

Annex A (informative)

Sizing and capacities of piping and tubing for natural gas

Note: This informative annex has been written in mandatory language to facilitate adoption where users of the Code or regulatory authorities wish to adopt it formally as additional requirements to this Code.

A.1 General

In order to determine the size of piping or tubing to be used in designing a gas piping system, the following factors shall be considered:

- a) allowable loss in pressure from point of delivery to equipment;
- b) maximum gas demand;
- c) length of piping and number of fittings;
- d) relative density of the gas; and
- e) diversity factor.

A.2 Description of tables

A.2.1 Outlet capacity

The total energy to be provided at each outlet should be determined directly from the manufacturer's Btu/h (kW) input rating of the equipment to be installed.

A.2.2 Natural gas quality

The tables listed in this annex assume that a gas having a calorific value of 1000 Btu/ft³ (38 MJ/m³) and a relative density of 0.6 for natural gas will be used.

A.2.3 Table applicability

Capacities for gas in Btu/h (kW) for different sizes and lengths are shown in Tables A.1 to A.7 for iron pipe or equivalent rigid pipe and in Tables A.8 to A.14 for tubing.

A.2.4 Fitting allowance

The formula used to derive Tables A.1 to A.4 and A.8 to A.11 contains a factor ($F = 1.2$), which is used to multiply the piping or tubing length, to allow for a reasonable number of fittings. Tables A.5 to A.7 and A.12 to A.14 do not contain a fitting allowance ($F = 1$), and Table A.16 should be utilized to determine equivalent lengths of fittings.

A.2.5 Tubing type

Tables A.8 to A.14 covering tubing are based on Type K tubing. Type K was selected since it has a smaller inside diameter than Types G and L.

A.2.6 Relative density

The application of the multipliers in Table A.15 converts the capacities given in Tables A.1 to A.14 to capacities with another gas of different relative density. Such application is accomplished by multiplying the capacities given in Tables A.1 to A.14 by the multipliers shown in Table A.15. If the exact relative density does not appear in the table, the next higher value of relative density shown shall be chosen.

A.3 Use of capacity tables

A.3.1 Size determination

To determine the size of each section of piping or tubing in a system within the range of the capacity tables, the procedure outlined in Clauses A.3.2 to A.3.9 shall be followed.

A.3.2 Demand determination

The gas demand of each appliance to be attached to the piping or tubing system shall be determined. The gas demand in terms of Btu/h (kW) for each piping system outlet shall be calculated.

A.3.3 Pressure determination

The design system pressure, the allowable loss in pressure (pressure drop), and the relative density of the gas to be used in the piping or tubing system shall be determined.

A.3.4 Length determination

The length of piping or tubing from the point of delivery to the most remote outlet in the building shall be measured.

A.3.5 Formulae

In the appropriate capacity table, the row showing the measured length, or the next larger length if the table does not give the exact length shall be selected. This is the only length used in determining the size of any section of piping or tubing. If the relative density factor is to be applied, the values in the selected column of the table shall be multiplied by the appropriate multiplier from Table A.15.

Capacities may also be determined by using the following formulas, which were used to generate the tables*:

for high pressure [1.5 psig (10.3 kPa) and above]:

$$Q = \left(K_1 \right) D^{2.623} \left[\frac{(P_1^2 - P_2^2) Y}{Cr \times L \times F} \right]^{0.541} (b \times z)$$

for low pressure [less than 1.5 psig (10.3 kPa)]:

$$Q = \left(K_2 \right) D^{2.623} \left[\frac{\Delta H}{Cr \times L \times F} \right]^{0.541} (b \times z)$$

where

Q = rate, Btu/h (kW) at 60 °F (15.6 °C) and 30 in Hg (101.3 kPa)

K_1 = 2237 for imperial measurements

= 0.3576 for SI (metric) measurements

D = inside diameter of pipe, in (cm)

P_1 = upstream pressure, absolute, psi (kPa)

P_2 = downstream pressure, absolute, psi (kPa)

Y = superexpansibility factor†

= 1/supercompressibility factor

= 1 for intents and purposes

- b = calorific value of the gas, Btu/ft³ (MJ/m³)
 z = factor to convert MJ/h to kW
 = 1 for imperial measurements
 = 0.2778 for SI (metric) measurements
 Cr = factor for viscosity, density, and temperature
 = $K_3ST \left[\frac{z}{s} \right]^{0.152}$
 = 0.6094 for natural gas
 where
 K_3 = 0.00354 for imperial measurements
 = 0.00638 for SI (metric) measurements
 S = relative density of gas at 60 °F (15.6 °C) and 30 in Hg (101.3 kPa), (natural gas = 0.6)
 T = absolute temperature, °R = °F + 460 (imperial)
 = absolute temperature, K = °C + 273 (metric)
 Z = viscosity of gas, centipoise (0.012 for natural gas)

Legend:

- L = length of pipe, ft (m)
 F = fitting allowance factor
 = 1.2 for Tables A.1 to A.4 and A.8 to A.11
 = 1 for Tables A.5 to A.7 and A.12 to A.14
 K_2 = 2313 for imperial measurements
 = 0.1509 for SI (metric) measurements

ΔH = pressure drop, in w.c. (Pa)

* For further details on the formulas, refer to B.C. Shebeko, *Polyflo Flow Computer*, 1974, available from Polyflo Computer Company, Box 50126, Dallas, Texas 75250, USA.

† For values for natural gas, refer to *Manual for Determination of Supercompressibility Factors for Natural Gas*, available from the American Gas Association, 1515 Wilson Boulevard, Arlington, Virginia 22209, USA.

For values for liquefied petroleum gases, refer to *Engineering Data Book*, available from Gas Processors Association.

A.3.6 Row choice

The horizontal row specified in Clause A.3.5 shall be used to locate all gas demand figures for this particular system of piping.

A.3.7 Column choice

Starting at the most remote outlet, in the horizontal row selected in accordance with Clause A.3.6, the gas demand for that outlet shall be located. If the exact figure of demand is not shown, the next larger figure to the right in the row shall be chosen.

A.3.8 Correct size

In the top row above this demand figure, the correct size of gas piping will be found.

A.3.9 Repeat

Proceed in a similar manner for each outlet and each section of gas piping. For each section of piping, the total gas demand supplied by that section shall be determined.

A.4 Bends, fittings, and valves expressed in equivalent lengths in feet of straight pipe

The equivalent lengths in feet shown in Table A.16* have been computed on the basis that the inside diameter corresponds to that of Schedule 40 (standard-weight) steel pipe, which is close enough for most purposes to that of other schedules of pipe. Where a more specific equivalent length is desired, this may be computed by multiplying the actual inside diameter of the pipe in inches by $n/12$, or the actual inside diameter in feet by “ n ” (“ n ” is a heading in Table A.16). The equivalent length values can be used with reasonable accuracy for copper or brass fittings and bends. For copper or brass valves, however, the equivalent length of pipe should be taken as 45% longer than the values in Table A.16, which are for steel pipe. Resistance per foot of copper or brass pipe is less than that of steel.

* From Crocker (1945), Table XIV, pp. 100–101. Used by permission of McGraw-Hill Book Company.

Table A.1 a)
Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe, including fittings, for pressures of less than 7 in w.c. based on a pressure drop of 0.5 in w.c.
 (See Clauses 6.3.2, A.2.3, A.2.4, A.2.6, A.3.5, E.1.3, and E.2.3.)

Pipe size (NPS)									
Length of pipe, ft	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
10	156	326	614	1 261	1 890	3 639	5 800	10 253	20 914
20	107	224	422	867	1 299	2 501	3 986	7 047	14 374
30	86	180	339	696	1 043	2 008	3 201	5 659	11 543
40	74	154	290	596	893	1 719	2 740	4 843	9 879
50	65	137	257	528	791	1 524	2 428	4 293	8 756
60	59	124	233	478	717	1 380	2 200	3 889	7 933
70	54	114	214	440	659	1 270	2 024	3 578	7 299
80	51	106	199	409	613	1 181	1 883	3 329	6 790
90	48	99	187	384	576	1 109	1 767	3 123	6 371
100	45	94	177	363	544	1 047	1 669	2 950	6 018
125	40	83	157	322	482	928	1 479	2 615	5 333
150	36	75	142	291	437	841	1 340	2 369	4 832
175	33	69	131	268	402	774	1 233	2 180	4 446
200	31	64	121	249	374	720	1 147	2 028	4 136
250	27	57	108	221	331	638	1 017	1 797	3 666
300	25	52	98	200	300	578	921	1 628	3 321
350	23	48	90	184	276	532	847	1 498	3 056
400	21	44	83	171	257	495	788	1 394	2 843
450	20	42	78	161	241	464	740	1 308	2 667
500	19	39	74	152	228	438	699	1 235	2 519

(Continued)

Table A.1 a) (Continued)

Length of pipe, ft	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
600	17	36	67	138	206	397	633	1 119	2 283
700	16	33	62	127	190	365	582	1 030	2 100
800	15	30	57	118	177	340	542	958	1 954
900	14	29	54	111	166	319	508	899	1 833
1 000	13	27	51	104	156	301	480	849	1 732
1 200	12	24	46	95	142	273	435	769	1 569
1 400	11	23	42	87	130	251	400	708	1 443
1 600	10	21	39	81	121	234	372	658	1 343
1 800	9	20	37	76	114	219	349	618	1 260
2 000	9	19	35	72	108	207	330	583	1 190

Table A.1 b)
Maximum capacity of natural gas in kW for Schedule 40 pipe and plastic pipe, including fittings, for pressures of less than 1.75 kPa based on a pressure drop of 125 Pa

Length of pipe, m	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3
3	46	97	182	374	560	1078	1718	3038
6	32	66	125	257	385	741	1181	2088
9	25	53	100	206	309	595	948	1677
12	22	46	86	176	264	509	812	1435
15	19	40	76	156	234	451	719	1272
18	18	37	69	142	212	409	652	1152
21	16	34	64	130	195	376	600	1060
24	15	31	59	121	182	350	558	986
27	14	29	55	114	171	328	523	925
30	13	28	52	108	161	310	494	874
35	12	26	48	99	148	285	455	804
40	11	24	45	92	138	266	423	748
45	11	22	42	86	129	249	397	702
50	10	21	40	82	122	235	375	663
60	9	19	36	74	111	213	340	601
70	8	18	33	68	102	196	313	553
80	8	16	31	63	95	182	291	514
90	7	15	29	59	89	171	273	482
100	7	14	27	56	84	162	258	456
125	6	13	24	50	74	143	228	404

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Table A.1 b) (Continued)

Length of pipe, m	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
150	6	12	22	45	67	130	207	366	746
175	5	11	20	41	62	119	190	337	687
200	5	10	19	39	58	111	177	313	639
250	4	9	17	34	51	99	157	278	566
300	4	8	15	31	46	89	142	252	513
350	4	7	14	28	43	82	131	231	472
400	3	7	13	26	40	76	122	215	439
500	3	6	11	23	35	68	108	191	389
600	3	5	10	21	32	61	98	173	353

Table A.2 a)
Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe, including fittings, for pressures of 7 in w.c. up to 14 in w.c. based on a pressure drop of 1 in w.c.
 (See Clauses 6.3.2, 6.3.4, A.2.3, A.2.4, A.2.6, A.3.5, E.1.2, and E.2.2.)

Length of pipe, ft	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
10	227	474	894	1 835	2 749	5 295	8 439	14 919	30 429
20	156	326	614	1 261	1 890	3 639	5 800	10 253	20 914
30	125	262	493	1 013	1 517	2 922	4 658	8 234	16 795
40	107	224	422	867	1 299	2 501	3 986	7 047	14 374
50	95	199	374	768	1 151	2 217	3 533	6 246	12 739
60	86	180	339	696	1 043	2 008	3 201	5 659	11 543
70	79	166	312	640	959	1 848	2 945	5 206	10 619
80	74	154	290	596	893	1 719	2 740	4 843	9 879
90	69	145	272	559	837	1 613	2 571	4 544	9 269
100	65	137	257	528	791	1 524	2 428	4 293	8 756
125	58	121	228	468	701	1 350	2 152	3 805	7 760
150	52	110	207	424	635	1 223	1 950	3 447	7 031
175	48	101	190	390	584	1 126	1 794	3 171	6 469
200	45	94	177	363	544	1 047	1 669	2 950	6 018
250	40	83	157	322	482	928	1 479	2 615	5 333
300	36	75	142	291	437	841	1 340	2 369	4 832
350	33	69	131	268	402	774	1 233	2 180	4 446
400	31	64	121	249	374	720	1 147	2 028	4 136
450	29	61	114	234	351	675	1 076	1 903	3 881
500	27	57	108	221	331	638	1 017	1 797	3 666

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Table A.2 a) (Continued)

Length of pipe, ft	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
600	25	52	98	200	300	578	921	1 628	3 321
700	23	48	90	184	276	532	847	1 498	3 056
800	21	44	83	171	257	495	788	1 394	2 843
900	20	42	78	161	241	464	740	1 308	2 667
1 000	19	39	74	152	228	438	699	1 235	2 519
1 200	17	36	67	138	206	397	633	1 119	2 283
1 400	16	33	62	127	190	365	582	1 030	2 100
1 600	15	30	57	118	177	340	542	958	1 954
1 800	14	29	54	111	166	319	508	899	1 833
2 000	13	27	51	104	156	301	480	849	1 732

Table A.2 b)
Maximum capacity of natural gas in kW for Schedule 40 pipe and plastic pipe, including fittings, for pressures of 1.75 kPa up to 3.50 kPa based on a pressure drop of 250 Pa

Length of pipe, m	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
3	67	141	265	544	815	1569	2500	4420	9015
6	46	97	182	374	560	1078	1718	3038	6196
9	37	78	146	300	450	866	1380	2439	4976
12	32	66	125	257	385	741	1181	2088	4259
15	28	59	111	228	341	657	1047	1850	3774
18	25	53	100	206	309	595	948	1677	3420
21	23	49	92	190	284	547	873	1542	3146
24	22	46	86	176	264	509	812	1435	2927
27	20	43	81	166	248	478	762	1346	2746
30	19	40	76	156	234	451	719	1272	2594
35	18	37	70	144	216	415	662	1170	2386
40	17	35	65	134	201	386	616	1088	2220
45	16	32	61	126	188	362	578	1021	2083
50	15	31	58	119	178	342	546	965	1968
60	13	28	52	108	161	310	494	874	1783
70	12	26	48	99	148	285	455	804	1640
80	11	24	45	92	138	266	423	748	1526
90	11	22	42	86	129	249	397	702	1432
100	10	21	40	82	122	235	375	663	1352
125	9	19	35	72	108	209	332	588	1199

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Table A.2 b) (Continued)

Length of pipe, m	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	4
150	8	17	32	65	98	189	301	1086
175	7	16	29	60	90	174	277	999
200	7	14	27	56	84	162	258	929
250	6	13	24	50	74	143	228	824
300	6	12	22	45	67	130	207	746
350	5	11	20	41	62	119	190	687
400	5	10	19	39	58	111	177	639
500	4	9	17	34	51	99	157	566
600	4	8	15	31	46	89	142	513

Table A.3 a)
Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe, including fittings, for pressures of 2 psig based on a pressure drop of 1 psig
 (See Clauses 6.3.4, A.2.3, A.2.4, A.2.6, A.3.5, E.1.3, and E.2.3.)

Length of pipe, ft	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	4
10	1 440	3 012	5 673	11 648	17 452	33 610	53 570	94 701
20	990	2 070	3 899	8 005	11 994	23 100	36 818	65 088
30	795	1 662	3 131	6 429	9 632	18 550	29 566	52 268
40	680	1 423	2 680	5 502	8 244	15 877	25 305	44 734
50	603	1 261	2 375	4 876	7 306	14 071	22 427	39 647
60	546	1 142	2 152	4 418	6 620	12 749	20 321	35 923
70	503	1 051	1 980	4 065	6 090	11 729	18 695	33 049
80	468	978	1 842	3 782	5 666	10 912	17 392	30 746
90	439	917	1 728	3 548	5 316	10 238	16 318	28 848
100	414	867	1 632	3 351	5 022	9 671	15 414	27 249
125	367	768	1 447	2 970	4 451	8 571	13 661	24 151
150	333	696	1 311	2 691	4 032	7 766	12 378	21 882
175	306	640	1 206	2 476	3 710	7 145	11 388	20 131
200	285	596	1 122	2 303	3 451	6 647	10 594	18 728
250	252	528	994	2 042	3 059	5 891	9 389	16 599
300	229	478	901	1 850	2 772	5 338	8 507	15 040
350	210	440	829	1 702	2 550	4 911	7 827	13 836
400	196	409	771	1 583	2 372	4 568	7 281	12 872
450	184	384	724	1 485	2 226	4 286	6 832	12 077
500	174	363	683	1 403	2 102	4 049	6 453	11 408

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Table A.3 a) (Continued)

Length of pipe, ft	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	4
600	157	329	619	1 271	1 905	3 669	5 847	21 083
700	145	302	570	1 170	1 752	3 375	5 379	19 396
800	135	281	530	1 088	1 630	3 140	5 004	18 045
900	126	264	497	1 021	1 530	2 946	4 695	16 931
1 000	119	249	470	964	1 445	2 783	4 435	15 993
1 200	108	226	426	874	1 309	2 521	4 019	14 490
1 400	99	208	392	804	1 204	2 320	3 697	13 331
1 600	92	193	364	748	1 120	2 158	3 439	12 402
1 800	87	181	342	702	1 051	2 025	3 227	11 636
2 000	82	171	323	663	993	1 913	3 048	10 992

Table A.3 b)
Maximum capacity of natural gas in kW for Schedule 40 pipe and plastic pipe, including fittings, for pressures of 14 kPa based on a pressure drop of 7 kPa

Length of pipe, m	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	4
3	430	899	1 693	3 475	5 207	10 028	15 983	57 632
6	295	618	1 163	2 388	3 579	6 892	10 985	39 610
9	237	496	934	1 918	2 874	5 535	8 821	31 808
12	203	424	800	1 642	2 460	4 737	7 550	27 224
15	180	376	709	1 455	2 180	4 198	6 691	24 128
18	163	341	642	1 318	1 975	3 804	6 063	21 862
21	150	314	591	1 213	1 817	3 500	5 578	20 112
24	140	292	550	1 128	1 690	3 256	5 189	18 711
27	131	274	516	1 059	1 586	3 055	4 869	17 556
30	124	259	487	1 000	1 498	2 885	4 599	16 583
35	114	238	448	920	1 378	2 655	4 231	15 256
40	106	221	417	856	1 282	2 470	3 936	14 193
45	99	208	391	803	1 203	2 317	3 693	13 317
50	94	196	369	759	1 136	2 189	3 489	12 579
60	85	178	335	687	1 030	1 983	3 161	11 397
70	78	163	308	632	947	1 824	2 908	10 485
80	73	152	286	588	881	1 697	2 705	9 755
90	68	143	269	552	827	1 593	2 538	9 152
100	64	135	254	521	781	1 504	2 398	8 645
125	57	119	225	462	692	1 333	2 125	7 662

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Table A.3 b) (Continued)

Length of pipe, m	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	4
150	52	108	204	419	627	1 208	1 925	6 943
175	48	100	188	385	577	1 111	1 771	6 387
200	44	93	175	358	537	1 034	1 648	5 942
250	39	82	155	318	476	916	1 460	5 266
300	36	74	140	288	431	830	1 323	4 772
350	33	68	129	265	397	764	1 217	4 390
400	30	64	120	246	369	711	1 133	4 084
500	27	56	106	218	327	630	1 004	3 619
600	24	51	96	198	296	571	910	3 279

Table A.4 a)
Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe, including fittings, for
pressures of 2 psig based on a pressure drop of 1.5 psig
 (See Clauses 6.3.4, A.2.3, A.2.4, A.2.6, and A.3.5.)

Length of pipe, ft	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	4
10	1 779	3 719	7 006	14 383	21 550	41 503	66 150	116 941
20	1 222	2 556	4 815	9 885	14 811	28 525	45 464	80 373
30	982	2 053	3 866	7 938	11 894	22 907	36 509	64 542
40	840	1 757	3 309	6 794	10 180	19 605	31 247	55 240
50	745	1 557	2 933	6 022	9 022	17 376	27 694	48 958
60	675	1 411	2 657	5 456	8 175	15 744	25 093	44 360
70	621	1 298	2 445	5 019	7 521	14 484	23 085	40 810
80	577	1 207	2 274	4 670	6 996	13 474	21 476	37 966
90	542	1 133	2 134	4 381	6 565	12 643	20 150	35 622
100	512	1 070	2 016	4 139	6 201	11 942	19 034	33 649
125	454	948	1 787	3 668	5 496	10 584	16 869	29 822
150	411	859	1 619	3 323	4 979	9 590	15 285	27 021
175	378	791	1 489	3 057	4 581	8 823	14 062	24 859
200	352	735	1 385	2 844	4 262	8 208	13 082	23 126
250	312	652	1 228	2 521	3 777	7 274	11 594	20 497
300	282	591	1 113	2 284	3 422	6 591	10 505	18 571
350	260	543	1 024	2 101	3 149	6 064	9 665	17 085
400	242	505	952	1 955	2 929	5 641	8 991	15 895
450	227	474	893	1 834	2 748	5 293	8 436	14 913
500	214	448	844	1 733	2 596	5 000	7 969	14 087

(Continued)

Table A.4 a) (Continued)

Length of pipe, ft	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
600	194	406	765	1 570	2 352	4 530	7 220	12 764	26 034
700	179	373	703	1 444	2 164	4 168	6 642	11 743	23 951
800	166	347	654	1 344	2 013	3 877	6 180	10 924	22 282
900	156	326	614	1 261	1 889	3 638	5 798	10 250	20 907
1 000	147	308	580	1 191	1 784	3 436	5 477	9 682	19 748
1 200	133	279	526	1 079	1 617	3 113	4 962	8 773	17 893
1 400	123	257	483	993	1 487	2 864	4 565	8 071	16 462
1 600	114	239	450	923	1 384	2 665	4 247	7 508	15 314
1 800	107	224	422	866	1 298	2 500	3 985	7 045	14 369
2 000	101	212	399	818	1 226	2 362	3 764	6 654	13 573

Table A.4 b)
Maximum capacity of natural gas in kW for Schedule 40 pipe and plastic pipe, including fittings, for pressures of 14 kPa based on a pressure drop of 10 kPa

Pipe size (NPS)									
Length of pipe, m	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
3	517	1 082	2 038	4 184	6 269	12 074	19 244	34 020	69 389
6	356	744	1 401	2 876	4 309	8 298	13 226	23 381	47 691
9	286	597	1 125	2 309	3 460	6 664	10 621	18 776	38 297
12	244	511	963	1 976	2 961	5 703	9 090	16 070	32 778
15	217	453	853	1 752	2 625	5 055	8 057	14 242	29 050
18	196	410	773	1 587	2 378	4 580	7 300	12 905	26 321
21	181	378	711	1 460	2 188	4 214	6 716	11 872	24 215
24	168	351	662	1 358	2 035	3 920	6 248	11 045	22 528
27	158	330	621	1 275	1 910	3 678	5 862	10 363	21 137
30	149	311	586	1 204	1 804	3 474	5 537	9 789	19 966
35	137	286	539	1 108	1 660	3 196	5 094	9 006	18 368
40	127	266	502	1 030	1 544	2 973	4 739	8 378	17 088
45	120	250	471	967	1 449	2 790	4 447	7 861	16 033
50	113	236	445	913	1 368	2 635	4 200	7 425	15 145
60	102	214	403	827	1 240	2 388	3 806	6 728	13 722
70	94	197	371	761	1 141	2 197	3 501	6 189	12 625
80	88	183	345	708	1 061	2 044	3 257	5 758	11 745
90	82	172	324	664	996	1 917	3 056	5 403	11 020
100	78	162	306	628	940	1 811	2 887	5 103	10 409
125	69	144	271	556	833	1 605	2 558	4 523	9 225

(Continued)

Table A.4 b) (Continued)

Length of pipe, m	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
150	62	130	246	504	755	1 454	2 318	4 098	8 359
175	57	120	226	464	695	1 338	2 133	3 770	7 690
200	53	112	210	431	646	1 245	1 984	3 507	7 154
250	47	99	186	382	573	1 103	1 758	3 109	6 341
300	43	90	169	346	519	1 000	1 593	2 817	5 745
350	39	82	155	319	478	920	1 466	2 591	5 285
400	37	77	144	296	444	856	1 364	2 411	4 917
500	32	68	128	263	394	758	1 209	2 137	4 358
600	29	62	116	238	357	687	1 095	1 936	3 949

Table A.5 a)
Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe for pressures of 5 psig
based on a pressure drop of 2.5 psig
 (See Clauses A.2.3, A.2.4, A.2.6, and A.3.5.)

Length of pipe, ft	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
10	2 800	5 855	11 028	22 643	33 925	65 337	104 137	184 096	375 496
20	1 924	4 024	7 580	15 562	23 317	44 906	71 573	126 528	258 077
30	1 545	3 231	6 087	12 497	18 724	36 061	57 475	101 606	207 245
40	1 323	2 766	5 210	10 696	16 026	30 864	49 192	86 962	177 375
50	1 172	2 451	4 617	9 479	14 203	27 354	43 598	77 073	157 204
60	1 062	2 221	4 183	8 589	12 869	24 785	39 503	69 833	142 438
70	977	2 043	3 849	7 902	11 839	22 801	36 342	64 246	131 041
80	909	1 901	3 581	7 351	11 014	21 212	33 809	59 768	121 909
90	853	1 783	3 359	6 897	10 334	19 903	31 722	56 079	114 383
100	806	1 685	3 173	6 515	9 762	18 800	29 964	52 972	108 045
125	714	1 493	2 812	5 774	8 652	16 662	26 557	46 948	95 759
150	647	1 353	2 548	5 232	7 839	15 097	24 062	42 538	86 764
175	595	1 245	2 344	4 813	7 212	13 889	22 137	39 135	79 822
200	554	1 158	2 181	4 478	6 709	12 921	20 594	36 407	74 259
250	491	1 026	1 933	3 969	5 946	11 452	18 252	32 267	65 814
300	445	930	1 751	3 596	5 388	10 376	16 538	29 236	59 633
350	409	855	1 611	3 308	4 957	9 546	15 215	26 897	54 861
400	381	796	1 499	3 078	4 611	8 881	14 154	25 022	51 038
450	357	747	1 406	2 888	4 327	8 332	13 281	23 478	47 887
500	337	705	1 329	2 728	4 087	7 871	12 545	22 177	45 234

(Continued)

Table A.5 a) (Continued)

Length of pipe, ft	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	4
600	306	639	1 204	2 471	3 703	7 131	11 366	40 985
700	281	588	1 107	2 274	3 407	6 561	10 457	37 706
800	262	547	1 030	2 115	3 169	6 104	9 728	35 078
900	245	513	967	1 985	2 974	5 727	9 128	32 912
1 000	232	485	913	1 875	2 809	5 410	8 622	31 089
1 200	210	439	827	1 699	2 545	4 901	7 812	28 169
1 400	193	404	761	1 563	2 341	4 509	7 187	25 915
1 600	180	376	708	1 454	2 178	4 195	6 686	24 109
1 800	169	353	664	1 364	2 044	3 936	6 273	22 621
2 000	159	333	628	1 288	1 930	3 718	5 926	21 367

Table A.5 b)
Maximum capacity of natural gas in kW for Schedule 40 pipe and plastic pipe for pressures of 34 kPa based on a pressure drop of 17 kPa

Pipe size (NPS)									
Length of pipe, m	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
3	821	1 716	3 232	6 635	9 942	19 147	30 518	53 950	110 041
6	564	1 179	2 221	4 561	6 833	13 160	20 975	37 080	75 631
9	453	947	1 784	3 662	5 487	10 568	16 843	29 776	60 734
12	388	810	1 527	3 134	4 696	9 045	14 416	25 485	51 980
15	344	718	1 353	2 778	4 162	8 016	12 776	22 587	46 069
18	311	651	1 226	2 517	3 771	7 263	11 576	20 465	41 742
21	286	599	1 128	2 316	3 470	6 682	10 650	18 828	38 402
24	266	557	1 049	2 154	3 228	6 216	9 908	17 515	35 726
27	250	523	985	2 021	3 029	5 833	9 296	16 434	33 520
30	236	494	930	1 909	2 861	5 509	8 781	15 524	31 663
35	217	454	856	1 757	2 632	5 069	8 079	14 282	29 130
40	202	423	796	1 634	2 448	4 715	7 516	13 286	27 100
45	190	396	747	1 533	2 297	4 424	7 052	12 466	25 427
50	179	374	705	1 448	2 170	4 179	6 661	11 775	24 018
60	162	339	639	1 312	1 966	3 787	6 035	10 669	21 762
70	149	312	588	1 207	1 809	3 484	5 552	9 816	20 021
80	139	290	547	1 123	1 683	3 241	5 165	9 132	18 625
90	130	272	513	1 054	1 579	3 041	4 847	8 568	17 476
100	123	257	485	995	1 491	2 872	4 578	8 093	16 507
125	109	228	430	882	1 322	2 546	4 057	7 173	14 630

(Continued)

Table A.5 b) (Continued)

Length of pipe, m	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	4
150	99	207	389	799	1 198	2 307	3 676	13 256
175	91	190	358	735	1 102	2 122	3 382	12 195
200	85	177	333	684	1 025	1 974	3 146	11 345
250	75	157	295	606	908	1 750	2 789	10 055
300	68	142	268	549	823	1 585	2 527	9 111
350	62	131	246	505	757	1 458	2 325	8 382
400	58	122	229	470	705	1 357	2 163	7 798
500	52	108	203	417	624	1 203	1 917	6 911
600	47	98	184	378	566	1 090	1 737	6 262

Table A.6 a)
Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe for pressures of 10 psig
based on a pressure drop of 5 psig
 (See Clauses A.2.3, A.2.4, A.2.6, and A.3.5.)

Length of pipe, ft	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
10	4 503	9 415	17 736	36 414	54 559	105 075	167 473	296 063	603 873
20	3 095	6 471	12 190	25 027	37 498	72 218	115 103	203 482	415 039
30	2 485	5 197	9 789	20 098	30 112	57 993	92 432	163 403	333 291
40	2 127	4 448	8 378	17 201	25 772	49 635	79 110	139 852	285 254
50	1 885	3 942	7 425	15 245	22 841	43 990	70 114	123 948	252 815
60	1 708	3 572	6 728	13 813	20 696	39 858	63 528	112 306	229 069
70	1 571	3 286	6 190	12 708	19 040	36 669	58 445	103 320	210 740
80	1 462	3 057	5 758	11 822	17 713	34 114	54 372	96 120	196 053
90	1 372	2 868	5 403	11 092	16 620	32 008	51 015	90 186	183 950
100	1 296	2 709	5 103	10 478	15 699	30 234	48 189	85 189	173 758
125	1 148	2 401	4 523	9 286	13 914	26 796	42 709	75 501	153 999
150	1 040	2 176	4 098	8 414	12 607	24 279	38 697	68 410	139 534
175	957	2 001	3 770	7 741	11 598	22 337	35 601	62 936	128 370
200	890	1 862	3 508	7 201	10 790	20 780	33 120	58 550	119 423
250	789	1 650	3 109	6 382	9 563	18 417	29 353	51 892	105 843
300	715	1 495	2 817	5 783	8 665	16 687	26 596	47 018	95 901
350	658	1 376	2 591	5 320	7 971	15 352	24 468	43 256	88 228
400	612	1 280	2 411	4 949	7 416	14 282	22 763	40 241	82 079
450	574	1 201	2 262	4 644	6 958	13 400	21 358	37 757	77 012
500	542	1 134	2 137	4 387	6 572	12 658	20 174	35 665	72 745

(Continued)

Table A.6 a) (Continued)

Length of pipe, ft	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
600	491	1 028	1 936	3 975	5 955	11 469	18 280	32 315	65 912
700	452	945	1 781	3 657	5 479	10 551	16 817	29 729	60 638
800	421	880	1 657	3 402	5 097	9 816	15 645	27 657	56 412
900	395	825	1 555	3 192	4 782	9 210	14 679	25 950	52 930
1 000	373	780	1 468	3 015	4 517	8 700	13 866	24 512	49 997
1 200	338	706	1 331	2 732	4 093	7 882	12 563	22 210	45 301
1 400	311	650	1 224	2 513	3 765	7 252	11 558	20 433	41 676
1 600	289	605	1 139	2 338	3 503	6 746	10 753	19 009	38 772
1 800	271	567	1 068	2 194	3 287	6 330	10 089	17 835	36 378
2 000	256	536	1 009	2 072	3 105	5 979	9 530	16 847	34 363

Table A.6 b)
Maximum capacity of natural gas in kW for Schedule 40 pipe and plastic pipe for pressures of 70 kPa based on a pressure drop of 35 kPa

Length of pipe, m	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
3	1 346	2 815	5 303	10 887	16 312	31 415	50 070	88 515	180 542
6	925	1 935	3 644	7 482	11 211	21 591	34 413	60 836	124 085
9	743	1 554	2 927	6 009	9 003	17 338	27 635	48 853	99 645
12	636	1 330	2 505	5 143	7 705	14 839	23 652	41 812	85 283
15	564	1 178	2 220	4 558	6 829	13 152	20 962	37 057	75 585
18	511	1 068	2 011	4 130	6 188	11 917	18 993	33 577	68 485
21	470	982	1 851	3 799	5 692	10 963	17 473	30 890	63 006
24	437	914	1 722	3 534	5 296	10 199	16 256	28 737	58 615
27	410	857	1 615	3 316	4 969	9 569	15 252	26 963	54 996
30	387	810	1 526	3 133	4 694	9 039	14 407	25 469	51 949
35	356	745	1 404	2 882	4 318	8 316	13 254	23 431	47 793
40	332	693	1 306	2 681	4 017	7 736	12 331	21 798	44 462
45	311	650	1 225	2 516	3 769	7 259	11 569	20 453	41 717
50	294	614	1 157	2 376	3 560	6 857	10 928	19 319	39 406
60	266	557	1 049	2 153	3 226	6 213	9 902	17 505	35 704
70	245	512	965	1 981	2 968	5 716	9 110	16 104	32 848
80	228	476	898	1 843	2 761	5 317	8 475	14 982	30 558
90	214	447	842	1 729	2 590	4 989	7 952	14 057	28 672
100	202	422	795	1 633	2 447	4 713	7 511	13 278	27 083
125	179	374	705	1 447	2 169	4 177	6 657	11 768	24 003

(Continued)

Table A.6 b) (Continued)

Length of pipe, m	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
150	162	339	639	1 311	1 965	3 784	6 032	10 663	21 749
175	149	312	588	1 207	1 808	3 482	5 549	9 810	20 009
200	139	290	547	1 122	1 682	3 239	5 162	9 126	18 614
250	123	257	485	995	1 491	2 871	4 575	8 088	16 497
300	111	233	439	901	1 351	2 601	4 146	7 329	14 948
350	103	214	404	829	1 242	2 393	3 814	6 742	13 752
400	95	199	376	771	1 156	2 226	3 548	6 272	12 793
500	85	177	333	684	1 024	1 973	3 145	5 559	11 339
600	77	160	302	619	928	1 788	2 849	5 037	10 274

Table A.7 a)
Maximum capacity of natural gas in thousands of Btu/h for Schedule 40 pipe and plastic pipe for pressures of 20 psig
based on a pressure drop of 10 psig
 (See Clauses 6.3.5, A.2.3, A.2.4, A.2.6, and A.3.5.)

Length of pipe, ft	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
10	7 669	16 036	30 207	62 018	92 922	178 959	285 232	504 240	1 028 489
20	5 271	11 021	20 761	42 625	63 865	122 998	196 039	346 561	706 875
30	4 233	8 851	16 672	34 229	51 286	98 771	157 426	278 301	567 645
40	3 623	7 575	14 269	29 296	43 894	84 536	134 736	238 190	485 831
50	3 211	6 714	12 646	25 964	38 902	74 922	119 414	211 103	430 583
60	2 909	6 083	11 459	23 525	35 248	67 885	108 198	191 275	390 139
70	2 676	5 596	10 542	21 643	32 428	62 453	99 541	175 970	358 923
80	2 490	5 206	9 807	20 135	30 168	58 101	92 603	163 706	333 909
90	2 336	4 885	9 202	18 892	28 306	54 514	86 887	153 600	313 296
100	2 207	4 614	8 692	17 845	26 737	51 494	82 073	145 090	295 937
125	1 956	4 089	7 703	15 816	23 697	45 638	72 740	128 591	262 284
150	1 772	3 705	6 980	14 330	21 471	41 351	65 907	116 512	237 648
175	1 630	3 409	6 421	13 184	19 753	38 043	60 634	107 190	218 633
200	1 517	3 171	5 974	12 265	18 377	35 391	56 408	99 720	203 396
250	1 344	2 811	5 294	10 870	16 287	31 367	49 993	88 380	180 266
300	1 218	2 547	4 797	9 849	14 757	28 420	45 298	80 078	163 334
350	1 120	2 343	4 413	9 061	13 576	26 146	41 673	73 671	150 265
400	1 042	2 180	4 106	8 430	12 630	24 324	38 769	68 537	139 793
450	978	2 045	3 852	7 909	11 850	22 823	36 376	64 306	131 163
500	924	1 932	3 639	7 471	11 194	21 558	34 360	60 743	123 896

(Continued)

Table A.7 a) (Continued)

Length of pipe, ft	Pipe size (NPS)							
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	4
600	837	1 750	3 297	6 769	10 142	19 533	31 133	112 259
700	770	1 610	3 033	6 228	9 331	17 970	28 642	103 277
800	716	1 498	2 822	5 794	8 681	16 718	26 646	96 079
900	672	1 406	2 648	5 436	8 145	15 686	25 001	90 148
1 000	635	1 328	2 501	5 135	7 693	14 817	23 616	85 153
1 200	575	1 203	2 266	4 652	6 971	13 425	21 397	77 155
1 400	529	1 107	2 085	4 280	6 413	12 351	19 685	70 981
1 600	492	1 030	1 939	3 982	5 966	11 490	18 313	66 034
1 800	462	966	1 820	3 736	5 598	10 781	17 183	61 958
2 000	436	913	1 719	3 529	5 288	10 183	16 231	58 525

Table A.7 b)
Maximum capacity of natural gas in kW for Schedule 40 pipe and plastic pipe for pressures of 140 kPa based on a pressure drop of 70 kPa

Length of pipe, m	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
3	2 296	4 801	9 044	18 568	27 820	53 578	85 396	150 964	307 919
6	1 578	3 300	6 216	12 761	19 121	36 824	58 692	103 757	211 631
9	1 267	2 650	4 991	10 248	15 354	29 571	47 132	83 320	169 947
12	1 085	2 268	4 272	8 771	13 141	25 309	40 339	71 311	145 453
15	961	2 010	3 786	7 773	11 647	22 431	35 751	63 202	128 912
18	871	1 821	3 431	7 043	10 553	20 324	32 393	57 266	116 804
21	801	1 675	3 156	6 480	9 709	18 698	29 801	52 684	107 458
24	745	1 559	2 936	6 028	9 032	17 395	27 724	49 012	99 969
27	699	1 462	2 755	5 656	8 474	16 321	26 013	45 986	93 797
30	661	1 381	2 602	5 343	8 005	15 417	24 572	43 438	88 600
35	608	1 271	2 394	4 915	7 364	14 183	22 606	39 963	81 511
40	565	1 182	2 227	4 573	6 851	13 195	21 030	37 178	75 831
45	531	1 109	2 090	4 290	6 428	12 380	19 732	34 883	71 149
50	501	1 048	1 974	4 053	6 072	11 694	18 639	32 950	67 207
60	454	949	1 789	3 672	5 502	10 596	16 888	29 855	60 895
70	418	873	1 645	3 378	5 062	9 748	15 537	27 466	56 022
80	389	813	1 531	3 143	4 709	9 069	14 454	25 552	52 118
90	365	762	1 436	2 949	4 418	8 509	13 562	23 975	48 901
100	344	720	1 357	2 785	4 173	8 037	12 810	22 646	46 191
125	305	638	1 202	2 469	3 699	7 123	11 353	20 071	40 938

(Continued)

Table A.7 b) (Continued)

Length of pipe, m	Pipe size (NPS)								
	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4
150	277	578	1 089	2 237	3 351	6 454	10 287	18 186	37 093
175	254	532	1 002	2 058	3 083	5 938	9 464	16 731	34 125
200	237	495	932	1 914	2 868	5 524	8 804	15 565	31 747
250	210	439	826	1 697	2 542	4 896	7 803	13 795	28 137
300	190	397	749	1 537	2 303	4 436	7 070	12 499	25 494
350	175	366	689	1 414	2 119	4 081	6 505	11 499	23 454
400	163	340	641	1 316	1 971	3 797	6 051	10 697	21 819
500	144	302	568	1 166	1 747	3 365	5 363	9 481	19 338
600	131	273	515	1 057	1 583	3 049	4 859	8 590	17 522

Table A.8 a)
Maximum capacity of natural gas in thousands of Btu/h for copper tubing, including fittings, for pressures of less than 7 in w.c. based on a pressure drop of 0.5 in w.c.
 (See Clauses 6.3.2, A.2.3, A.2.4, A.2.5, A.2.6, and A.3.5.)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
10	24	50	101	176	250	535	963
20	17	34	69	121	172	368	662
30	13	27	56	97	138	295	531
40	11	23	48	83	118	253	455
50	10	21	42	74	105	224	403
60	9	19	38	67	95	203	365
70	8	17	35	62	87	187	336
80	8	16	33	57	81	174	313
90	7	15	31	54	76	163	293
100	7	14	29	51	72	154	277
125	6	13	26	45	64	136	245
150	6	11	23	41	58	124	222
175	5	11	21	38	53	114	205
200	5	10	20	35	50	106	190
250	4	9	18	31	44	94	169
300	4	8	16	28	40	85	153
350	4	7	15	26	37	78	141
400	3	7	14	24	34	73	131
450	3	6	13	23	32	68	123
500	3	6	12	21	30	64	116

(Continued)

Table A.8 a) (Continued)

Outside diameter (in)							
Length of tube, ft	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
600	3	5	11	19	27	58	105
700	2	5	10	18	25	54	97
800	2	5	9	16	23	50	90
900	2	4	9	15	22	47	84
1000	2	4	8	15	21	44	80
1200	2	4	8	13	19	40	72
1400	2	3	7	12	17	37	66
1600	2	3	6	11	16	34	62
1800	1	3	6	11	15	32	58
2000	1	3	6	10	14	30	55

Table A.8 b)
Maximum capacity of natural gas in kW for copper tubing, including fittings, for pressures of less than 1.75 kPa based on a pressure drop of 125 Pa

Length of tube, m	Outside diameter (mm)						
	9.5	13	16	19	22	29	35
3	7	15	30	52	74	158	285
6	5	10	21	36	51	109	196
9	4	8	17	29	41	87	157
12	3	7	14	25	35	75	135
15	3	6	13	22	31	66	119
18	3	6	11	20	28	60	108
21	2	5	10	18	26	55	100
24	2	5	10	17	24	51	93
27	2	4	9	16	23	48	87
30	2	4	9	15	21	46	82
35	2	4	8	14	20	42	75
40	2	4	7	13	18	39	70
45	2	3	7	12	17	37	66
50	2	3	7	11	16	35	62
60	1	3	6	10	15	31	56
70	1	3	5	10	13	29	52
80	1	2	5	9	13	27	48
90	1	2	5	8	12	25	45
100	1	2	4	8	11	24	43
125	1	2	4	7	10	21	38
150	1	2	4	6	9	19	34

(Continued)

Table A.8 b) (Continued)

Length of tube, m	Outside diameter (mm)					
	9.5	13	16	19	22	29
175	1	2	3	6	8	18
200	1	2	3	5	8	16
250	1	1	3	5	7	14
300	1	1	2	4	6	13
350	1	1	2	4	6	12
400	1	1	2	4	5	11
500	—	1	2	3	5	10
600	—	1	2	3	4	9
						35
						32
						29
						26
						24
						22
						20
						18
						16

Table A.9 a)
Maximum capacity of natural gas in thousands of Btu/h for copper tubing, including fittings, for pressures of 7 in w.c. to 14 in w.c. based on a pressure drop of 1 in w.c.
 (See Clauses 6.3.2, A.2.3, A.2.4, A.2.5, A.2.6, and A.3.5.)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
10	35	72	147	257	364	778	1401
20	24	50	101	176	250	535	963
30	19	40	81	142	201	429	773
40	17	34	69	121	172	368	662
50	15	30	61	107	152	326	586
60	13	27	56	97	138	295	531
70	12	25	51	90	127	272	489
80	11	23	48	83	118	253	455
90	11	22	45	78	111	237	427
100	10	21	42	74	105	224	403
125	9	18	37	65	93	198	357
150	8	17	34	59	84	180	324
175	7	15	31	55	77	165	298
200	6	14	29	51	72	154	277
250	6	13	26	45	64	136	245
300	5	11	23	41	58	124	222
350	5	11	21	38	53	114	205
400	4	10	20	35	50	106	190
450	4	9	19	33	46	99	179
500	4	9	18	31	44	94	169

(Continued)

Table A.9 a) (Continued)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
600	3	7	16	28	40	85	153
700	3	7	15	26	37	78	141
800	3	7	14	24	34	73	131
900	3	6	13	23	32	68	123
1000	3	6	12	21	30	64	116
1200	3	5	11	19	27	58	105
1400	2	5	10	18	25	54	97
1600	2	5	9	16	23	50	90
1800	2	4	9	15	22	47	84
2000	2	4	8	15	21	44	80

Table A.9 b)
Maximum capacity of natural gas in kW for copper tubing, including fittings, for pressures of 1.75 kPa up to 3.50 kPa
based on a pressure drop of 250 Pa

Length of tube, m	Outside diameter (mm)									
	9.5	13	16	19	22	29	35			
3	10	21	44	76	108	231	415			
6	7	15	30	52	74	158	285			
9	6	12	24	42	60	127	229			
12	5	10	21	36	51	109	196			
15	4	9	18	32	45	97	174			
18	4	8	17	29	41	87	157			
21	4	7	15	27	38	80	145			
24	3	7	14	25	35	75	135			
27	3	7	13	23	33	70	126			
30	3	6	13	22	31	66	119			
35	3	6	12	20	29	61	110			
40	3	5	11	19	27	57	102			
45	2	5	10	18	25	53	96			
50	2	5	9	17	24	50	91			
60	2	4	9	15	21	46	82			
70	2	4	8	14	20	42	76			
80	2	4	7	13	18	39	70			
90	2	3	7	12	17	37	66			
100	2	3	7	11	16	35	62			
125	1	3	6	10	14	31	55			
150	1	3	5	9	13	28	50			

(Continued)

Table A.9 b) (Continued)

Length of tube, m	Outside diameter (mm)									
	9.5	13	16	19	22	29	35			
175	1	2	5	8	12	26	46			
200	1	2	4	8	11	24	43			
250	1	2	4	7	10	21	38			
300	1	2	4	6	9	19	34			
350	1	2	3	6	8	18	32			
400	1	2	3	5	8	16	29			
500	1	1	3	5	7	14	26			
600	1	1	2	4	6	13	24			

Table A.10 a)
Maximum capacity of natural gas in thousands of Btu/h for copper tubing, including fittings, for pressures of 2 psig
based on a pressure drop of 1 psig
 (See Clauses 6.3.4, A.2.3, A.2.4, A.2.5, A.2.6, and A.3.5.)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
10	222	458	933	1630	2312	4939	8891
20	153	315	641	1120	1589	3395	6111
30	123	253	515	899	1276	2726	4907
40	105	217	440	770	1092	2333	4200
50	93	192	390	682	968	2068	3722
60	84	174	354	618	877	1873	3373
70	78	160	325	569	807	1724	3103
80	72	149	303	529	751	1603	2887
90	68	140	284	496	704	1504	2708
100	64	132	268	469	665	1421	2558
125	57	117	238	416	590	1260	2267
150	51	106	215	377	534	1141	2055
175	47	97	198	346	492	1050	1890
200	44	91	184	322	457	977	1758
250	39	80	163	286	405	866	1558
300	35	73	148	259	367	784	1412
350	32	67	136	238	338	722	1299
400	30	62	127	222	314	671	1209
450	28	58	119	208	295	630	1134
500	27	55	112	196	279	595	1071

(Continued)

Table A.10 a) (Continued)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
600	24	50	102	178	252	539	970
700	22	46	94	164	232	496	893
800	21	43	87	152	216	461	831
900	19	40	82	143	203	433	779
1000	18	38	77	135	191	409	736
1200	17	34	70	122	173	370	667
1400	15	32	64	112	160	341	614
1600	14	29	60	105	148	317	571
1800	13	28	56	98	139	298	536
2000	13	26	53	93	132	281	506

Table A.10 b)
Maximum capacity of natural gas in kW for copper tubing, including fittings, for pressures of 14 kPa based on a pressure drop of 7 kPa

Length of tube, m	Outside diameter (mm)					
	9.5	13	16	19	22	29
3	66	137	278	486	690	1474
6	46	94	191	334	474	1013
9	37	75	154	268	381	813
12	31	65	131	230	326	696
15	28	57	116	204	289	617
18	25	52	106	184	262	559
21	23	48	97	170	241	514
24	22	44	90	158	224	478
27	20	42	85	148	210	449
30	19	39	80	140	199	424
35	18	36	74	129	183	390
40	16	34	69	120	170	363
45	15	32	64	112	159	341
50	14	30	61	106	151	322
60	13	27	55	96	136	291
70	12	25	51	88	126	268
80	11	23	47	82	117	249
90	11	22	44	77	110	234
100	10	21	42	73	103	221
125	9	18	37	65	92	196
150	8	16	34	59	83	178

(Continued)

Table A.10 b) (Continued)

Length of tube, m	Outside diameter (mm)									
	9.5	13	16	19	22	29	35			
175	7	15	31	54	76	163	294			
200	7	14	29	50	71	152	274			
250	6	12	25	44	63	135	242			
300	5	11	23	40	57	122	220			
350	5	10	21	37	53	112	202			
400	5	10	20	34	49	104	188			
500	4	9	17	31	43	93	167			
600	4	8	16	28	39	84	151			

Table A.11 a)
Maximum capacity of natural gas in thousands of Btu/h for copper tubing, including fittings, for pressures of 2 psig
based on a pressure drop of 1.5 psig
 (See Clauses 6.3.4, A.2.3, A.2.4, A.2.5, A.2.6, and A.3.5.)

Length of tube, ft	Outside diameter (in)							1-3/ 8
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8	
10	274	566	1 151	2 012	2 855	6 099		10 980
20	189	389	791	1 383	1 962	4 192		7 546
30	151	312	636	1 111	1 576	3 366		6 060
40	130	267	544	951	1 349	2 881		5 186
50	115	237	482	843	1 195	2 553		4 597
60	104	215	437	763	1 083	2 313		4 165
70	96	198	402	702	996	2 128		3 832
80	89	184	374	653	927	1 980		3 565
90	84	172	351	613	870	1 858		3 345
100	79	163	331	579	822	1 755		3 159
125	70	144	294	513	728	1 555		2 800
150	63	131	266	465	660	1 409		2

(Continued)

Table A.11 a) (Continued)

Length of tube, ft	Outside diameter (in)						1-3/ 8
	3/8	1/2	5/8	3/4	7/8	1-1/8	
175	58	120	245	428	607	1 296	537 2 334
200	54	112	228	398	565	1 206	2 171
250	48	99	202	353	500	1 069	1 924
300	44	90	183	320	453	969	1 744
350	40	83	168	294	417	891	1 604
400	37	77	157	274	388	829	1 492
450	35	72	147	257	364	778	1 400
500	33	68	139	242	344	735	1 323
600	30	62	126	220	312	666	1 198
700	28	57	116	202	287	612	1 102
800	26	53	108	188	267	570	1 026
900	24	50	101	176	250	535	962
1 000	23	47	95	167	236	505	909
1 200	21	42	86	151	214	458	824

(Continued)

Table A.11 a) (Continued)

Length of tube, ft	Outside diameter (in)					
	3/8	1/2	5/8	3/4	7/8	1-1/8
1 400	19	39	79	139	197	421
1 600	18	36	74	129	183	392
1 800	17	34	69	121	172	367
2 000	16	32	66	115	162	347
						1-3/8
						758
						705
						661
						625

Table A.11 b)
Maximum capacity of natural gas in kW for copper tubing, including fittings, for pressures of 14 kPa based on a pressure drop of 10 kPa

Length of tube, m	Outside diameter (mm)						
	9.5	13	16	19	22	29	35
3	80	165	335	586	831	1774	3194
6	55	113	230	402	571	1220	2196
9	44	91	185	323	458	979	1763
12	38	78	158	277	392	838	1509
15	33	69	140	245	348	743	1337
18	30	62	127	222	315	673	1212
21	28	57	117	204	290	619	1115
24	26	53	109	190	270	576	1037
27	24	50	102	178	253	541	973
30	23	47	96	168	239	511	919
35	21	44	89	155	220	470	846
40	20	41	83	144	205	437	787
45	18	38	77	135	192	410	738
50	17	36	73	128	181	387	697
60	16	33	66	116	164	351	632
70	15	30	61	107	151	323	581
80	14	28	57	99	141	300	541
90	13	26	53	93	132	282	507
100	12	25	50	88	125	266	479
125	11	22	45	78	110	236	425
150	10	20	40	71	100	214	385

(Continued)

Table A.11 b) (Continued)

Length of tube, m	Outside diameter (mm)						
	9.5	13	16	19	22	29	35
175	9	18	37	65	92	197	354
200	8	17	35	60	86	183	329
250	7	15	31	53	76	162	292
300	7	14	28	48	69	147	264
350	6	13	26	45	63	135	243
400	6	12	24	41	59	126	226
500	5	10	21	37	52	111	201
600	5	9	19	33	47	101	182

Table A.12 a)
Maximum capacity of natural gas in thousands of Btu/h for copper tubing for pressures of 5 psig based on a pressure drop of 2.5 psig
 (See Clauses A.2.3, A.2.4, A.2.5, A.2.6, and A.3.5.)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
10	432	891	1 813	3 168	4 495	9 601	17 285
20	297	612	1 246	2 177	3 089	6 599	11 880
30	238	492	1 000	1 749	2 481	5 299	9 540
40	204	421	856	1 497	2 123	4 535	8 165
50	181	373	759	1 326	1 882	4 020	7 236
60	164	338	688	1 202	1 705	3 642	6 557
70	151	311	633	1 106	1 569	3 351	6 032
80	140	289	589	1 029	1 459	3 117	5 612
90	132	271	552	965	1 369	2 925	5 265
100	124	256	522	912	1 293	2 763	4 973
125	110	227	462	808	1 146	2 448	4 408
150	100	206	419	732	1 039	2 218	3 994
175	92	189	385	673	955	2 041	3 674
200	85	176	358	627	889	1 899	3 418
250	76	156	318	555	788	1 683	3 030
300	69	142	288	503	714	1 525	2 745
350	63	130	265	463	657	1 403	2 525
400	59	121	246	431	611	1 305	2 349
450	55	114	231	404	573	1 224	2 204
500	52	107	218	382	541	1 157	2 082

(Continued)

Table A.12 a) (Continued)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
600	47	97	198	346	491	1 048	1 887
700	43	89	182	318	451	964	1 736
800	40	83	169	296	420	897	1 615
900	38	78	159	278	394	842	1 515
1 000	36	74	150	262	372	795	1 431
1 200	32	67	136	238	337	720	1 297
1 400	30	61	125	219	310	663	1 193
1 600	28	57	116	203	289	616	1 110
1 800	26	54	109	191	271	578	1 041
2 000	25	51	103	180	256	546	984

Table A.12 b)
Maximum capacity of natural gas in kW for copper tubing for pressures of 34 kPa based on a pressure drop of 17 kPa

Length of tube, m	Outside diameter (mm)									
	9.5	13	16	19	22	29	35			
3	127	261	531	929	1317	2814	5066			
6	87	179	365	638	905	1934	3482			
9	70	144	293	512	727	1553	2796			
12	60	123	251	439	622	1329	2393			
15	53	109	222	389	552	1178	2121			
18	48	99	202	352	500	1067	1922			
21	44	91	185	324	460	982	1768			
24	41	85	172	301	428	914	1645			
27	39	80	162	283	401	857	1543			
30	36	75	153	267	379	810	1458			
35	34	69	141	246	349	745	1341			
40	31	64	131	229	324	693	1248			
45	29	60	123	215	304	650	1171			
50	28	57	116	203	288	614	1106			
60	25	52	105	184	261	556	1002			
70	23	48	97	169	240	512	922			
80	21	44	90	157	223	476	857			
90	20	41	84	147	209	447	805			
100	19	39	80	139	198	422	760			
125	17	35	71	123	175	374	674			
150	15	31	64	112	159	339	610			

(Continued)

Table A.12 b) (Continued)

Length of tube, m	Outside diameter (mm)						
	9.5	13	16	19	22	29	35
175	14	29	59	103	146	312	561
200	13	27	55	96	136	290	522
250	12	24	49	85	120	257	463
300	10	22	44	77	109	233	419
350	10	20	40	71	100	214	386
400	9	19	38	66	93	199	359
500	8	16	33	58	83	177	318
600	7	15	30	53	75	160	288

Table A.13 a)
Maximum capacity of natural gas in thousands of Btu/h for copper tubing for pressures of 10 psig based on a
pressure drop of 5 psig
 (See Clauses A.2.3, A.2.4, A.2.5, A.2.6, and A.3.5.)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
10	695	1 433	2 915	5 095	7 228	15 440	27 797
20	477	985	2 004	3 502	4 968	10 612	19 105
30	383	791	1 609	2 812	3 989	8 522	15 342
40	328	677	1 377	2 407	3 414	7 294	13 131
50	291	600	1 220	2 133	3 026	6 464	11 637
60	263	544	1 106	1 933	2 742	5 857	10 544
70	242	500	1 017	1 778	2 523	5 388	9 701
80	225	465	946	1 654	2 347	5 013	9 025
90	212	437	888	1 552	2 202	4 703	8 467
100	200	412	839	1 466	2 080	4 443	7 998
125	177	365	743	1 299	1 843	3 938	7 089
150	160	331	674	1 177	1 670	3 568	6 423
175	148	305	620	1 083	1 537	3 282	5 909
200	137	283	577	1 008	1 429	3 054	5 497
250	122	251	511	893	1 267	2 706	4 872
300	110	228	463	809	1 148	2 452	4 414
350	101	209	426	744	1 056	2 256	4 061
400	94	195	396	693	982	2 099	3 778
450	89	183	372	650	922	1 969	3 545
500	84	173	351	614	871	1 860	3 349

(Continued)

Table A.13 a) (Continued)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
600	76	156	318	556	789	1 685	3 034
700	70	144	293	512	726	1 550	2 791
800	65	134	272	476	675	1 442	2 597
900	61	126	256	447	634	1 353	2 436
1 000	58	119	241	422	598	1 278	2 301
1 200	52	108	219	382	542	1 158	2 085
1 400	48	99	201	352	499	1 066	1 918
1 600	45	92	187	327	464	991	1 785
1 800	42	86	176	307	435	930	1 675
2 000	40	82	166	290	411	879	1 582

Table A.13 b)
Maximum capacity of natural gas in kW for copper tubing for pressures of 70 kPa based on a pressure drop of 35 kPa

Length of tube, m	Outside diameter (mm)						
	9.5	13	16	19	22	29	35
3	208	428	872	1523	2161	4617	8311
6	143	294	599	1047	1485	3173	5712
9	115	236	481	841	1193	2548	4587
12	98	202	412	720	1021	2181	3926
15	87	179	365	638	905	1933	3480
18	79	163	331	578	820	1751	3153
21	72	150	304	532	754	1611	2901
24	67	139	283	495	702	1499	2698
27	63	131	266	464	658	1406	2532
30	60	123	251	438	622	1328	2392
35	55	113	231	403	572	1222	2200
40	51	106	215	375	532	1137	2047
45	48	99	201	352	499	1067	1920
50	45	94	190	333	472	1008	1814
60	41	85	172	301	427	913	1644
70	38	78	159	277	393	840	1512
80	35	73	148	258	366	781	1407
90	33	68	138	242	343	733	1320
100	31	64	131	229	324	693	1247
125	28	57	116	203	287	614	1105
150	25	52	105	184	260	556	1001

(Continued)

Table A.13 b) (Continued)

Length of tube, m	Outside diameter (mm)					
	9.5	13	16	19	22	29
175	23	47	97	169	240	512
200	21	44	90	157	223	476
250	19	39	80	139	197	422
300	17	35	72	126	179	382
350	16	33	66	116	165	352
400	15	30	62	108	153	327
500	13	27	55	96	136	290
600	12	24	50	87	123	263
						473

Table A.14 a)
Maximum capacity of natural gas in thousands of Btu/h for copper tubing for pressures of 20 psig based on a
pressure drop of 10 psig
 (See Clauses A.2.3, A.2.4, A.2.5, A.2.6, and A.3.5.)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
10	1 183	2 441	4 965	8 677	12 311	26 297	47 342
20	813	1 677	3 412	5 964	8 461	18 074	32 538
30	653	1 347	2 740	4 789	6 795	14 514	26 129
40	559	1 153	2 345	4 099	5 815	12 422	22 363
50	495	1 022	2 079	3 633	5 154	11 010	19 820
60	449	926	1 883	3 292	4 670	9 975	17 958
70	413	852	1 733	3 028	4 296	9 177	16 522
80	384	792	1 612	2 817	3 997	8 538	15 370
90	360	743	1 512	2 643	3 750	8 011	14 421
100	340	702	1 429	2 497	3 542	7 567	13 622
125	302	622	1 266	2 213	3 139	6 706	12 073
150	273	564	1 147	2 005	2 845	6 076	10 939
175	251	519	1 055	1 845	2 617	5 590	10 064
200	234	483	982	1 716	2 435	5 201	9 363
250	207	428	870	1 521	2 158	4 609	8 298
300	188	388	789	1 378	1 955	4 176	7 518
350	173	357	725	1 268	1 799	3 842	6 917
400	161	332	675	1 179	1 673	3 574	6 435
450	151	311	633	1 107	1 570	3 354	6 038
500	142	294	598	1 045	1 483	3 168	5 703

(Continued)

Table A.14 a) (Continued)

Length of tube, ft	Outside diameter (in)						
	3/8	1/2	5/8	3/4	7/8	1-1/8	1-3/8
600	129	266	542	947	1 344	2 870	5 167
700	119	245	499	871	1 236	2 641	4 754
800	111	228	464	811	1 150	2 457	4 423
900	104	214	435	761	1 079	2 305	4 150
1 000	98	202	411	718	1 019	2 217	3 920
1 200	89	183	372	651	924	1 973	3 551
1 400	82	168	343	599	850	1 815	3 267
1 600	76	157	319	557	790	1 688	3 040
1 800	71	147	299	523	742	1 584	2 852
2 000	67	139	283	494	701	1 496	2 694

Table A.14 b)
Maximum capacity of natural gas in kW for copper tubing for pressures of 140 kPa based on a pressure drop of 70 kPa

Length of tube, m	Outside diameter (mm)						
	9.5	13	16	19	22	29	35
3	354	731	1 487	2 598	3 686	7 874	14 175
6	243	502	1 022	1 786	2 533	5 412	9 742
9	195	403	820	1 434	2 034	4 346	7 823
12	167	345	702	1 227	1 741	3 719	6 696
15	148	306	622	1 088	1 543	3 296	5 934
18	134	277	564	986	1 398	2 987	5 377
21	124	255	519	907	1 286	2 748	4 947
24	115	237	483	844	1 197	2 556	4 602
27	108	223	453	791	1 123	2 398	4 318
30	102	210	428	748	1 061	2 266	4 079
35	94	193	394	688	976	2 084	3 752
40	87	180	366	640	908	1 939	3 491
45	82	169	344	600	852	1 819	3 275
50	77	159	324	567	805	1 719	3 094
60	70	145	294	514	729	1 557	2 803
70	64	133	270	473	671	1 433	2 579
80	60	124	252	440	624	1 333	2 399
90	56	116	236	413	585	1 250	2 251
100	53	110	223	390	553	1 181	2 126
125	47	97	198	345	490	1 047	1 885
150	43	88	179	313	444	949	1 708

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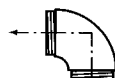


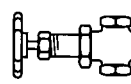
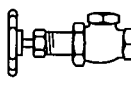





Table A.14 b) (Continued)

Length of tube, m	Outside diameter (mm)						
	9.5	13	16	19	22	29	35
175	39	81	165	288	409	873	1 571
200	37	75	153	268	380	812	1 461
250	32	67	136	237	337	719	1 295
300	29	60	123	215	305	652	1 173
350	27	56	113	198	281	600	1 080
400	25	52	105	184	261	558	1 004
500	22	46	93	163	231	494	890
600	20	42	85	148	210	448	807

Table A.15
Multipliers to be used with Tables A.1 to A.14 when the relative density of the gas is
other than 0.60
(See Clauses 6.3.6, A.2.6, A.3.5, E.1.4, and E.2.4.)


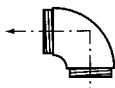



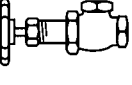




Relative density	Multiplier
0.35	1.31
0.40	1.23
0.45	1.16
0.50	1.10
0.55	1.04
0.60	1.00
0.65	0.962
0.70	0.926
0.75	0.895
0.80	0.867
0.85	0.841
0.90	0.817
1.00	0.775
1.10	0.740
1.20	0.707
1.30	0.680
1.80	0.577
1.90	0.565
2.00	0.547
2.10	0.535

Table A.16 a)
Resistance of bends, fittings, and valves for natural gas and propane expressed in equivalent length of straight pipe in feet*
 (See Clauses 6.3.7, A.2.4, and A.4.)

90° welding elbows and smooth bends‡											
Threaded fittings†			Valves (threaded, flanged, or welded)					Welding tees			
Elbows											
	45°	90°	Tee	Plug	Globe	Angle	Swing check	R/d§ = 1-1/2	Forged	Mitre**	
k factor	0.42	0.9	1.8	0.9	10	5	2.5	0.36	1.35	1.8	
n (L/D ratio††)	14	30	60	30	333	167	83	12	45	60	
Nominal pipe size, in (Schedule 40)											
3/8	0.58	1.23	2.46	1.23	13.7	6.85	3.42	0.49	1.85	2.46	
1/2	0.73	1.55	3.10	1.55	17.3	8.65	4.32	0.62	2.33	3.10	
3/4	0.96	2.06	4.12	2.06	22.9	11.4	5.72	0.82	3.09	4.12	
1	1.22	2.62	5.24	2.62	29.1	14.6	7.27	1.05	3.93	5.24	
1-1/4	1.61	3.45	6.90	3.45	38.3	19.1	9.58	1.38	5.17	6.90	
1-1/2	1.88	4.02	8.04	4.02	44.7	22.4	11.2	1.61	6.04	8.04	
2	2.41	5.17	10.3	5.17	57.4	28.7	14.4	2.07	7.75	10.3	
2-1/2	2.88	6.16	12.3	6.16	68.5	34.3	17.1	2.47	9.25	12.3	

(Continued)

Table A.16 a) (Continued)

Threaded fittings†		Valves (threaded, flanged, or welded)						90° welding elbows and smooth bends‡		Welding tees	
Elbows											
45°	90°	Tee	Plug	Globe	Angle	Swing check	R/d§ = 1-1/2	Forged	Mitre**		
k factor	0.42	0.9	1.8	0.9	10	5	2.5	0.36	1.35	1.8	
n (L/D ratio††)	14	30	60	30	333	167	83	12	45	60	
Nominal pipe size, in (Schedule 40)	Inside diameter (d), in										
3	3.068	3.58	7.67	15.3	7.67	85.2	42.6	21.3	3.07	11.5	15.3
4	4.026	4.70	10.1	20.2	10.1	112	56.0	28.0	4.03	15.1	20.2
5	5.047	5.88	12.6	25.2	12.6	140	70.0	35.0	5.05	18.9	25.2

* Values for welded fittings are for conditions where the bore is not obstructed by weld spatter or backing rings. If appreciably obstructed, values for threaded fittings shall be used.

† Flanged fittings have three-fourths the resistance of threaded fittings.

‡ Tabular figures give the extra resistance due to curvature alone, to which should be added the actual length of the bend.

§ R/d is the ratio of the elbow or bend radius to the inside diameter of the pipe.

** Small socket-welding fittings are equivalent to mitre elbows and mitre tees.

†† n = resistance in equivalent number of diameters of straight pipe, computed from the relation $n = k / 4f$, where the friction factor, f , is assumed to be 0.0075;

$n = L / D$, where L = equivalent length of Schedule 40 straight pipe in feet, and D = inside diameter of pipe in feet. For pipe having other inside diameters, the resistance expressed in equivalent length in feet can be computed from the above n values.

Note: The equivalent lengths in feet shown in the table have been computed on the basis that the inside diameter corresponds to that of Schedule 40 (standard-weight) steel pipe, which is close enough for most purposes involving other schedules of pipe. Where a more specific solution for equivalent length is desired, this may be made by multiplying the actual inside diameter of the pipe in feet by $n / 12$, or the actual diameter in feet by n , read from the table heading. The

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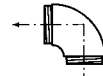
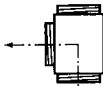
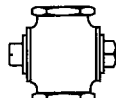
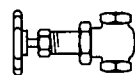
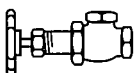
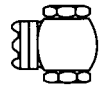



Table A.16 a) (Continued)

equivalent length values can be used with reasonable accuracy for copper or brass fittings and bends. For copper or brass valves, however, the equivalent length of pipe should be taken as 45% longer than the values in the table, which are for steel pipe. Resistance per foot of copper or brass pipe is less than that of steel.

Example of calculation: To obtain the total equivalent length, add to the actual length of pipe involved the length in feet to allow for various fittings as shown in this table. Thus, if the problem involves 300 ft of NPS 4 pipe having three standard 90° elbows and two plug valves, the total equivalent length will be as follows:

$300 + (3 \times 10.1) + (2 \times 10.1) = 350.5 \text{ ft}$

Table A.16 b)
Resistance of bends, fittings, and valves for natural gas and propane expressed in equivalent length of straight pipe in metres*

k factor	90° welding elbows and smooth bends‡										Welding tees
	Threaded fittings†					Valves (threaded, flanged, or welded)					
	Elbows										
	45°	90°	Tee	Plug	Globe	Angle	Swing check	R/d§ = 1-1/2	Forged	Mitre**	
	0.42	0.9	1.8	0.9	10	5	2.5	0.36	1.35	1.8	
n (L/D ratio††)	14	30	60	30	333	167	83	12	45	60	
Nominal pipe size, in (Schedule 40)	Inside diameter (d), mm										
3/8	12.52	0.18	0.37	0.75	0.37	4.18	2.09	1.04	0.15	0.56	0.75
1/2	15.80	0.22	0.47	0.94	0.47	5.27	2.64	1.29	0.19	0.71	0.94
3/4	20.93	0.29	0.63	1.26	0.63	6.98	3.47	1.74	0.25	0.94	1.26
1	26.64	0.37	0.80	1.60	0.80	8.87	4.45	2.22	0.32	1.20	1.60
1-1/4	35.05	0.49	1.05	2.10	1.05	11.67	5.82	2.92	0.42	1.58	2.10
1-1/2	40.89	0.49	1.23	2.45	1.23	13.62	6.83	3.41	0.49	1.84	2.45
2	52.50	0.73	1.58	3.14	1.58	17.50	8.75	4.39	0.63	2.36	3.14
2-1/2	62.71	0.88	1.88	3.75	1.88	20.88	10.45	5.21	0.75	2.82	3.75
3	77.93	1.09	2.34	4.66	2.34	25.97	12.98	6.49	0.94	3.51	4.66

(Continued)

(Continued)

Table A.16 b) (Continued)

Table A.16 b) (Continued)

equivalent length of pipe should be taken as 45% longer than the values in the table, which are for steel pipe. Resistance per metre of copper or brass pipe is less than that of steel.

Example of calculation: To obtain the total equivalent length, add to the actual length of pipe involved the length in metres to allow for various fittings as shown in this table. Thus, if the problem involves 100 m of NPS 4 pipe having three standard 90° elbows and two plug valves, the total equivalent length will be as follows:

$$100 + (3 \times 3.08) + (2 \times 3.08) = 115.4 \text{ m}$$

Table A.17
Use of capacity tables for sizing plastic pipe for natural gas and propane
 (See Clause 6.3.5.)

Nominal pipe size	Pipe inside diameters, in							
	Schedule 40 steel pipe		SDR 21 plastic pipe		SDR 13.5 plastic pipe		SDR 11 plastic pipe	
	Min	Max	Min	Max	Min	Max	Min	Max
1/2	0.64	0.67	0.68	0.72	0.62*	0.66*	0.61*	0.65*
3/4	0.83	0.87	0.83	0.88	0.83	0.88	0.81*	0.82*
1	1.07	1.1	1.09	1.14	1.08	1.13	1.02*	1.02*
1-1/4	1.4	1.43	1.44	1.49	1.37*	1.42*	1.3*	1.29*
1-1/2	1.63	1.66	1.67	1.73	1.57*	1.62*	1.48*	1.48*
2	2.1	2.14	2.1	2.15	1.98*	2.03*	1.89*	1.84*
2-1/2	2.5	2.55	2.55	2.61	2.39*	2.46*	2.29*	2.23*

* Denotes inside diameter of plastic pipe that may be less than the inside diameter of Schedule 40 steel pipe. The tables in this annex should be used only for sizing plastic pipe with inside diameters equal to or greater than steel pipe. Sometimes plastic pipe with inside diameters less than the inside diameter of Schedule 40 steel pipe sized using the tables in this annex does not supply gas at a sufficient volume and pressure. Plastic pipe with inside diameters less than the inside diameter of Schedule 40 steel pipe should be sized using the calculation method detailed in this annex.

Notes:

- 1) Dimensions of Schedule 40 steel pipe are derived from ASTM A53/A53M and ASME B36.10.
- 2) Dimensions of plastic pipe are derived from CSA B137.4.

