the correct method of utilizing a Pitot tube to gain accurate test results.

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Rep. AAI

Alternates

Lee J. Dosedlo, Underwriters Laboratories Inc.
(Alternate to K. M. Bell)
Russell P. Fleming, National Automatic Sprinkler and Fire Control Assn., Inc.
(Alternate to R. Martineau)
Richard A. Hennie, Union Camp Corp.
(Alternate to J. W. Sheppard)
Michael L. Johnson, Sprinklerfitters Local Union 669
(Alternate to Sprinklerfitters Union Rep.)
Peter R. Yurkonis, Rolf Jensen & Associates Inc.
(Alternate to James W. Simms)

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred.

NOTE: Membership on a Committee shall not in and of itself constitute an endorsement of the Association or any document developed by the Committee on which the member serves.

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Recommended Practice for

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Chapter 1 Flow Testing

1-1 Introduction. Fire flow tests are made on water distribution systems to determine the rate of flow available at various locations for fire fighting purposes. A certain residual pressure in the mains is specified at which the rate of flow should be available. Additional benefit is derived from fire flow tests by the indication of possible deficiencies (such as tuberculation of piping or closed valves or both) which could be corrected to ensure adequate fire flows as needed.

1-2 Definitions.

Authority Having Jurisdiction. The "authority having jurisdiction" is the organization, office or individual responsible for "approving" equipment, an installation or a procedure.

NOTE: The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner since jurisdictions and "approval" agencies vary as do their responsibilities. Where public safety is primary, the "authority having jurisdiction" may be a federal, state, local or other regional department or individual such as a fire chief, fire marshal, chief of a fire prevention bureau, labor department, health department, building official, electrical inspector, or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the "authority having jurisdiction." In many circumstances the property owner or his designated agent assumes the role of the "authority having jurisdiction"; at government installations, the commanding officer or departmental official may be the "authority having jurisdiction.".

Listed. Equipment or materials included in a list published by an organization acceptable to the "authority having jurisdiction" and concerned with product evaluation, that maintains periodic inspection of production of listed equipment or materials and whose listing states either that the equipment or material meets appropriate standards or has been tested and found suitable for use in a specified manner.

NOTE: The means for identifying listed equipment may vary for each organization concerned with product evaluation, some of which do not recognize equipment as listed unless it is also labeled. The "authority having jurisdiction" should utilize the system employed by the listing organization to identify a listed product.

Rated Capacity. The flow available from a hydrant at the designated residual pressure (rated pressure), either measured or calculated.

Should. Indicates a recommendation or that which is advised but not required.

1-3 Rating Pressure. For the purpose of uniform marking of fire hydrants, the ratings should be based on a residual pressure of 20 psi (1.4 bar) for all hydrants having a static pressure in excess of 40 psi (2.8 bar). Hydrants having a static pressure of less than 40 psi (2.8 bar) should be rated at one-half of the static pressure.

It is generally recommended that a minimum residual pressure of 20 psi (1.4 bar) be maintained at hydrants when delivering the fire flow. Fire department 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 a lesser pressure as the minimum pressure. A primary concern should be the ability to maintain sufficient residual pressure to prevent developing a negative pressure at any point in the street mains, which could result in the collapse of the mains or other water system components or backsiphonage of polluted water from some other interconnected source. It should be noted that the use of residual pressures of less than 20 psi is not permitted by many state health departments.

1-4 Procedure. Tests should be made during a period of ordinary demand. The procedure consists of discharging water at a measured rate of flow from the system at a given location and observing the corresponding pressure drop in the mains.

1-5 Data Sheet. The data secured during the testing of hydrants for uniform marking may be valuable for other purposes. With this in mind, it is suggested that the form

Hydrant Flow Test Report

LOCATION _____ DATE _____

TEST MADE BY _____ TIME _____ M.

REPRESENTATIVE OF _____

WITNESS _____

STATE PURPOSE OF TEST _____

_____

CONSUMPTION RATE DURING TEST _____

IF PUMPS AFFECT TEST, INDICATE PUMPS OPERATING _____

FLOW HYDRANTS _____ A_1 A_2 A_3 A_4

Size Nozzle _____

Pitot Reading _____

Discharge Coefficient _____ TOTAL GPM

GPM _____

STATIC B _____ psi RESIDUAL B _____ psi

PROJECTED RESULTS @ 20 psi Residual ____ gpm, or @ ____ psi Residual ____ gpm

REMARKS _____

_____

_____

_____

LOCATION MAP Show line sizes and distance to next cross connected line. Show valves and hydrant branch size. Indicate North. Show flowing hydrants – Label A_1, A_2, A_3, A_4. Show location of Static and Residual - Label B

Indicate B Hydrant _____ Sprinkler _____ Other (Identify) _____

Figure 1-5 Sample Hydrant Flow Test Report.

shown in Figure 1-5 be used to record information that is taken. The back of the form should include a location sketch. When the tests are complete the forms should be filed for future reference by interested parties.

1-6 Layout of Test. After the location at which the test is to be run has been determined, a group of test hydrants in the vicinity is selected. Once selected, due consideration should be given to potential interference to traffic flow patterns, damage to surroundings (e.g., roadways, sidewalks, landscapes, vehicles, and pedestrians), and potential flooding problems both local and remote from the test site. One hydrant is chosen to be the residual hydrant at which the normal pressure will be observed with the other hydrants in the group closed, and the residual pressure will be observed with the other hydrants flowing. This hydrant is chosen so that the hydrants which will be flowed are the next hydrants between it and the larger mains, which constitute the immmediate sources of supply in the area. In Figure 1-6, several test layouts are indicated, showing the residual hydrant in each case by means of a circle.

The number of hydrants to be used in any test depends upon the strength of the distribution system in the vicinity of the test location. To obtain satisfactory test results for theoretical calculation of expected flows or rated capacities, sufficient discharge should be achieved to cause a drop in pressure at the residual hydrant of at least 25 percent or to flow the total demand necessary for fire fighting purposes. If the mains are small and the system weak, only one or two hydrants need to be flowed. If, on the other hand, the mains are large and the system strong, it may be necessary to flow as many as seven or eight hydrants.

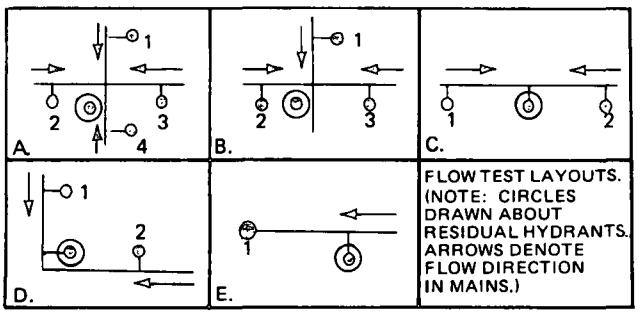

Figure 1-6 Suggested Test Layouts for Hydrants.

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1-7 Equipment. The equipment necessary for field work consists of a single 200-psi (14-bar) bourdon pressure gage with 1-psi graduations, a number of Pitot tubes, hydrant wrenches, 50- or 60-psi (3.5- or 4.0-bar) bourdon pressure gages with ½-psi graduations, and scales with 1/16-in. graduations (one Pitot tube, a 50- or 60-psi gage, a hydrant wrench, and a scale for each hydrant to be flowed), and a special hydrant cap tapped with a hole into which a short length of ¼-in. brass pipe is fitted. This pipe is provided with a T connection for the 200-psi (14-bar) gage and a cock at the end for relieving air pressure. All pressure gages should be calibrated at least every 12 months, or more frequently depending on use. When more than one hydrant is flowed, it may be desirable and necessary to use portable radios to facilitate communication between team members.

1-8 Test Procedure. In a typical test, the 200-psi (14-bar) gage is attached to one of the 2½-in. (6.4-cm) outlets of the residual hydrant using the special cap, the cock on the gage piping is opened, and the hydrant valve is opened full. As soon as the air is exhausted from the barrel, the cock is closed. A reading is taken when the needle comes to rest. At a given signal, each of the other hydrants is opened in succession with discharge taking place directly from the open hydrant butts. Hydrants should be opened one at a time. With all hydrants flowing, water should be allowed to flow for a sufficient time to clear all debris and foreign substances from the stream(s). At that time, a signal is given to the people at the hydrants to read the Pitot pressure of the streams simultaneously while the residual pressure is being read. The final magnitude of the pressure drop can be controlled by the number of hydrants used and the number of outlets opened on each.

After the readings have been taken, hydrants should be shut down slowly, and one at a time, to prevent undue surges in the system.

1-9 Pitot Readings. When measuring discharge from open hydrant butts, it is always preferable from the standpoint of accuracy to use 2½-in. (6.4-cm) outlets rather than pumper outlets. In practically all cases the 2½-in. (6.4-cm) outlets are filled across the entire cross section during flow, while with the larger outlets there is very frequently a void near the bottom. When measuring the Pitot pressure of a stream of practically uniform velocity, the orifice in the Pitot tube is held downstream approximately one-half the diameter of the hydrant outlet or nozzle opening, and in the center of the stream. The center line of the orifice should be at right angles to the plane of the face of the hydrant outlet. The air chamber on the Pitot tube should be kept elevated. Pitot readings of less than 10 psi (.7 bar) and more than 30 psi (2.0 bar) should be avoided if possible. Opening additional hydrant outlets will aid in controlling the Pitot reading. With dry barrel hydrants, the hydrant valve should be wide open. This minimizes problems with underground drain valves. With wet barrel hydrants, the valve for the flowing outlet should be wide open. This gives a more streamlined flow and a more accurate Pitot reading.

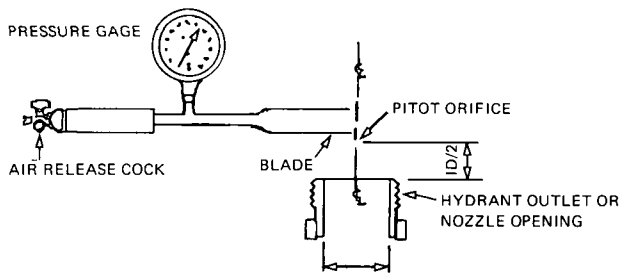

Figure 1-9 Pitot Tube Position.

1-10 Determination of Discharge. At the hydrants used for flow during the test, the discharges from the open butts are determined from measurements of the diameter of the outlets flowed, the velocity pressures of the streams

as indicated by the Pitot gage readings, and the coefficient of the outlet being flowed as determined from Figure 1-10. If flow tubes (stream straighteners) are being utilized, a coefficient of 0.95 is suggested unless the coefficient of the tube is known.

The formula used to compute the discharge, Q, in gpm from these measurements is:

$$Q = 29.83\ cd^2\sqrt{p} \qquad (a)$$

where c is the coefficient of discharge (*see Figure 1-10*),

d the diameter of the outlet in inches, and

p the velocity pressure in psi.

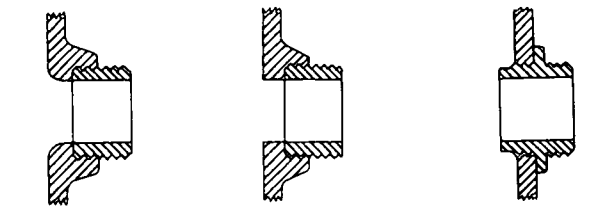

Figure 1-10 Three general types of hydrant outlets and their coefficients of discharge.

1-11 Use of Pumper Outlets. If it is necessary to use a pumper outlet, and flow tubes (stream straighteners) are not available, the best results are obtained with the velocity pressure maintained between 5 and 10 psi (.3 and .7 bar). For pumper outlets, the approximate discharge can be computed from equation (a) using the velocity pressure at the center of the stream and multiplying the result by one of the coefficients in Table 1-11, depending upon the velocity pressure. These coefficients are applied in addition to the coefficient in equation (a) and are for average type hydrants.

Table 1-11 Pumper Outlet Coefficients

Velocity Pressure	Coefficient
2 psi	0.97
3 psi	0.92
4 psi	0.89
5 psi	0.86
6 psi	0.84
7 psi and over	0.83

1-12 Determination of Discharge Without a Pitot. If a Pitot tube is not available for use to measure the hydrant discharge, a 50- or 60-psi (3.5- or 4.0-bar) gage tapped into a hydrant cap may be used. The hydrant cap with gage attached is placed on one outlet, and the flow is allowed to take place through the other outlet at the same elevation. The readings obtained from a gage so located and the readings obtained from a gage on a Pitot tube held in the stream are approximately the same.

1-13 Calculation Results.

1-13.1 The discharge in gallons-per-minute for each outlet flowed is obtained from the discharge tables in 1-13.1 or by the use of formula (a). If more than one outlet is used, the discharges from all are added to obtain the total discharge.

The formula which is generally used to compute the discharge at the specified residual pressure or for any desired pressure drop is formula (b):

$$Q_R = Q_F \times \frac{h_r^{0.54}}{h_f^{0.54}} \qquad (b)$$

Q_R = flow predicted at desired residual pressure
Q_F = total flow measured during test
h_r = pressure drop to desired residual pressure
h_f = pressure drop measured during test

In this equation, any units of discharge or pressure drop may be used as long as the same units are used for each value of the same variable. In other words, if Q_R is expressed in gpm, Q_F must be in gpm, and if h_r is expressed in psi, h_f must be expressed in psi. These are the units which are normally used in applying formula (b) to fire flow test computations.

1-13.2 Discharge Calculations from Table. One means of solving this equation without the use of logarithms is by using Table 1-13.2. This table gives the values of the 0.54 power of the numbers from 1 to 175. Knowing the values of h_f, h_r, and Q_F, the values of $h_f^{0.54}$ and $h_r^{0.54}$ can be read from the table and formula (b) solved for Q_R. Results are usually carried to the nearest 100 gpm (380 L/min) for discharges of 1000 gpm (3800 L/min) or more, and to the nearest 50 gpm (190 L/min) for smaller discharges, which is as close as can be justified by the degree of accuracy of the field observations.

Table 1-13.1 Theoretical Discharge Through Circular Orifices (United States Gallons of Water per Minute)

(See Notes)

Velocity Head psi	Feet*	Velocity of Discharge fps	Diameter of Orifice in Inches									Velocity Head psi
			2	2½	2½	2¾	3	4	4½	5	6	
1	2.31	12.15	119	151	186	226	268	477	604	746	1074	1
2	4.61	17.26	169	214	264	319	380	675	854	1055	1519	2
3	6.92	21.14	207	262	323	391	465	827	1046	1292	1860	3
4	9.23	24.41	239	302	373	451	537	955	1208	1492	2148	4
5	11.54	27.27	267	338	417	504	600	1067	1351	1668	2401	5
6	13.84	29.82	292	370	457	553	658	1169	1480	1827	2630	6
7	16.15	32.27	316	400	493	597	710	1263	1598	1973	2841	7
8	18.46	34.42	337	427	527	638	759	1350	1709	2109	3037	8
9	20.76	36.56	358	453	559	677	805	1432	1812	2237	3222	9
10	23.07	38.50	377	478	590	713	849	1509	1910	2358	3396	10
11	25.38	40.44	396	501	618	748	890	1583	2003	2473	3562	11
12	27.68	42.18	413	523	646	781	930	1653	2093	2583	3720	12
13	29.99	43.91	430	544	672	813	968	1721	2178	2689	3872	13
14	32.30	45.55	446	565	698	844	1005	1786	2260	2790	4018	14
15	34.61	47.18	462	585	722	874	1040	1848	2340	2888	4159	15
16	36.91	48.71	477	604	746	902	1074	1909	2416	2983	4296	16
17	39.22	50.25	492	623	769	930	1107	1968	2491	3075	4428	17
18	41.53	51.68	506	641	791	957	1139	2025	2562	3164	4556	18
19	43.83	53.10	520	658	813	983	1170	2080	2633	3251	4681	19
20	46.14	54.53	534	675	834	1009	1201	2134	2701	3335	4803	20
22	50.75	57.19	560	708	874	1058	1259	2239	2833	3497	5037	22
24	55.37	59.74	585	740	913	1105	1315	2338	2959	3653	5261	24
26	59.98	62.09	608	770	951	1150	1369	2434	3080	3802	5476	26
28	64.60	64.44	631	799	987	1194	1421	2526	3196	3946	5682	28
30	69.21	66.79	654	827	1021	1236	1470	2614	3309	4085	5882	30
32	73.82	68.93	675	854	1055	1276	1519	2700	3417	4218	6075	32
34	78.44	71.08	696	882	1087	1315	1565	2783	3522	4348	6262	34
36	83.05	73.12	716	906	1119	1354	1611	2864	3624	4475	6443	36
38	87.67	75.16	736	931	1149	1391	1655	2942	3724	4597	6620	38
40	92.28	77.10	755	955	1179	1427	1698	3019	3820	4716	6792	40
42	96.89	78.94	773	979	1209	1462	1740	3093	3915	4833	6960	42
44	101.51	80.78	791	1002	1237	1496	1781	3166	4007	4947	7123	44
46	106.12	82.62	809	1024	1264	1530	1820	3237	4097	5058	7283	46
48	110.74	84.46	827	1046	1292	1563	1860	3307	4185	5167	7440	48
50	115.35	86.19	844	1068	1318	1595	1898	3375	4271	5273	7593	50
52	119.98	87.83	860	1089	1344	1627	1936	3442	4356	5378	7744	52
54	124.58	89.56	877	1110	1370	1658	1973	3507	4439	5480	7891	54
56	129.19	91.20	893	1130	1395	1688	2009	3572	4520	5581	8036	56
58	133.81	92.83	909	1150	1420	1718	2045	3635	4600	5679	8178	58
60	138.42	94.36	924	1170	1444	1747	2080	3697	4679	5776	8318	60
62	143.03	96.00	940	1189	1468	1776	2114	3758	4756	5872	8456	62
64	147.65	97.53	955	1208	1491	1805	2148	3818	4832	5966	8591	64
66	152.26	98.96	969	1227	1515	1833	2181	3877	4907	6059	8724	66
68	156.88	100.49	984	1245	1537	1860	2214	3936	4981	6150	8855	68
70	161.49	101.92	998	1263	1560	1887	2246	3993	5054	6239	8985	70
72	166.10	103.35	1012	1281	1582	1914	2278	4050	5126	6327	9112	72
74	170.72	104.78	1026	1299	1604	1941	2309	4106	5196	6415	9238	74
76	175.33	106.21	1040	1317	1625	1967	2340	4161	5266	6501	9362	76
78	179.95	107.64	1054	1334	1647	1992	2371	4215	5335	6586	9484	78
80	184.56	108.97	1067	1351	1668	2018	2401	4269	5403	6670	9605	80
82	189.17	110.30	1080	1367	1688	2043	2431	4322	5470	6753	9724	82
84	193.79	111.72	1094	1384	1708	2068	2461	4374	5536	6835	9842	84
86	198.40	112.95	1106	1400	1729	2092	2490	4426	5602	6916	9959	86
88	203.02	114.28	1119	1417	1749	2116	2518	4477	5667	6996	10074	88
90	207.63	115.61	1132	1433	1769	2140	2547	4528	5731	7075	10188	90
92	212.24	116.83	1144	1448	1788	2164	2575	4578	5794	7153	10300	92
94	216.86	118.16	1157	1464	1808	2187	2603	4627	5856	7230	10411	94
96	221.47	119.38	1169	1480	1827	2210	2630	4676	5919	7307	10521	96
98	226.09	120.61	1181	1495	1846	2233	2658	4725	5980	7383	10630	98
100	230.70	121.84	1193	1510	1864	2256	2685	4773	6041	7458	10739	100
102	235.31	123.08	1205	1525	1883	2278	2711	4820	6101	7532	10846	102
104	239.93	124.29	1217	1540	1901	2301	2738	4867	6160	7605	10951	104
106	244.54	125.41	1228	1555	1919	2323	2764	4914	6219	7678	11056	106
108	249.16	126.64	1240	1569	1938	2344	2790	4960	6278	7750	11160	108
110	253.77	127.76	1251	1584	1955	2366	2816	5006	6335	7821	11263	110
112	258.38	128.98	1263	1598	1973	2387	2841	5051	6393	7892	11365	112
114	263.00	130.11	1274	1612	1991	2409	2866	5096	6450	7962	11466	114
116	267.61	131.23	1285	1626	2008	2430	2892	5140	6506	8032	11566	116
118	272.23	132.35	1296	1640	2025	2451	2916	5184	6562	8101	11665	118
120	276.84	133.48	1307	1654	2042	2471	2941	5228	6617	8169	11764	120
122	281.45	134.60	1318	1668	2059	2492	2965	5272	6672	8237	11861	122
124	286.07	135.72	1329	1681	2076	2512	2990	5315	6726	8304	11958	124
126	290.68	136.75	1339	1695	2093	2532	3014	5357	6781	8371	12054	126
128	295.30	137.87	1350	1709	2109	2552	3037	5400	6834	8437	12150	128
130	299.91	138.89	1360	1722	2126	2572	3061	5442	6887	8503	12244	130
132	304.52	140.01	1371	1735	2142	2592	3084	5484	6940	8568	12338	132
134	309.14	141.03	1381	1748	2158	2611	3108	5525	6992	8633	12431	134
136	313.75	142.08	1391	1761	2174	2631	3131	5565	7044	8697	12523	136

* 1 psi = 2.307 ft of water.

Notes to Table 1-13.1

This table is computed from the formula $Q = 29.83cd^2\sqrt{p}$ with $c = 1.00$. The theoretical discharge of sea water, as from fireboat nozzles, may be found by subtracting 1 percent from the figures in the following table, or from the formula $Q = 29.83cd^2\sqrt{p}$.

Appropriate coefficient should be applied where it is read from hydrant outlet. Where more accurate results are required, a coefficient appropriate on the particular nozzle must be selected and applied to the figures of the table.

The discharge from circular openings of sizes other than those in the table may readily be computed by applying the principle that quantity discharged under a given head varies as the square of the diameter of the opening.

Table 1-13.2 Values of "h" to the 0.54 Power

h	$h^{0.54}$	h	$h^{0.54}$	h	$h^{0.54}$	h	$h^{0.54}$	h	$h^{0.54}$
1	1.00	36	6.93	71	9.99	106	12.41	141	14.47
2	1.45	37	7.03	72	10.07	107	12.47	142	14.53
3	1.81	38	7.13	73	10.14	108	12.53	143	14.58
4	2.11	39	7.23	74	10.22	109	12.60	144	14.64
5	2.39	40	7.33	75	10.29	110	12.66	145	14.69
6	2.63	41	7.43	76	10.37	111	12.72	146	14.75
7	2.86	42	7.53	77	10.44	112	12.78	147	14.80
8	3.07	43	7.62	78	10.51	113	12.84	148	14.86
9	3.28	44	7.72	79	10.59	114	12.90	149	14.91
10	3.47	45	7.81	80	10.66	115	12.96	150	14.97
11	3.65	46	7.91	81	10.73	116	13.03	151	15.02
12	3.83	47	8.00	82	10.80	117	13.09	152	15.07
13	4.00	48	8.09	83	10.87	118	13.15	153	15.13
14	4.16	49	8.18	84	10.94	119	13.21	154	15.18
15	4.32	50	8.27	85	11.01	120	13.27	155	15.23
16	4.48	51	8.36	86	11.08	121	13.33	156	15.29
17	4.62	52	8.44	87	11.15	122	13.39	157	15.34
18	4.76	53	8.53	88	11.22	123	13.44	158	15.39
19	4.90	54	8.62	89	11.29	124	13.50	159	15.44
20	5.04	55	8.71	90	11.36	125	13.56	160	15.50
21	5.18	56	8.79	91	11.43	126	13.62	161	15.55
22	5.31	57	8.88	92	11.49	127	13.68	162	15.60
23	5.44	58	8.96	93	11.56	128	13.74	163	15.65
24	5.56	59	9.04	94	11.63	129	13.80	164	15.70
25	5.69	60	9.12	95	11.69	130	13.85	165	15.76
26	5.81	61	9.21	96	11.76	131	13.91	166	15.81
27	5.93	62	9.29	97	11.83	132	13.97	167	15.86
28	6.05	63	9.37	98	11.89	133	14.02	168	15.91
29	6.16	64	9.45	99	11.96	134	14.08	169	15.96
30	6.28	65	9.53	100	12.02	135	14.14	170	16.01
31	6.39	66	9.61	101	12.09	136	14.19	171	16.06
32	6.50	67	9.69	102	12.15	137	14.25	172	16.11
33	6.61	68	9.76	103	12.22	138	14.31	173	16.16
34	6.71	69	9.84	104	12.28	139	14.36	174	16.21
35	6.82	70	9.92	105	12.34	140	14.42	175	16.26

Method of Use

Insert in formula (b) the values of $h_r^{0.54}$ and $h_f^{0.54}$ determined from the table and the value of Q_F, and solve the equation of Q_R.

1-14 System Corrections. It must be remembered that flow test results show the strength of the distribution system and do not necessarily indicate the degree of adequacy of the entire water works system. Consider a system supplied by pumps at one location and having no elevated storage. If the pressure at the pump station drops during the test, it is an indication that the distribution system is capable of delivering more than the pumps can deliver at their normal operating pressure. It is necessary to use a value for the drop in pressure for the test which is equal to the actual drop obtained in the field during the test, minus the drop in discharge pressure at the pumping station. If sufficient pumping capacity is available at the station and the discharge pressure could be maintained by operating additional pumps, the water system as a whole could deliver the computed quantity. If, however, additional pumping units are not available, the distribution system would be capable of delivering the computed quantity, but the water system as a whole would be limited by the pumping capacity. The portion of the pressure drop for which a correction can be made for tests on systems with storage is generally estimated upon the basis of a study of all the tests made and the pressure drops observed on the recording gage at the station for each. The corrections may vary from very substantial portions of the observed pressure drops for tests near the pumping station, to zero for tests remote from the station.

Chapter 2 Marking of Hydrants

2-1 Classification of Hydrants. Hydrants should be classified in accordance with their rated capacities (at 20 psi (1.4 bar) residual pressure or other designated value) as follows:

Class AA — Rated capacity of 1500 gpm or greater (5680 L/min)

Class A — Rated capacity of 1000-1499 gpm (3785-5675 L/min)

Class B — Rated capacity of 500-999 gpm (1900-3780 L/min)

Class C — Rated capacity of less than 500 gpm (1900 L/min)

2-2 Marking of Hydrants.

2-2.1 Public Hydrants. All barrels are to be chrome yellow except in cases where another color has already been adopted. The tops and nozzle caps should be painted with the following capacity-indicating color scheme to provide simplicity and consistency with colors used in signal work for safety, danger, and intermediate condition:

Class AA — Light blue

Class A — Green

Class B — Orange

Class C — Red

For rapid identification at night, it is recommended that the capacity colors be of a reflective-type paint.

Hydrants rated at less than 20 psi (1.4 bar) should have the rated pressure stenciled in black on the hydrant top.

In addition to the painted top and nozzle caps, it may be advantageous to stencil the rated capacity of high volume hydrants on the top.

The classification and marking of hydrants provided for in this chapter anticipate determination based on individual flow test. Where a group of hydrants may be used at time of fire, some special marking designating group flow capacity may be desirable.

2-2.2 Flush Hydrants. Location markers for flush hydrants should carry the same color background as stated above for class indication, with such other data stenciled thereon as may be deemed necessary.

2-2.3 Private Hydrants. Marking on private hydrants within private enclosures is to be at the owner's discretion. When private hydrants are located on public streets, they should be painted red or some other color to distinguish them from public hydrants.

Index

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Contact NFPA Standards Administration for final date for receipt of proposals on a specific document.

INSTRUCTIONS

Please use the forms which follow for submitting proposed amendments. Use a separate form for each proposal.

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   (a) The number and title of the document
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2. Check the box indicating whether or not this proposal recommends new text, revised text, or to delete text.

3. In the space identified as "Proposal" include the wording you propose as new or revised text, or indicate if you wish to delete text.

4. In the space titled "Statement of Problem and Substantiation for Proposal" state the problem which will be resolved by your recommendation and give the specific reason for your proposal including copies of tests, research papers, fire experience, etc. If a statement is more than 200 words in length, the technical committee is authorized to abstract it for the Technical Committee Report.

5. Check the box indicating whether or not this proposal is original material, and if it is not, indicate source.

6. If supplementary material (photographs, diagrams, reports, etc.) is included, you may be required to submit sufficient copies for all members and alternates of the technical committee.

NOTE: The NFPA Regulations Governing Committee Projects in Paragraph 10-10 state: Each proposal shall be submitted to the Council Secretary and shall include:

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Date 5/18/85 Name John B. Smith Tel. No. 617-555-1212

Address 9 Seattle St.. Seattle, WA 02255

Representing (Please indicate organization, company or self) Fire Marshals Assn. of North America

1. a) Document Title: Protective Signaling Systems NFPA No. & Year NFPA 72D

b) Section/Paragraph: 2-7.1 (Exception)

2. Proposal recommends: (Check one) ☐ new text
☐ revised text
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3. Proposal (include proposed new or revised wording, or identification of wording to be deleted):

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4. Statement of Problem and Substantiation for Proposal:

A properly installed and maintained system should be free of ground faults. The occurrence of one or more ground faults should be required to cause a "trouble" signal because it indicates a condition that could contribute to future malfunction of the system. Ground fault protection has been widely available on these systems for years and its cost is negligible. Requiring it on all systems will promote better installations, maintenance and reliability.

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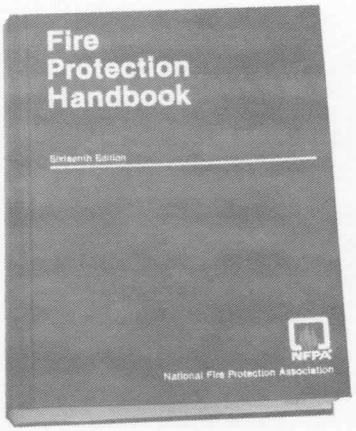

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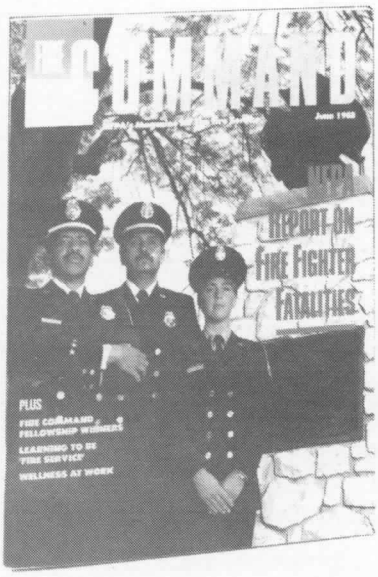

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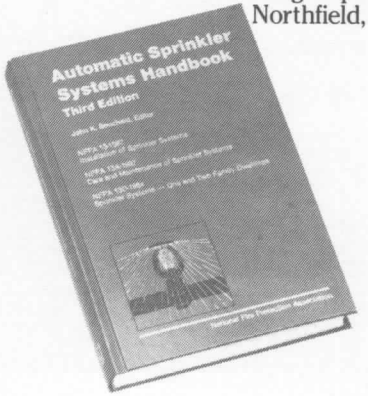

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