

CHIMNEYS AND VENTS

**TABLE 504.2(5)**  
**SINGLE-WALL METAL PIPE OR TYPE B ASBESTOS CEMENT VENT**

<b>Number of Appliances</b>	Single
<b>Appliance Type</b>	Draft hood equipped
<b>Appliance Vent Connection</b>	Connected directly to pipe or vent

HEIGHT (H) (feet)	LATERAL (L) (feet)	VENT DIAMETER—(D) inches							
		3	4	5	6	7	8	10	12
		MAXIMUM APPLIANCE INPUT RATING IN THOUSANDS OF BTU/H							
6	0	39	70	116	170	232	312	500	750
	2	31	55	94	141	194	260	415	620
	5	28	51	88	128	177	242	390	600
8	0	42	76	126	185	252	340	542	815
	2	32	61	102	154	210	284	451	680
	5	29	56	95	141	194	264	430	648
	10	24	49	86	131	180	250	406	625
10	0	45	84	138	202	279	372	606	912
	2	35	67	111	168	233	311	505	760
	5	32	61	104	153	215	289	480	724
	10	27	54	94	143	200	274	455	700
	15	NA	46	84	130	186	258	432	666
15	0	49	91	151	223	312	420	684	1,040
	2	39	72	122	186	260	350	570	865
	5	35	67	110	170	240	325	540	825
	10	30	58	103	158	223	308	514	795
	15	NA	50	93	144	207	291	488	760
	20	NA	NA	82	132	195	273	466	726
20	0	53	101	163	252	342	470	770	1,190
	2	42	80	136	210	286	392	641	990
	5	38	74	123	192	264	364	610	945
	10	32	65	115	178	246	345	571	910
	15	NA	55	104	163	228	326	550	870
	20	NA	NA	91	149	214	306	525	832
30	0	56	108	183	276	384	529	878	1,370
	2	44	84	148	230	320	441	730	1,140
	5	NA	78	137	210	296	410	694	1,080
	10	NA	68	125	196	274	388	656	1,050
	15	NA	NA	113	177	258	366	625	1,000
	20	NA	NA	99	163	240	344	596	960
	30	NA	NA	NA	NA	192	295	540	890
50	0	NA	120	210	310	443	590	980	1,550
	2	NA	95	171	260	370	492	820	1,290
	5	NA	NA	159	234	342	474	780	1,230
	10	NA	NA	146	221	318	456	730	1,190
	15	NA	NA	NA	200	292	407	705	1,130
	20	NA	NA	NA	185	276	384	670	1,080
	30	NA	NA	NA	NA	222	330	605	1,010

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 British thermal unit per hour = 0.2931 W.

TABLE 504.2(6) EXTERIOR MASONRY CHIMNEY

MINIMUM ALLOWABLE INPUT RATING OF SPACE-HEATING APPLIANCE IN THOUSANDS OF BTU PER HOUR									
VENT HEIGHT (feet)	Internal area of chimney (square inches)								
	12	19		28	38	50	63	78	113
37°F or Greater Local 99% Winter Design Temperature: 37°F or Greater									
6	0	0		0	0	0	0	0	0
8	0	0		0	0	0	0	0	0
10	0	0		0	0	0	0	0	0
15	NA	0		0	0	0	0	0	0
20	NA	NA		123	190	249	184	0	0
30	NA	NA		NA	NA	NA	393	334	0
50	NA	NA		NA	NA	NA	NA	NA	579
27 to 36°F Local 99% Winter Design Temperature: 27 to 36°F									
6	0	0		68	116	156	180	212	266
8	0	0		82	127	167	187	214	263
10	0	51		97	141	183	201	225	265
15	NA	NA		NA	NA	233	253	274	305
20	NA	NA		NA	NA	NA	307	330	362
30	NA	NA		NA	NA	NA	419	445	485
50	NA	NA		NA	NA	NA	NA	NA	763
17 to 26°F Local 99% Winter Design Temperature: 17 to 26°F									
6	NA	NA		NA	NA	NA	215	259	349
8	NA	NA		NA	NA	197	226	264	352
10	NA	NA		NA	NA	214	245	278	358
15	NA	NA		NA	NA	NA	296	331	398
20	NA	NA		NA	NA	NA	352	387	457
30	NA	NA		NA	NA	NA	NA	507	581
50	NA	NA		NA	NA	NA	NA	NA	NA
5 to 16°F Local 99% Winter Design Temperature: 5 to 16°F									
6	NA	NA		NA	NA	NA	NA	NA	416
8	NA	NA		NA	NA	NA	NA	312	423
10	NA	NA		NA	NA	NA	289	331	430
15	NA	NA		NA	NA	NA	NA	393	485
20	NA	NA		NA	NA	NA	NA	450	547
30	NA	NA		NA	NA	NA	NA	NA	682
50	NA	NA		NA	NA	NA	NA	NA	972
-10 to 4°F Local 99% Winter Design Temperature: -10 to 4°F									
6	NA	NA		NA	NA	NA	NA	NA	484
8	NA	NA		NA	NA	NA	NA	NA	494
10	NA	NA		NA	NA	NA	NA	NA	513
15	NA	NA		NA	NA	NA	NA	NA	586
20	NA	NA		NA	NA	NA	NA	NA	650
30	NA	NA		NA	NA	NA	NA	NA	805
50	NA	NA		NA	NA	NA	NA	NA	1,003
-11°F or Lower Local 99% Winter Design Temperature: -11°F or Lower									
Not recommended for any vent configurations									

For SI: °C = (°F - 32)/1.8, 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 British thermal unit per hour = 0.2931 W.

**Note:** See Figure B-19 in Appendix B for a map showing local 99-percent winter design temperatures in the United States.

**504.2.11 Vent connector size limitation.** Vent connectors shall not be increased in size more than two sizes greater than the listed appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter.

**504.2.12 Component commingling.** In a single run of vent or vent connector, different diameters and types of vent and connector components shall be permitted to be used, provided that all such sizes and types are permitted by the tables.

**504.2.13 Draft hood conversion accessories.** Draft hood conversion accessories for use with masonry chimneys venting listed Category I fan-assisted appliances shall be listed and installed in accordance with the manufacturer's installation instructions for such listed accessories.

**504.2.14 Table interpolation.** Interpolation shall be permitted in calculating capacities for vent dimensions that fall between the table entries (see Example 3, Appendix B).

**504.2.15 Extrapolation prohibited.** Extrapolation beyond the table entries shall not be permitted.

**504.2.16 Engineering calculations.** For vent heights less than 6 feet (1829 mm) and greater than shown in the tables, engineering methods shall be used to calculate vent capacities.

**504.2.17 Height entries.** Where the actual height of a vent falls between entries in the height column of the applicable table in Tables 504.2(1) through 504.2(6), either interpolation shall be used or the lower appliance input rating shown in the table entries shall be used for FAN MAX and NAT MAX column values and the higher appliance input rating shall be used for the FAN MIN column values.

**504.3 Application of multiple appliance vent Tables 504.3(1) through 504.3(7).** The application of Tables 504.3(1) through 504.3(7b) shall be subject to the requirements of Sections 504.3.1 through 504.3.2728.

**504.3.1 Vent obstructions.** These venting tables shall not be used where obstructions, as described in Section 503.15, are installed in the venting system. The installation of vents serving listed appliances with vent dampers shall be in accordance with the appliance manufacturer's instructions or in accordance with the following:

1. The maximum capacity of the vent connector shall be determined using the NAT Max column.
2. The maximum capacity of the vertical vent or chimney shall be determined using the FAN+NAT column when the second appliance is a fan-assisted appliance, or the NAT+NAT column when the second appliance is equipped with a draft hood.
3. The minimum capacity shall be determined as if the appliance were a fan-assisted appliance.
  - 3.1 The minimum capacity of the vent connector shall be determined using the FAN Min column.
  - 3.2 The FAN+FAN column shall be used where the second appliance is a fan-assisted appliance, and the FAN+NAT column shall be used where the second appliance is equipped with a draft hood, to determine whether the vertical vent or chimney configuration is not permitted (NA). Where the vent configuration is NA, the vent configuration shall not be permitted and an alternative venting configuration shall be utilized.

**504.3.2 Connector length limit.** The vent connector shall be routed to the vent utilizing the shortest possible route. Except as provided in Section 504.3.3, the maximum vent connector horizontal length shall be 1½ feet for each inch (457-18 mm per mm) of connector diameter as shown in Table 504.3.2.

**504.3.3 Connectors with longer lengths.** Connectors with longer horizontal lengths than those listed in Section 504.3.2 are permitted under the following conditions:

1. The maximum capacity (FAN Max or NAT Max) of the vent connector shall be reduced 10 percent for each additional multiple of the length allowed by Section 504.3.2. For example, the maximum length listed in Table 504.3.2 for a 4-inch (102 mm) connector is 6 feet (1829 mm). With a connector length greater than 6 feet (1829 mm) but not exceeding 12 feet (3658 mm), the maximum capacity must be reduced by 10 percent ( $0.90 \times$  maximum vent connector capacity). With a connector length greater than 12 feet (3658 mm) but not exceeding 18 feet (5486 mm), the maximum capacity must be reduced by 20 percent ( $0.80 \times$  maximum vent capacity).
2. For a connector serving a fan-assisted appliance, the minimum capacity (FAN Min) of the connector shall be determined by referring to the corresponding single appliance table. For Type B double-wall connectors, Table 504.2(1) shall be used. For single-wall connectors, Table 504.2(2) shall be used. The height ( $H$ ) and lateral ( $L$ ) shall be measured according to the procedures for a single-appliance vent, as if the other appliances were not present.

**TABLE 504.3.2  
MAXIMUM VENT CONNECTOR LENGTH**

CONNECTOR DIAMETER MAXIMUM (inches)	CONNECTOR HORIZONTAL LENGTH (feet)
3	4½
4	6
5	7½
6	9
7	10½
8	12
9	13½
10	15
12	18
14	21
16	24
18	27
20	30
22	33
24	36

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

**504.3.4 Vent connector manifold.** Where the vent connectors are combined prior to entering the vertical portion of the common vent to form a common vent manifold, the size of the common vent manifold and the common vent shall be determined by applying a 10-percent reduction ( $0.90 \times$  maximum common vent capacity) to the common

vent capacity part of the common vent tables. The length of the

common vent connector manifold ( $L_m$ ) shall not exceed 1½ feet for each inch (457–18 mm per mm) of common vent connector manifold diameter ( $D$ ) (see Figure B-11).

**504.3.5 Common vertical vent offset.** Where the common vertical vent is offset, the maximum capacity of the common vent shall be reduced in accordance with Section 504.3.6. The horizontal length of the common vent offset ( $L_o$ ) shall not exceed 1½ feet for each inch (457–18 mm per mm) of common vent diameter ( $D$ ). Where multiple offsets occur in a common vent, the total horizontal length of all offsets combined shall not exceed 1½ feet for each inch (18 mm per mm) of common vent diameter ( $D$ ).

**504.3.6 Elbows in vents.** For each elbow up to and including 45 degrees (0.79 rad) in the common vent, the maximum common vent capacity listed in the venting tables shall be reduced by 5 percent. For each elbow greater than 45 degrees (0.79 rad) up to and including 90 degrees (1.57 rad), the maximum common vent capacity listed in the venting tables shall be reduced by 10 percent.

**504.3.7 Elbows in connectors.** The vent connector capacities listed in the common vent sizing tables include allowance for two 90-degree (1.57 rad) elbows. For each additional elbow up to and including 45 degrees (0.79 rad), the maximum vent connector capacity listed in the venting tables shall be reduced by 5 percent. For each elbow greater than 45 degrees (0.79 rad) up to and including 90 degrees (1.57 rad), the maximum vent connector capacity listed in the venting tables shall be reduced by 10 percent.

**504.3.8 Common vent minimum size.** The cross-sectional area of the common vent shall be equal to or greater than the cross-sectional area of the largest connector.

**504.3.9 Common vent fittings.** At the point where tee or wye fittings connect to a common vent, the opening size of the fitting shall be equal to the size of the common vent. Such fittings shall not be prohibited from having reduced-size openings at the point of connection of appliance vent connectors.

**504.3.9.1 Tee and wye fittings.** Tee and wye fittings connected to a common vent shall be considered ~~as-to be~~ part of the common vent and shall be constructed of materials consistent with that of the common vent.

**504.3.10 High-altitude installations.** Sea-level input ratings shall be used when determining maximum capacity for high-altitude installation. Actual input (derated for altitude) shall be used for determining minimum capacity for high-altitude installation.

**504.3.11 Connector rise measurement.** Connector rise ( $R$ ) for each appliance connector shall be measured from the draft hood outlet or flue collar to the centerline where the vent gas streams come together.

**504.3.12 Vent height measurement.** For multiple appliances all located on one floor, available total height ( $H$ ) shall be measured from the highest draft hood outlet or flue collar up to the level of the outlet of the common vent.

**504.3.13 Multistory height measurement.** For multistory installations, available total height ( $H$ ) for each segment of the system shall be the vertical distance between the highest

draft hood outlet or flue collar entering that segment and the centerline of the next higher interconnection tee (~~see Figure B-13~~).

**504.3.14 Multistory lowest portion sizing.** The size of the lowest connector and of the vertical vent leading to the lowest interconnection of a multistory system shall be in accordance with Table 504.2(1) or 504.2(2) for available total height ( $H$ ) up to the lowest interconnection (~~see Figure B-13~~).

**504.3.15 Multistory common vents.** Where used in multistory systems, vertical common vents shall be Type B double wall and shall be installed with a listed vent cap.

**504.3.16 Multistory common vent offsets.** Offsets in multistory common vent systems shall be limited to a single offset in each system, and systems with an offset shall comply with all of the following:

1. The offset angle shall not exceed 45 degrees (0.79 rad) from vertical.
2. The horizontal length of the offset shall not exceed 1½ feet for each inch (457–18 mm per mm) of common vent diameter of the segment in which the offset is located.
3. For the segment of the common vertical vent containing the offset, the common vent capacity listed in the common venting tables shall be reduced by 20 percent (0.80 maximum common vent capacity).
4. A multistory common vent shall not be reduced in size above the offset.

**504.3.17 Vertical vent maximum size.** Where two or more appliances are connected to a vertical vent or chimney, the flow area of the largest section of vertical vent or chimney shall not exceed seven times the smallest listed appliance categorized vent areas, flue collar area, or draft hood outlet area unless designed in accordance with approved engineering methods.

**504.3.18 Multiple input rate appliances.** For appliances with more than one input rate, the minimum vent connector capacity (FAN Min) determined from the tables shall be less than the lowest appliance input rating, and the maximum vent connector capacity (FAN Max or NAT Max) determined from the tables shall be greater than the highest appliance input rating.

**504.3.19 Liner system sizing and connections.** Listed, corrugated metallic chimney liner systems in masonry chimneys shall be sized by using Table 504.3(1) or 504.3(2) for Type B vents, with the maximum capacity reduced by 20 percent (0.80 × maximum capacity) and the minimum capacity as shown in Table 504.3(1) or 504.3(2). Corrugated metallic liner systems installed with bends or offsets shall have their maximum capacity further reduced in accordance with Sections 504.3.5 and 504.3.6. The 20-percent reduction for corrugated metallic chimney liner systems includes an allowance for one long-radius 90-degree (1.57 rad) turn at the bottom of the liner. Where double-wall connectors are required, tee and wye fittings used to connect to the common vent chimney liner shall be listed double-wall fittings. Connections between chimney liners and listed double-wall fittings shall be made with listed adapter fittings designed for such purpose.

**504.3.20 Chimney and vent location.** Tables 504.3(1), 504.3(2), 504.3(3), 504.3(4) and 504.3(5) shall only be used for chimneys and vents not exposed to the outdoors below the roof line. A Type B vent or listed chimney lining system passing through an unused masonry chimney flue shall not be considered to be exposed to the outdoors.

Where vents extend outdoors above the roof more than 5 feet (1524mm) higher than required by Figure 503.6.5 and where vents terminate in accordance with Section 503.6.5, Item 2, the outdoor portion of the vent shall be enclosed as required by this section for vents not considered to be exposed to the outdoors or such venting system shall be engineered. A Type B vent shall not be considered to be exposed to the outdoors where it passes through an unventilated enclosure or chase insulated to a value of not less than R8.

Tables 504.3(6a), 504.3(6b), 504.3(7a) and 504.3(7b) shall be used for clay-tile-lined exterior masonry chimneys, provided all of the following conditions are met:

1. Vent connector is Type B double wall.
2. At least one appliance is draft hood equipped.
3. The combined appliance input rating is less than the maximum capacity given by Table 504.3(6a) for NAT+NAT or Table 504.3(7a) for FAN+NAT.
4. The input rating of each space-heating appliance is greater than the minimum input rating given by Table 504.3(6b) for NAT+NAT or Table 504.3(7b) for FAN+NAT.
5. The vent connector sizing is in accordance with Table 504.3(3).

~~Where these conditions cannot be met, an alternative venting design shall be used, such as a listed chimney lining system.~~

~~**Exception:** Vents serving listed appliances installed in accordance with the appliance manufacturer's installation instructions.~~

**504.3.21 Connector maximum and minimum size.** Vent connectors shall not be increased in size more than two sizes greater than the listed appliance categorized vent diameter, flue collar diameter, or draft hood outlet diameter. Vent connectors for draft hood-equipped appliances shall not be smaller than the draft hood outlet diameter. Where a vent connector size(s) determined from the tables for a fan-assisted appliance(s) is smaller than the flue collar diameter, the use of the smaller size(s) shall be permitted provided that the installation complies with all of the following conditions:

1. Vent connectors for fan-assisted appliance flue collars 12 inches (305 mm) in diameter or smaller are not reduced by more than one table size [e.g., 12 inches to 10 inches (305 mm to 254 mm) is a one-size reduction] and those larger than 12 inches (305 mm) in diameter are not reduced more than two table sizes [e.g., 24 inches to 20 inches (610 mm to 508 mm) is a two-size reduction].
2. The fan-assisted appliance(s) is common vented with a draft-hood-equipped appliances(s).
3. The vent connector has a smooth interior wall.

**504.3.22 Component commingling.** All ~~combinations~~ Combinations of pipe sizes, ~~and~~ single-wall and double-wall metal pipe shall be allowed within any connector run(s) or within the common vent, provided that all of the appropriate tables permit all of the desired sizes and types of pipe, as if they were used for the entire length of the subject connector or vent. Where single-wall and Type B double-wall metal pipes are used for vent connectors within the same venting system, the common vent must be sized using Table 504.3(2) or 504.3(4), as appropriate.

**504.3.23 Draft hood conversion accessories.** Draft hood conversion accessories for use with masonry chimneys

venting listed Category I fan-assisted appliances shall be listed and installed in accordance with the manufacturer's installation instructions for such listed accessories.

**504.3.24 Multiple sizes permitted.** Where a table permits more than one diameter of pipe to be used for a connector or vent, all the permitted sizes shall be permitted to be used.

**504.3.25 Table interpolation.** Interpolation shall be permitted in calculating capacities for vent dimensions that fall between table entries ~~(see Appendix B, Example 3).~~

**504.3.26 Extrapolation prohibited.** Extrapolation beyond the table entries shall not be permitted.

**504.3.27 Engineering calculations.** For vent heights less than 6 feet (1829 mm) and greater than shown in the tables, engineering methods shall be used to calculate vent capacities.

**504.3.28 Height entries.** Where the actual height of a vent falls between entries in the height column of the applicable table in Tables 504.3(1) through 504.3(7b), either interpolation shall be used or the lower appliance input rating shown in the table shall be used for FAN MAX and NAT MAX column values and the higher appliance input rating shall be used for the FAN MIN column values.

## SECTION 505 DIRECT-VENT, INTEGRAL VENT, MECHANICAL VENT AND VENTILATION/EXHAUST HOOD VENTING

**505.1 General.** The installation of direct-vent and integral vent appliances shall be in accordance with Section 503. Mechanical venting systems and exhaust hood venting systems shall be designed and installed in accordance with Section 503.

**505.1.1 Commercial cooking appliances vented by exhaust hoods.** Where commercial cooking appliances are vented by means of the Type I or II kitchen exhaust hood system that serves such appliances, the exhaust system shall be fan powered and the appliances shall be interlocked with the exhaust hood system to prevent appliance operation when the exhaust hood system is not operating. The method of interlock between the exhaust hood system and the appliance equipped with standing pilot burner ignition system shall not cause such pilots to be extinguished. Where a solenoid valve is installed in the gas piping as part of an interlock system, gas piping shall not be installed to bypass such valve. Dampers shall not be installed in the exhaust system.

**Exception:** An interlock between the cooking appliance(s) and the exhaust hood system shall not be required where heat sensors or other approved methods automatically activate the exhaust hood system when cooking operations occur.

## SECTION 506 FACTORY-BUILT CHIMNEYS

**506.1 Building heating appliances.** Factory-built chimneys for building heating appliances producing flue gases having a temperature not greater than 1,000°F (538°C), measured at the entrance to the chimney, shall be listed and labeled in accordance with UL 103 and shall be

installed and terminated in accordance with the manufacturer's installation instructions.

**506.2 Support.** Where factory-built chimneys are supported by structural members, such as joists and rafters, such members shall be designed to support the additional load.

**506.3 Medium-heat appliances.** Factory-built chimneys for medium-heat appliances producing flue gases having a temperature above 1,000°F (538°C), measured at the entrance to the chimney, shall be listed and labeled in accordance with UL 959 and shall be installed and terminated in accordance with the manufacturer's installation instructions.

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# CHIMNEYS AND VENTS

**TABLE 504.3(1)**  
**TYPE B DOUBLE-WALL VENT**

Number of Appliances	Two or more
Appliance Type	Category I
Appliance Vent Connection	Type B double-wall connector

## VENT CONNECTOR CAPACITY

VENT HEIGHT (H) (feet)	CONNECTOR RISE (R) (feet)	TYPE B DOUBLE-WALL VENT AND CONNECTOR DIAMETER—(D) inches																									
		3		4		5		6		7		8		9		10											
		APPLIANCE INPUT RATING LIMITS IN THOUSANDS OF BTU/H																									
		FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT		
		Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max		
6	1	22	37	26	35	66	46	46	106	72	58	164	104	77	225	142	92	296	185	109	376	237	128	466	289		
	2	23	41	31	37	75	55	48	121	86	60	183	124	79	253	168	95	333	220	112	424	282	131	526	345		
	3	24	44	35	38	81	62	49	132	96	62	199	139	82	275	189	97	363	248	114	463	317	134	575	386		
8	1	22	40	27	35	72	48	49	114	76	64	176	109	84	243	148	100	320	194	118	408	248	138	507	303		
	2	23	44	32	36	80	57	51	128	90	66	195	129	86	269	175	103	356	230	121	454	294	141	564	358		
	3	24	47	36	37	87	64	53	139	101	67	210	145	88	290	198	105	384	258	123	492	330	143	612	402		
10	1	22	43	28	34	78	50	49	123	78	65	189	113	89	257	154	106	341	200	125	436	257	146	542	314		
	2	23	47	33	36	86	59	51	136	93	67	206	134	91	282	182	109	374	238	128	479	305	149	596	372		
	3	24	50	37	37	92	67	52	146	104	69	220	150	94	303	205	111	402	268	131	515	342	152	642	417		
15	1	21	50	30	33	89	53	47	142	83	64	220	120	88	298	163	110	389	214	134	493	273	162	609	333		
	2	22	53	35	35	96	63	49	153	99	66	235	142	91	320	193	112	419	253	137	532	323	165	658	394		
	3	24	55	40	36	102	71	51	163	111	68	248	160	93	339	218	115	445	286	140	565	365	167	700	444		
20	1	21	54	31	33	99	56	46	157	87	62	246	125	86	334	171	107	436	224	131	552	285	158	681	347		
	2	22	57	37	34	105	66	48	167	104	64	259	149	89	354	202	110	463	265	134	587	339	161	725	414		
	3	23	60	42	35	110	74	50	176	116	66	271	168	91	371	228	113	486	300	137	618	383	164	764	466		
30	1	20	62	33	31	113	59	45	181	93	60	288	134	83	391	182	103	512	238	125	649	305	151	802	372		
	2	21	64	39	33	118	70	47	190	110	62	299	158	85	408	215	105	535	282	129	679	360	155	840	439		
	3	22	66	44	34	123	79	48	198	124	64	309	178	88	423	242	108	555	317	132	706	405	158	874	494		
50	1	19	71	36	30	133	64	43	216	101	57	349	145	78	477	197	97	627	257	120	797	330	144	984	403		
	2	21	73	43	32	137	76	45	223	119	59	358	172	81	490	234	100	645	306	123	820	392	148	1,014	478		
	3	22	75	48	33	141	86	46	229	134	61	366	194	83	502	263	103	661	343	126	842	441	151	1,043	538		
100	1	18	82	37	28	158	66	40	262	104	53	442	150	73	611	204	91	810	266	112	1,038	341	135	1,285	417		
	2	19	83	44	30	161	79	42	267	123	55	447	178	75	619	242	94	822	316	115	1,054	405	139	1,306	494		
	3	20	84	50	31	163	89	44	272	138	57	452	109	78	627	272	97	834	355	118	1,069	455	142	1,327	555		

## COMMON VENT CAPACITY

VENT HEIGHT (H) (feet)																						
	4			5			6			7			8			9			10			
	COMBINED APPLIANCE INPUT RATING IN THOUSANDS OF BTU/H																					
	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	
6	92	81	65	140	116	103	204	161	147	309	248	200	404	314	260	547	434	335	672	520	410	
8	101	90	73	155	129	114	224	178	163	339	275	223	444	348	290	602	480	378	740	577	465	
10	110	97	79	169	141	124	243	194	178	367	299	242	477	377	315	649	522	405	800	627	495	
15	125	112	91	195	164	144	283	228	206	427	352	280	556	444	365	753	612	465	924	733	565	
20	136	123	102	215	183	160	314	255	229	475	394	310	621	499	405	842	688	523	1,035	826	640	
30	152	138	118	244	210	185	361	297	266	547	459	360	720	585	470	979	808	605	1,209	975	740	
50	167	153	134	279	244	214	421	353	310	641	547	423	854	706	550	1,164	977	705	1,451	1,188	860	
100	175	163	NA	311	277	NA	489	421	NA	751	658	479	1,025	873	625	1,408	1,215	800	1,784	1,502	975	

(continued)

**TABLE 504.3(1)—continued**  
**TYPE B DOUBLE-WALL VENT**

<b>Number of Appliances</b>	Two or more
<b>Appliance Type</b>	Category I
<b>Appliance Vent Connection</b>	Type B double-wall connector

**VENT CONNECTOR CAPACITY**

VENT HEIGHT (H) (feet)	CONNECTOR RISE (R) (feet)	TYPE B DOUBLE-WALL VENT AND DIAMETER—(D) inches																					
		12		14		16		18		20		22		24									
		APPLIANCE INPUT RATING LIMITS IN THOUSANDS OF BTU/H																					
		FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	
Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max
6	2	174	764	496	223	1,046	653	281	1,371	853	346	1,772	1,080	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	180	897	616	230	1,231	827	287	1,617	1,081	352	2,069	1,370	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8	2	186	822	516	238	1,126	696	298	1,478	910	365	1,920	1,150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	192	952	644	244	1,307	884	305	1,719	1,150	372	2,211	1,460	471	2,737	1,800	560	3,319	2,180	662	3,957	2,590	
	6	198	1,050	772	252	1,445	1,072	313	1,902	1,390	380	2,434	1,770	478	3,018	2,180	568	3,665	2,640	669	4,373	3,130	
10	2	196	870	536	249	1,195	730	311	1,570	955	379	2,049	1,205	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	201	997	664	256	1,371	924	318	1,804	1,205	387	2,332	1,535	486	2,887	1,890	581	3,502	2,280	686	4,175	2,710	
	6	207	1,095	792	263	1,509	1,118	325	1,989	1,455	395	2,556	1,865	494	3,169	2,290	589	3,849	2,760	694	4,593	3,270	
15	2	214	967	568	272	1,334	790	336	1,760	1,030	408	2,317	1,305	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	221	1,085	712	279	1,499	1,006	344	1,978	1,320	416	2,579	1,665	523	3,197	2,060	624	3,881	2,490	734	4,631	2,960	
	6	228	1,181	856	286	1,632	1,222	351	2,157	1,610	424	2,796	2,025	533	3,470	2,510	634	4,216	3,030	743	5,035	3,600	
20	2	223	1,051	596	291	1,443	840	357	1,911	1,095	430	2,533	1,385	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	230	1,162	748	298	1,597	1,064	365	2,116	1,395	438	2,778	1,765	554	3,447	2,180	661	4,190	2,630	772	5,005	3,130	
	6	237	1,253	900	307	1,726	1,288	373	2,287	1,695	450	2,984	2,145	567	3,708	2,650	671	4,511	3,190	785	5,392	3,790	
30	2	216	1,217	632	286	1,664	910	367	2,183	1,190	461	2,891	1,540	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	223	1,316	792	294	1,802	1,160	376	2,366	1,510	474	3,110	1,920	619	3,840	2,365	728	4,861	2,860	847	5,606	3,410	
	6	231	1,400	952	303	1,920	1,410	384	2,524	1,830	485	3,299	2,340	632	4,080	2,875	741	4,976	3,480	860	5,961	4,150	
50	2	206	1,479	689	273	2,023	1,007	350	2,659	1,315	435	3,548	1,665	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	213	1,561	860	281	2,139	1,291	359	2,814	1,685	447	3,730	2,135	580	4,601	2,633	709	5,569	3,185	851	6,633	3,790	
	6	221	1,631	1,031	290	2,242	1,575	369	2,951	2,055	461	3,893	2,605	594	4,808	3,208	724	5,826	3,885	867	6,943	4,620	
100	2	192	1,923	712	254	2,644	1,050	326	3,490	1,370	402	4,707	1,740	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	4	200	1,984	888	263	2,731	1,346	336	3,606	1,760	414	4,842	2,220	523	5,982	2,750	639	7,254	3,330	769	8,650	3,950	
	6	208	2,035	1,064	272	2,811	1,642	346	3,714	2,150	426	4,968	2,700	539	6,143	3,350	654	7,453	4,070	786	8,892	4,810	

**COMMON VENT CAPACITY**

VENT HEIGHT (H) (feet)	TYPE B DOUBLE-WALL COMMON VENT DIAMETER—(D) inches																				
	12			14			16			18			20			22			24		
	COMBINED APPLIANCE INPUT RATING IN THOUSANDS OF BTU/H																				
	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT
6	900	696	588	1,284	990	815	1,735	1,336	1,065	2,253	1,732	1,345	2,838	2,180	1,660	3,488	2,677	1,970	4,206	3,226	2,390
8	994	773	652	1,423	1,103	912	1,927	1,491	1,190	2,507	1,936	1,510	3,162	2,439	1,860	3,890	2,998	2,200	4,695	3,616	2,680
10	1,076	841	712	1,542	1,200	995	2,093	1,625	1,300	2,727	2,113	1,645	3,444	2,665	2,030	4,241	3,278	2,400	5,123	3,957	2,920
15	1,247	986	825	1,794	1,410	1,158	2,440	1,910	1,510	3,184	2,484	1,910	4,026	3,133	2,360	4,971	3,862	2,790	6,016	4,670	3,400
20	1,405	1,116	916	2,006	1,588	1,290	2,722	2,147	1,690	3,561	2,798	2,140	4,548	3,552	2,640	5,573	4,352	3,120	6,749	5,261	3,800
30	1,658	1,327	1,025	2,373	1,892	1,525	3,220	2,558	1,990	4,197	3,326	2,520	5,303	4,193	3,110	6,539	5,157	3,680	7,940	6,247	4,480
50	2,024	1,640	1,280	2,911	2,347	1,863	3,964	3,183	2,430	5,184	4,149	3,075	6,567	5,240	3,800	8,116	6,458	4,500	9,837	7,813	5,475
100	2,569	2,131	1,670	3,732	3,076	2,450	5,125	4,202	3,200	6,749	5,509	4,050	8,597	6,986	5,000	10,681	8,648	5,920	13,004	10,499	7,200

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 British thermal unit per hour = 0.2931 W.



# CHIMNEYS AND VENTS

**TABLE 504.3(2)**  
**TYPE B DOUBLE-WALL VENT**

Number of Appliances	Two or more
Appliance Type	Category I
Appliance Vent Connection	Single-wall metal connector

## VENT CONNECTOR CAPACITY

VENT HEIGHT (H) (feet)	CONNECTOR RISE (R) (feet)	SINGLE-WALL METAL VENT CONNECTOR DIAMETER—(D) inches																									
		3		4		5		6		7		8		9		10											
		APPLIANCE INPUT RATING LIMITS IN THOUSANDS OF BTU/H																									
		FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT		
Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	
6	1	NA	NA	26	NA	NA	46	NA	NA	71	NA	NA	102	207	223	140	262	293	183	325	373	234	447	463	286		
	2	NA	NA	31	NA	NA	55	NA	NA	85	168	182	123	215	251	167	271	331	219	334	422	281	458	524	344		
	3	NA	NA	34	NA	NA	62	121	131	95	175	198	138	222	273	188	279	361	247	344	462	316	468	574	385		
8	1	NA	NA	27	NA	NA	48	NA	NA	75	NA	NA	106	226	240	145	285	316	191	352	403	244	481	502	299		
	2	NA	NA	32	NA	NA	57	125	126	89	184	193	127	234	266	173	293	353	228	360	450	292	492	560	355		
	3	NA	NA	35	NA	NA	64	130	138	100	191	208	144	241	287	197	302	381	256	370	489	328	501	609	400		
10	1	NA	NA	28	NA	NA	50	119	121	77	182	186	110	240	253	150	302	335	196	372	429	252	506	534	308		
	2	NA	NA	33	84	85	59	124	134	91	189	203	132	248	278	183	311	369	235	381	473	302	517	589	368		
	3	NA	NA	36	89	91	67	129	144	102	197	217	148	257	299	203	320	398	265	391	511	339	528	637	413		
15	1	NA	NA	29	79	87	52	116	138	81	177	214	116	238	291	158	312	380	208	397	482	266	556	596	324		
	2	NA	NA	34	83	94	62	121	150	97	185	230	138	246	314	189	321	411	248	407	522	317	568	646	387		
	3	NA	NA	39	87	100	70	127	160	109	193	243	157	255	333	215	331	438	281	418	557	360	579	690	437		
20	1	49	56	30	78	97	54	115	152	84	175	238	120	233	325	165	306	425	217	390	538	276	546	664	336		
	2	52	59	36	82	103	64	120	163	101	182	252	144	243	346	197	317	453	259	400	574	331	558	709	403		
	3	55	62	40	87	107	72	125	172	113	190	264	164	252	363	223	326	476	294	412	607	375	570	750	457		
30	1	47	60	31	77	110	57	112	175	89	169	278	129	226	380	175	296	497	230	378	630	294	528	779	358		
	2	51	62	37	81	115	67	117	185	106	177	290	152	236	397	208	307	521	274	389	662	349	541	819	425		
	3	54	64	42	85	119	76	122	193	120	185	300	172	244	412	235	316	542	309	400	690	394	555	855	482		
50	1	46	69	34	75	128	60	109	207	96	162	336	137	217	460	188	284	604	245	364	768	314	507	951	384		
	2	49	71	40	79	132	72	114	215	113	170	345	164	226	473	223	294	623	293	376	793	375	520	983	458		
	3	52	72	45	83	136	82	119	221	123	178	353	186	235	486	252	304	640	331	387	816	423	535	1,013	518		
100	1	45	79	34	71	150	61	104	249	98	153	424	140	205	585	192	269	774	249	345	993	321	476	1,236	393		
	2	48	80	41	75	153	73	110	255	115	160	428	167	212	593	228	279	788	299	358	1,011	383	490	1,259	469		
	3	51	81	46	79	157	85	114	260	129	168	433	190	222	603	256	289	801	339	368	1,027	431	506	1,280	527		

## COMMON VENT CAPACITY

VENT HEIGHT (H) (feet)	TYPE B DOUBLE-WALL COMMON VENT DIAMETER—(D) inches																				
	4			5			6			7			8			9			10		
	COMBINED APPLIANCE INPUT RATING IN THOUSANDS OF BTU/H																				
	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT
6	NA	78	64	NA	113	99	200	158	144	304	244	196	398	310	257	541	429	332	665	515	407
8	NA	87	71	NA	126	111	218	173	159	331	269	218	436	342	285	592	473	373	730	569	460
10	NA	94	76	163	137	120	237	189	174	357	292	236	467	369	309	638	512	398	787	617	487
15	121	108	88	189	159	140	275	221	200	416	343	274	544	434	357	738	599	456	905	718	553
20	131	118	98	208	177	156	305	247	223	463	383	302	606	487	395	824	673	512	1,013	808	626
30	145	132	113	236	202	180	350	286	257	533	446	349	703	570	459	958	790	593	1,183	952	723
50	159	145	128	268	233	208	406	337	296	622	529	410	833	686	535	1,139	954	689	1,418	1,157	838
100	166	153	NA	297	263	NA	469	398	NA	726	633	464	999	846	606	1,378	1,185	780	1,741	1,459	948

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 British thermal unit per hour = 0.2931 W.

**TABLE 504.3(3)**  
**MASONRY CHIMNEY**

<b>Number of Appliances</b>	Two or more
<b>Appliance Type</b>	Category I
<b>Appliance Vent Connection</b>	Type B double-wall connector

**VENT CONNECTOR CAPACITY**

VENT HEIGHT (H) (feet)	CONNECTOR RISE (R) (feet)	TYPE B DOUBLE-WALL VENT CONNECTOR DIAMETER—(D) inches																									
		3		4			5			6			7			8			9			10					
		APPLIANCE INPUT RATING LIMITS IN THOUSANDS OF BTU/H																									
		FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT		
Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	
6	1	24	33	21	39	62	40	52	106	67	65	194	101	87	274	141	104	370	201	124	479	253	145	599	319		
	2	26	43	28	41	79	52	53	133	85	67	230	124	89	324	173	107	436	232	127	562	300	148	694	378		
	3	27	49	34	42	92	61	55	155	97	69	262	143	91	369	203	109	491	270	129	633	349	151	795	439		
8	1	24	39	22	39	72	41	55	117	69	71	213	105	94	304	148	113	414	210	134	539	267	156	682	335		
	2	26	47	29	40	87	53	57	140	86	73	246	127	97	350	179	116	473	240	137	615	311	160	776	394		
	3	27	52	34	42	97	62	59	159	98	75	269	145	99	383	206	119	517	276	139	672	358	163	848	452		
10	1	24	42	22	38	80	42	55	130	71	74	232	108	101	324	153	120	444	216	142	582	277	165	739	348		
	2	26	50	29	40	93	54	57	153	87	76	261	129	103	366	184	123	498	247	145	652	321	168	825	407		
	3	27	55	35	41	105	63	58	170	100	78	284	148	106	397	209	126	540	281	147	705	366	171	893	463		
15	1	24	48	23	38	93	44	54	154	74	72	277	114	100	384	164	125	511	229	153	658	297	184	824	375		
	2	25	55	31	39	105	55	56	174	89	74	299	134	103	419	192	128	558	260	156	718	339	187	900	432		
	3	26	59	35	41	115	64	57	189	102	76	319	153	105	448	215	131	597	292	159	760	382	190	960	486		
20	1	24	52	24	37	102	46	53	172	77	71	313	119	98	437	173	123	584	239	150	752	312	180	943	397		
	2	25	58	31	39	114	56	55	190	91	73	335	138	101	467	199	126	625	270	153	805	354	184	1,011	452		
	3	26	63	35	40	123	65	57	204	104	75	353	157	104	493	222	129	661	301	156	851	396	187	1,067	505		
30	1	24	54	25	37	111	48	52	192	82	69	357	127	96	504	187	119	680	255	145	883	337	175	1,115	432		
	2	25	60	32	38	122	58	54	208	95	72	376	145	99	531	209	122	715	287	149	928	378	179	1,171	484		
	3	26	64	36	40	131	66	56	221	107	74	392	163	101	554	233	125	746	317	152	968	418	182	1,220	535		
50	1	23	51	25	36	116	51	51	209	89	67	405	143	92	582	213	115	798	294	140	1,049	392	168	1,334	506		
	2	24	59	32	37	127	61	53	225	102	70	421	161	95	604	235	118	827	326	143	1,085	433	172	1,379	558		
	3	26	64	36	39	135	69	55	237	115	72	435	80	98	624	260	121	854	357	147	1,118	474	176	1,421	611		
100	1	23	46	24	35	108	50	49	208	92	65	428	155	88	640	237	109	907	334	134	1,222	454	161	1,589	596		
	2	24	53	31	37	120	60	51	224	105	67	444	174	92	660	260	113	933	368	138	1,253	497	165	1,626	651		
	3	25	59	35	38	130	68	53	237	118	69	458	193	94	679	285	116	956	399	141	1,282	540	169	1,661	705		

**COMMON VENT CAPACITY**

VENT HEIGHT (H) (feet)	MINIMUM INTERNAL AREA OF MASONRY CHIMNEY FLUE (square inches)																							
	12			19			28			38			50			63			78			113		
	COMBINED APPLIANCE INPUT RATING IN THOUSANDS OF BTU/H																							
	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT
6	NA	74	25	NA	119	46	NA	178	71	NA	257	103	NA	351	143	NA	458	188	NA	582	246	1,041	853	NA
8	NA	80	28	NA	130	53	NA	193	82	NA	279	119	NA	384	163	NA	501	218	724	636	278	1,144	937	408
10	NA	84	31	NA	138	56	NA	207	90	NA	299	131	NA	409	177	606	538	236	776	686	302	1,226	1,010	454
15	NA	NA	36	NA	152	67	NA	233	106	NA	334	152	523	467	212	682	611	283	874	781	365	1,374	1,156	546
20	NA	NA	41	NA	NA	75	NA	250	122	NA	368	172	565	508	243	742	668	325	955	858	419	1,513	1,286	648
30	NA	NA	NA	NA	NA	NA	NA	270	137	NA	404	198	615	564	278	816	747	381	1,062	969	496	1,702	1,473	749
50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	620	328	879	831	461	1,165	1,089	606	1,905	1,692	922
100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	348	NA	NA	499	NA	NA	669	2,053	1,921	1,058

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>, 1 foot = 304.8 mm, 1 British thermal unit per hour = 0.2931 W.

# CHIMNEYS AND VENTS

**TABLE 504.3(4)  
MASONRY CHIMNEY**

Number of Appliances	Two or more
Appliance Type	Category I
Appliance Vent Connection	Single-wall metal connector

## VENT CONNECTOR CAPACITY

VENT HEIGHT (H) (feet)	CONNECTOR RISE (R) (feet)	SINGLE-WALL METAL VENT CONNECTOR DIAMETER—(D) inches																									
		3		4			5			6			7			8			9			10					
		APPLIANCE INPUT RATING LIMITS IN THOUSANDS OF BTU/H																									
		FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT	FAN		NAT		
Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	Min	Max	Max	
6	1	NA	NA	21	NA	NA	39	NA	NA	66	179	191	100	231	271	140	292	366	200	362	474	252	499	594	316		
	2	NA	NA	28	NA	NA	52	NA	NA	84	186	227	123	239	321	172	301	432	231	373	557	299	509	696	376		
	3	NA	NA	34	NA	NA	61	134	153	97	193	258	142	247	365	202	309	491	269	381	634	348	519	793	437		
8	1	NA	NA	21	NA	NA	40	NA	NA	68	195	208	103	250	298	146	313	407	207	387	530	263	529	672	331		
	2	NA	NA	28	NA	NA	52	137	139	85	202	240	125	258	343	177	323	465	238	397	607	309	540	766	391		
	3	NA	NA	34	NA	NA	62	143	156	98	210	264	145	266	376	205	332	509	274	407	663	356	551	838	450		
10	1	NA	NA	22	NA	NA	41	130	151	70	202	225	106	267	316	151	333	434	213	410	571	273	558	727	343		
	2	NA	NA	29	NA	NA	53	136	150	86	210	255	128	276	358	181	343	489	244	420	640	317	569	813	403		
	3	NA	NA	34	97	102	62	143	166	99	217	277	147	284	389	207	352	530	279	430	694	363	580	880	459		
15	1	NA	NA	23	NA	NA	43	129	151	73	199	271	112	268	376	161	349	502	225	445	646	291	623	808	366		
	2	NA	NA	30	92	103	54	135	170	88	207	295	132	277	411	189	359	548	256	456	706	334	634	884	424		
	3	NA	NA	34	96	112	63	141	185	101	215	315	151	286	439	213	368	586	289	466	755	378	646	945	479		
20	1	NA	NA	23	87	99	45	128	167	76	197	303	117	265	425	169	345	569	235	439	734	306	614	921	347		
	2	NA	NA	30	91	111	55	134	185	90	205	325	136	274	455	195	355	610	266	450	787	348	627	986	443		
	3	NA	NA	35	96	119	64	140	199	103	213	343	154	282	481	219	365	644	298	461	831	391	639	1,042	496		
30	1	NA	NA	24	86	108	47	126	187	80	193	347	124	259	492	183	338	665	250	430	864	330	600	1,089	421		
	2	NA	NA	31	91	119	57	132	203	93	201	366	142	269	518	205	348	699	282	442	908	372	613	1,145	473		
	3	NA	NA	35	95	127	65	138	216	105	209	381	160	277	540	229	358	729	312	452	946	412	626	1,193	524		
50	1	NA	NA	24	85	113	50	124	204	87	188	392	139	252	567	208	328	778	287	417	1,022	383	582	1,302	492		
	2	NA	NA	31	89	123	60	130	218	100	196	408	158	262	588	230	339	806	320	429	1,058	425	596	1,346	545		
	3	NA	NA	35	94	131	68	136	231	112	205	422	176	271	607	255	349	831	351	440	1,090	466	610	1,386	597		
100	1	NA	NA	23	84	104	49	122	200	89	182	410	151	243	617	232	315	875	328	402	1,181	444	560	1,537	580		
	2	NA	NA	30	88	115	59	127	215	102	190	425	169	253	636	254	326	899	361	415	1,210	488	575	1,570	634		
	3	NA	NA	34	93	124	67	133	228	115	199	438	188	262	654	279	337	921	392	427	1,238	529	589	1,604	687		

## COMMON VENT CAPACITY

VENT HEIGHT (H) (feet)	MINIMUM INTERNAL AREA OF MASONRY CHIMNEY FLUE (square inches)																							
	12			19			28			38			50			63			78			113		
	COMBINED APPLIANCE INPUT RATING IN THOUSANDS OF BTU/H																							
	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT	FAN +FAN	FAN +NAT	NAT +NAT
6	NA	NA	25	NA	118	45	NA	176	71	NA	255	102	NA	348	142	NA	455	187	NA	579	245	NA	846	NA
8	NA	NA	28	NA	128	52	NA	190	81	NA	276	118	NA	380	162	NA	497	217	NA	633	277	1,136	928	405
10	NA	NA	31	NA	136	56	NA	205	89	NA	295	129	NA	405	175	NA	532	234	171	680	300	1,216	1,000	450
15	NA	NA	36	NA	NA	66	NA	230	105	NA	335	150	NA	400	210	677	602	280	866	772	360	1,359	1,139	540
20	NA	NA	NA	NA	NA	74	NA	247	120	NA	362	170	NA	503	240	765	661	321	947	849	415	1,495	1,264	640
30	NA	NA	NA	NA	NA	NA	NA	NA	135	NA	398	195	NA	558	275	808	739	377	1,052	957	490	1,682	1,447	740
50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	612	325	NA	821	456	1,152	1,076	600	1,879	1,672	910
100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	494	NA	NA	663	2,006	1,885	1,046	

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>, 1 foot = 304.8 mm, 1 British thermal unit per hour = 0.2931 W.

**TABLE 504.3(5)**  
**SINGLE-WALL METAL PIPE OR TYPE ASBESTOS CEMENT VENT**

<b>Number of Appliances</b>	Two or more
<b>Appliance Type</b>	Draft hood-equipped
<b>Appliance Vent Connection</b>	Direct to pipe or vent

**VENT CONNECTOR CAPACITY**

TOTAL VENT HEIGHT (H) (feet)	CONNECTOR RISE (R) (feet)	VENT CONNECTOR DIAMETER—(D) inches					
		3	4	5	6	7	8
		MAXIMUM APPLIANCE INPUT RATING IN THOUSANDS OF BTU/H					
6-8	1	21	40	68	102	146	205
	2	28	53	86	124	178	235
	3	34	61	98	147	204	275
15	1	23	44	77	117	179	240
	2	30	56	92	134	194	265
	3	35	64	102	155	216	298
30 and up	1	25	49	84	129	190	270
	2	31	58	97	145	211	295
	3	36	68	107	164	232	321

**COMMON VENT CAPACITY**

TOTAL VENT HEIGHT (H) (feet)	COMMON VENT DIAMETER—(D) inches						
	4	5	6	7	8	10	12
	COMBINED APPLIANCE INPUT RATING IN THOUSANDS OF BTU/H						
6	48	78	111	155	205	320	NA
8	55	89	128	175	234	365	505
10	59	95	136	190	250	395	560
15	71	115	168	228	305	480	690
20	80	129	186	260	340	550	790
30	NA	147	215	300	400	650	940
50	NA	NA	NA	360	490	810	1,190

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 British thermal unit per hour = 0.2931 W.

# CHIMNEYS AND VENTS

**TABLE 504.3(6a)**  
**EXTERIOR MASONRY CHIMNEY**

<b>Number of Appliances</b>	Two or more
<b>Appliance Type</b>	NAT + NAT
<b>Appliance Vent Connection</b>	Type B double-wall connector

**Combined Appliance Maximum  
Input Rating in Thousands of Btu per Hour**

<b>VENT HEIGHT (feet)</b>	<b>INTERNAL AREA OF CHIMNEY (square inches)</b>							
	12	19	28	38	50	63	78	113
6	25	46	71	103	143	188	246	NA
8	28	53	82	119	163	218	278	408
10	31	56	90	131	177	236	302	454
15	NA	67	106	152	212	283	365	546
20	NA	NA	NA	NA	NA	325	419	648
30	NA	NA	NA	NA	NA	NA	496	749
50	NA	NA	NA	NA	NA	NA	NA	922
100	NA	NA	NA	NA	NA	NA	NA	NA

**TABLE 504.3(6b)**  
**EXTERIOR MASONRY CHIMNEY**

<b>Number of Appliances</b>	Two or more
<b>Appliance Type</b>	NAT + NAT
<b>Appliance Vent Connection</b>	Type B double-wall connector

**Minimum Allowable Input Rating of  
Space-heating Appliance in Thousands of Btu per Hour**

<b>VENT HEIGHT (feet)</b>	<b>INTERNAL AREA OF CHIMNEY (square inches)</b>							
	12	19	28	38	50	63	78	113
<b>37°F or Greater Local 99% Winter Design Temperature: 37°F or Greater</b>								
6	0	0	0	0	0	0	0	NA
8	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
15	NA	0	0	0	0	0	0	0
20	NA	NA	NA	NA	NA	184	0	0
30	NA	NA	NA	NA	NA	393	334	0
50	NA	NA	NA	NA	NA	NA	NA	579
100	NA	NA	NA	NA	NA	NA	NA	NA
<b>27 to 36°F Local 99% Winter Design Temperature: 27 to 36°F</b>								
6	0	0	68	NA	NA	180	212	NA
8	0	0	82	NA	NA	187	214	263
10	0	51	NA	NA	NA	201	225	265
15	NA	NA	NA	NA	NA	253	274	305
20	NA	NA	NA	NA	NA	307	330	362
30	NA	NA	NA	NA	NA	NA	445	485
50	NA	NA	NA	NA	NA	NA	NA	763
100	NA	NA	NA	NA	NA	NA	NA	NA

(continued)

**TABLE 504.3(6b)**  
**EXTERIOR MASONRY CHIMNEY—continued**

**Minimum Allowable Input Rating of  
Space-heating Appliance in Thousands of Btu per Hour**

<b>VENT HEIGHT (feet)</b>	<b>INTERNAL AREA OF CHIMNEY (square inches)</b>							
	12	19	28	38	50	63	78	113
<b>17 to 26°F Local 99% Winter Design Temperature: 17 to 26°F</b>								
6	NA	NA	NA	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA	NA	264	352
10	NA	NA	NA	NA	NA	NA	278	358
15	NA	NA	NA	NA	NA	NA	331	398
20	NA	NA	NA	NA	NA	NA	387	457
30	NA	NA	NA	NA	NA	NA	NA	581
50	NA	NA	NA	NA	NA	NA	NA	862
100	NA	NA	NA	NA	NA	NA	NA	NA
<b>5 to 16°F Local 99% Winter Design Temperature: 5 to 16°F</b>								
6	NA	NA	NA	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA	NA	NA	430
15	NA	NA	NA	NA	NA	NA	NA	485
20	NA	NA	NA	NA	NA	NA	NA	547
30	NA	NA	NA	NA	NA	NA	NA	682
50	NA	NA	NA	NA	NA	NA	NA	NA
100	NA	NA	NA	NA	NA	NA	NA	NA
<b>4°F or Lower Local 99% Winter Design Temperature: 4°F or Lower</b>								
<b>Not recommended for any vent configurations</b>								

For SI: °C = (°F - 32)/1.8, 1 inch = 25.4 mm, 1 square inch = 645.16 mm², 1 foot = 304.8 mm, 1 British thermal unit per hour = 0.2931 W.

**Note:** See Figure B-19 in Appendix B for a map showing local 99-percent winter design temperatures in the United States.

**TABLE 504.3(7a)**  
**EXTERIOR MASONRY CHIMNEY**

<b>Number of Appliances</b>	Two or more
<b>Appliance Type</b>	FAN + NAT
<b>Appliance Vent Connection</b>	Type B double-wall connector

**Combined Appliance Maximum Input Rating in Thousands of Btu per Hour**

VENT HEIGHT (feet)	INTERNAL AREA OF CHIMNEY (square inches)							
	12	19	28	38	50	63	78	113
6	74	119	178	257	351	458	582	853
8	80	130	193	279	384	501	636	937
10	84	138	207	299	409	538	686	1,010
15	NA	152	233	334	467	611	781	1,156
20	NA	NA	250	368	508	668	858	1,286
30	NA	NA	NA	404	564	747	969	1,473
50	NA	NA	NA	NA	NA	831	1,089	1,692
100	NA	NA	NA	NA	NA	NA	NA	1,921

**TABLE 504.3(7b)**  
**EXTERIOR MASONRY CHIMNEY**

<b>Number of Appliances</b>	Two or more
<b>Appliance Type</b>	FAN + NAT
<b>Appliance Vent Connection</b>	Type B double-wall connector

**Minimum Allowable Input Rating of Space-heating Appliance in Thousands of Btu per Hour**

VENT HEIGHT (feet)	INTERNAL AREA OF CHIMNEY (square inches)							
	12	19	28	38	50	63	78	113
<b>37°F or Greater Local 99% Winter Design Temperature: 37°F or Greater</b>								
6	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0
15	NA	0	0	0	0	0	0	0
20	NA	NA	123	190	249	184	0	0
30	NA	NA	NA	334	398	393	334	0
50	NA	NA	NA	NA	NA	714	707	579
100	NA	NA	NA	NA	NA	NA	NA	1,600
<b>27 to 36°F Local 99% Winter Design Temperature: 27 to 36°F</b>								
6	0	0	68	116	156	180	212	266
8	0	0	82	127	167	187	214	263
10	0	51	97	141	183	201	225	265
15	NA	111	142	183	233	253	274	305
20	NA	NA	187	230	284	307	330	362
30	NA	NA	NA	330	319	419	445	485
50	NA	NA	NA	NA	NA	672	705	763
100	NA	NA	NA	NA	NA	NA	NA	1,554

(continued)

**TABLE 504.3(7b)**  
**EXTERIOR MASONRY CHIMNEY—continued**

**Minimum Allowable Input Rating of Space-heating Appliance in Thousands of Btu per Hour**

VENT HEIGHT (feet)	INTERNAL AREA OF CHIMNEY (square inches)							
	12	19	28	38	50	63	78	113
<b>17 to 26°F Local 99% Winter Design Temperature: 17 to 26°F</b>								
6	0	55	99	141	182	215	259	349
8	52	74	111	154	197	226	264	352
10	NA	90	125	169	214	245	278	358
15	NA	NA	167	212	263	296	331	398
20	NA	NA	212	258	316	352	387	457
30	NA	NA	NA	362	429	470	507	581
50	NA	NA	NA	NA	NA	723	766	862
100	NA	NA	NA	NA	NA	NA	NA	1,669
<b>5 to 16°F Local 99% Winter Design Temperature: 5 to 16°F</b>								
6	NA	78	121	166	214	252	301	416
8	NA	94	135	182	230	269	312	423
10	NA	111	149	198	250	289	331	430
15	NA	NA	193	247	305	346	393	485
20	NA	NA	NA	293	360	408	450	547
30	NA	NA	NA	377	450	531	580	682
50	NA	NA	NA	NA	NA	797	853	972
100	NA	NA	NA	NA	NA	NA	NA	1,833
<b>-10 to 4°F Local 99% Winter Design Temperature: -10 to 4°F</b>								
6	NA	NA	145	196	249	296	349	484
8	NA	NA	159	213	269	320	371	494
10	NA	NA	175	231	292	339	397	513
15	NA	NA	NA	283	351	404	457	586
20	NA	NA	NA	333	408	468	528	650
30	NA	NA	NA	NA	NA	603	667	805
50	NA	NA	NA	NA	NA	NA	955	1,003
100	NA	NA	NA	NA	NA	NA	NA	NA
<b>-11°F or Lower Local 99% Winter Design Temperature: -11°F or Lower</b>								
<b>Not recommended for any vent configurations</b>								

For SI: °C = (°F - 32)/1.8, 1 inch = 25.4 mm, 1 square inch = 645.16 mm<sup>2</sup>, 1 foot = 304.8 mm, 1 British thermal unit per hour = 0.2931 W.

**Note:** See Figure B-19 in Appendix B for a map showing local 99-percent winter design temperatures in the United States.

## CHAPTER 6 SPECIFIC APPLIANCES

### User note:

*About this chapter: Similar to Chapter 9 of the International Mechanical Code®, Chapter 6 of this code addresses specific types of appliances in detail. Requirements include listing and labeling, installation, location, clearances, venting and exhausting, controls, support and combustion and ventilation air.*

### SECTION 601

#### GENERAL

**601.1 Scope.** This chapter shall govern the approval, design, installation, construction, maintenance, alteration and repair of the appliances and equipment specifically identified herein.

### SECTION 602 DECORATIVE APPLIANCES FOR INSTALLATION IN FIREPLACES

**602.1 General.** Decorative appliances for installation in approved solid fuel-burning fireplaces shall be tested in accordance with ANSI Z21.60/CSA 6.26 and shall be installed in accordance with the manufacturer's installation instructions. Manually lighted natural gas decorative appliances shall be tested in accordance with ANSI Z21.84.

**602.2 Flame safeguard device.** Decorative appliances for installation in approved solid fuel-burning fireplaces, with the exception of those tested in accordance with ANSI Z21.84, shall utilize a direct ignition device, an ignitor or a pilot flame to ignite the fuel at the main burner, and shall be equipped with a flame safeguard device. The flame safeguard device shall automatically shut off the fuel supply to a main burner or group of burners when the means of ignition of such burners becomes inoperative.

**602.3 Prohibited installations.** Decorative appliances for installation in fireplaces shall not be installed where prohibited by Section 303.3.

### SECTION 603 LOG LIGHTERS

**603.1 General.** Log lighters shall be tested in accordance with CSA 8 and installed in accordance with the manufacturer's installation instructions.

### SECTION 604 VENTED GAS FIREPLACES (DECORATIVE APPLIANCES)

**604.1 General.** Vented gas fireplaces shall be tested in accordance with ANSI Z21.50/CSA 2.22, shall be installed in accordance with the manufacturer's installation instructions and shall be designed and equipped as specified in Section 602.2.

**604.2 Access.** Panels, grilles and access doors that are required to be removed for normal servicing operations shall not be attached to the building.

### SECTION 605 VENTED GAS FIREPLACE HEATERS

**605.1 General.** Vented gas fireplace heaters shall be installed in accordance with the manufacturer's installation instructions,

shall be tested in accordance with ANSI Z21.88/CSA 2.33 and shall be designed and equipped as specified in Section 602.2.

### SECTION 606 INCINERATORS AND CREMATORIES

**606.1 General.** Incinerators and crematories shall be installed in accordance with the manufacturer's installation instructions.

### SECTION 607 COMMERCIAL-INDUSTRIAL INCINERATORS

**607.1 Incinerators, commercial industrial.** Commercial-industrial-type incinerators shall be constructed and installed in accordance with NFPA 82.

### SECTION 608 VENTED WALL FURNACES

**608.1 General.** Vented wall furnaces shall be tested in accordance with ANSI Z21.86/CSA 2.32 and shall be installed in accordance with the manufacturer's installation instructions.

**608.2 Venting.** Vented wall furnaces shall be vented in accordance with Section 503.

**608.3 Location.** Vented wall furnaces shall be located so as not to cause a fire hazard to walls, floors, combustible furnishings or doors. Vented wall furnaces installed between bathrooms and adjoining rooms shall not circulate air from bathrooms to other parts of the building.

**608.4 Door swing.** Vented wall furnaces shall be located so that a door cannot swing within 12 inches (305 mm) of an air inlet or air outlet of such furnace measured at right angles to the opening. Doorstops or door closers shall not be installed to obtain this clearance.

**608.5 Ducts prohibited.** Ducts shall not be attached to wall furnaces. Casing extension boots shall not be installed unless listed as part of the appliance.

**608.6 Access.** Vented wall furnaces shall be provided with access for cleaning of heating surfaces, removal of burners, replacement of sections, motors, controls, filters and other working parts, and for adjustments and lubrication of parts requiring such attention. Panels, grilles and access doors that are required to be removed for normal servicing operations shall not be attached to the building construction.

### SECTION 609 FLOOR FURNACES

**609.1 General.** Floor furnaces shall be tested in accordance with ANSI Z21.86/CSA 2.32 and shall be installed in accordance with the manufacturer's installation instructions.

**609.2 Placement.** The following provisions apply to floor furnaces:

1. Floors. Floor furnaces shall not be installed in the floor of any doorway, stairway landing, aisle or passageway of any enclosure, public or private, or in an exit way from any such room or space.
2. Walls and corners. The register of a floor furnace with a horizontal warm-air outlet shall not be placed closer than 6 inches (152 mm) to the nearest wall. A distance of at least 18 inches (457 mm) from two adjoining sides of the floor furnace register to walls shall be provided to eliminate the necessity of occupants walking over the warm-air discharge. The remaining sides shall be permitted to be placed not closer than 6 inches (152 mm) to a wall. Wall-register models shall not be placed closer than 6 inches (152 mm) to a corner.
3. Draperies. The furnace shall be placed so that a door, drapery or similar object cannot be nearer than 12 inches (305 mm) to any portion of the register of the furnace.
4. Floor construction. Floor furnaces shall not be installed in concrete floor construction built on grade.
5. Thermostat. The controlling thermostat for a floor furnace shall be located within the same room or space as the floor furnace or shall be located in an adjacent room or space that is permanently open to the room or space containing the floor furnace.

**609.3 Bracing.** The floor around the furnace shall be braced and headed with a support framework designed in accordance with the *Arkansas Fire Prevention Code*.

**609.4 Clearance.** The lowest portion of the floor furnace shall have not less than a 6-inch (152 mm) clearance from the grade level; except where the lower 6-inch (152 mm) portion of the floor furnace is sealed by the manufacturer to prevent entrance of water, the minimum clearance shall be not less than 2 inches (51 mm). Where such clearances cannot be provided, the ground below and to the sides shall be excavated to form a pit under the furnace so that the required clearance is provided beneath the lowest portion of the furnace. A 12-inch (305 mm) minimum clearance shall be provided on all sides except the control side, which shall have an 18-inch (457 mm) minimum clearance.

**609.5 First floor installation.** Where the basement story level below the floor in which a floor furnace is installed is utilized as habitable space, such floor furnaces shall be enclosed as specified in Section 609.6 and shall project into a nonhabitable space.

**609.6 Upper floor installations.** Floor furnaces installed in upper stories of buildings shall project below into nonhabitable space and shall be separated from the nonhabitable space by an enclosure constructed of noncombustible materials. The floor furnace shall be provided with access, clearance to all sides and bottom of not less than 6 inches (152 mm) and combustion air in accordance with Section 304.

## **SECTION 610 (AFGC) DUCT FURNACES**

**610.1 General.** Duct furnaces shall be tested in accordance with ANSI Z83.8/CSA 2.6 or UL 795 and shall be installed in accordance with the manufacturer's installation instructions.

**610.2 Access panels.** Ducts connected to duct furnaces shall have removable access panels on both the upstream and downstream sides of the furnace.

**610.3 Location of draft hood and controls.** The controls, combustion air inlets and draft hoods for duct furnaces shall be located outside of the ducts. The draft hood shall be located in the same enclosure from which combustion air is taken.

**610.4 Circulating air.** Where a duct furnace is installed so that supply ducts convey air to areas outside the space containing the furnace, the return air shall also be conveyed by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

The duct furnace shall be installed on the positive pressure side of the circulating air blower.

## **SECTION 611 (AFGC) NONRECIRCULATING DIRECT-FIRED INDUSTRIAL AIR HEATERS**

**611.1 General.** Nonrecirculating direct-fired industrial air heaters shall be listed to ANSI Z83.4/CSA 3.7 and shall be installed in accordance with the manufacturer's instructions.

**611.2 Installation.** Nonrecirculating direct-fired industrial air heaters shall not be used to supply any area containing sleeping quarters. Nonrecirculating direct-fired industrial air heaters shall be installed only in industrial or commercial occupancies. Nonrecirculating direct-fired industrial air heaters shall be permitted to provide ventilation air.

**611.3 Clearance from combustible materials.** Nonrecirculating direct-fired industrial air heaters shall be installed with a clearance from combustible materials of not less than that shown on the rating plate and in the manufacturer's instructions.

**611.4 Supply air.** All air handled by a nonrecirculating direct-fired industrial air heater, including combustion air, shall be ducted directly from the outdoors.

**611.5 Outdoor air louvers.** If outdoor air louvers of either the manual or automatic type are used, such devices shall be proven to be in the open position prior to allowing the main burners to operate.

**611.6 Atmospheric vents and gas reliefs or bleeds.** Nonrecirculating direct-fired industrial air heaters with valve train components equipped with atmospheric vents or gas reliefs or bleeds shall have their atmospheric vent lines or gas reliefs or bleeds lead to the outdoors. Means shall be employed on these lines to prevent water from entering and to prevent blockage by insects and foreign matter. An atmospheric vent line shall not be required to be provided on a valve train component equipped with a listed vent limiter.

**611.7 Relief opening.** The design of the installation shall include provisions to permit nonrecirculating direct-fired industrial air heaters to operate at rated capacity without overpressurizing the space served by the heaters by taking into account the structure's designed infiltration rate, providing properly designed relief openings or an interlocked power exhaust system, or a combination of these methods. The structure's designed infiltration rate and the size of relief openings shall be determined by approved engineering methods. Relief openings shall be permitted to be louvers or counterbalanced gravity dampers. Motorized dampers or closable louvers shall be permitted to be used, provided they are verified to be in their full open position prior to main burner operation.



**611.8 Access.** Nonrecirculating direct-fired industrial air heaters shall be provided with access for removal of burners; replacement of motors, controls, filters and other working parts; and for adjustment and lubrication of parts requiring maintenance.

**611.9 Purging.** Inlet ducting, where used, shall be purged by not less than four air changes prior to an ignition attempt.

#### **SECTION 612 (AFGC)** **RECIRCULATING DIRECT-FIRED INDUSTRIAL** **AIR HEATERS**

**612.1 General.** Recirculating direct-fired industrial air heaters shall be listed to ANSI Z83.18 and shall be installed in accordance with the manufacturer's installation instructions.

**612.2 Location.** Recirculating direct-fired industrial air heaters shall be installed only in industrial and commercial occupancies. Recirculating direct-fired air heaters shall not serve any area containing sleeping quarters. Recirculating direct-fired industrial air heaters shall not be installed in hazardous locations or in buildings that contain flammable solids, liquids or gases, explosive materials or substances that can become toxic when exposed to flame or heat.

**612.3 Installation.** Direct-fired industrial air heaters shall be permitted to be installed in accordance with their listing and the manufacturer's instructions. Direct-fired industrial air heaters shall be installed only in industrial or commercial occupancies. Direct-fired industrial air heaters shall be permitted to provide fresh air ventilation.

**612.4 Clearance from combustible materials.** Direct-fired industrial air heaters shall be installed with a clearance from combustible material of not less than that shown on the label and in the manufacturer's instructions.

**612.5 Air supply.** Air to direct-fired industrial air heaters shall be taken from the building, ducted directly from outdoors, or a combination of both. Direct-fired industrial air heaters shall incorporate a means to supply outside ventilation air to the space at a rate of not less than 4 cubic feet per minute per 1,000 Btu per hour (0.38 m<sup>3</sup> per min per kW) of rated input of the heater. If a separate means is used to supply ventilation air, an interlock shall be provided so as to lock out the main burner operation until the mechanical means is verified. Where outside air dampers or closing louvers are used, they shall be verified to be in the open position prior to main burner operation.

**612.6 Atmospheric vents, gas reliefs or bleeds.** Direct-fired industrial air heaters with valve train components equipped with atmospheric vents, gas reliefs or bleeds shall have their atmospheric vent lines and gas reliefs or bleeds lead to the out- doors.

Means shall be employed on these lines to prevent water from entering and to prevent blockage by insects and foreign matter. An atmospheric vent line shall not be required to be provided on a valve train component equipped with a listed vent limiter.

**612.7 Relief opening.** The design of the installation shall include adequate provision to permit direct-fired industrial air heaters to operate at rated capacity by taking

into account the structure's designed infiltration rate, providing properly designed relief openings or an interlocked power exhaust system, or a combination of these methods. The structure's designed infiltration rate and the size of relief openings shall be determined by approved engineering methods. Relief openings shall be permitted to be louvers or counterbalanced gravity dampers. Motorized dampers or closable louvers shall be permitted to be used, provided they are verified to be in their full open position prior to main burner operation.

#### **SECTION 613** **Deleted**

#### **SECTION 614** **Deleted**

#### **SECTION 615** **SAUNA** **HEATERS**

**615.1 General.** Sauna heaters shall be installed in accordance with the manufacturer's installation instructions.

**615.2 Location and protection.** Sauna heaters shall be located so as to minimize the possibility of accidental contact by a person in the room.

**615.2.1 Guards.** Sauna heaters shall be protected from accidental contact by an approved guard or barrier of material having a low coefficient of thermal conductivity. The guard shall not substantially affect the transfer of heat from the heater to the room.

**615.3 Access.** Panels, grilles and access doors that are required to be removed for normal servicing operations shall not be attached to the building.

**615.4 Combustion and dilution air intakes.** Sauna heaters of other than the direct-vent type shall be installed with the draft hood and combustion air intake located outside the sauna room. Where the combustion air inlet and the draft hood are in a dressing room adjacent to the sauna room, there shall be provisions to prevent physically blocking the combustion air inlet and the draft hood inlet, and to prevent physical contact with the draft hood and vent assembly, or warning notices shall be posted to avoid such contact. Any warning notice shall be easily readable, shall contrast with its background and the wording shall be in letters not less than 1/4 inch (6.4 mm) high.

**615.5 Combustion and ventilation air.** Combustion air shall not be taken from inside the sauna room. Combustion and ventilation air for a sauna heater not of the direct-vent type shall be provided to the area in which the combustion air inlet and draft hood are located in accordance with Section 304.

**615.6 Heat and time controls.** Sauna heaters shall be equipped with a thermostat which will limit room temperature to 194°F (90°C). If the thermostat is not an integral part of the sauna heater, the heat-sensing element shall be located within 6 inches (152 mm) of the ceiling. If the heat-sensing element is a capillary tube and bulb, the assembly shall be attached to the wall or other support, and shall be protected against physical damage.

**615.6.1 Timers.** A timer, if provided to control main burner operation, shall have a maximum operating time of 1 hour. The control for the timer shall be located outside the sauna room.

**615.7 Sauna room.** A ventilation opening into the sauna room shall be provided. The opening shall be not less than 4 inches by 8 inches (102 mm by 203 mm) located near the top of the door into the sauna room.

**615.7.1 Warning notice.** The following permanent notice, constructed of approved material, shall be mechanically attached to the sauna room on the outside:

WARNING: DO NOT EXCEED 30 MINUTES IN SAUNA. EXCESSIVE EXPOSURE CAN BE HARMFUL TO HEALTH. ANY PERSON WITH POOR HEALTH SHOULD CONSULT A PHYSICIAN BEFORE USING SAUNA.

The words shall contrast with the background and the wording shall be in letters not less than  $\frac{1}{4}$  inch (6.4 mm) high.

**Exception:** This section shall not apply to one and two-family dwellings.

#### **SECTION 616 (AFGC) ENGINE AND GAS TURBINE- POWERED EQUIPMENT**

**616.1 Powered equipment.** Permanently installed equipment powered by internal combustion engines and turbines shall be installed in accordance with the manufacturer's installation instructions and NFPA 37. Stationary engine generator assemblies shall meet the requirements of UL 2200.

**616.2 Gas supply connection.** Equipment powered by internal combustion engines and turbines shall not be rigidly connected to the gas supply piping.

#### **SECTION 617 (AFGC) POOL AND SPA HEATERS**

**617.1 General.** Pool and spa heaters shall be tested in accordance with ANSI Z21.56/CSA 4.7 and shall be installed in accordance with the manufacturer's installation instructions.

#### **SECTION 618 (AFGC) FORCED-AIR WARM-AIR FURNACES**

**618.1 General.** Forced-air warm-air furnaces shall be tested in accordance with ANSI Z21.47/CSA 2.3 or UL 795 and shall be installed in accordance with the manufacturer's installation instructions.

~~**618.2 Forced-air furnaces.** The minimum unobstructed total area of the outside and return air ducts or openings to a forced-air warm-air furnace shall be not less than 2 square inches for each 1,000 Btu/h (4402 mm<sup>2</sup>/W) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions. The minimum unobstructed total area of supply ducts from a forced-air warm-air furnace shall be not less than 2 square inches for each 1,000 Btu/h (4402 mm<sup>2</sup>/W) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions.~~

~~**Exception:** The total area of the supply air ducts and outside and return air ducts shall not be required to be larger than the minimum size required by the furnace manufacturer's installation instructions.~~

~~**618.3-2 Dampers.** Volume dampers shall not be placed in the air inlet to a furnace in a manner that will reduce the required air to the furnace.~~

~~**618.4 Circulating air ducts for forced-air warm-air furnaces.** Circulating air for fuel-burning, forced-air type, warm-air furnaces shall be conducted into the blower housing from outside the furnace enclosure by continuous air-tight ducts.~~

~~**618.5-3 Prohibited sources.** Outside or return air for a forced-air heating system shall not be taken from the following locations:~~

- ~~1. Closer than 10 feet (3048 mm) from an appliance vent outlet, a vent opening from a plumbing drainage system or the discharge outlet of an exhaust fan, unless the outlet is 3 feet (914 mm) above the outside air inlet.~~
- ~~2. Where there is the presence of objectionable odors, fumes or flammable vapors; or where located less than 10 feet (3048mm) above the surface of any abutting public way or driveway; or where located at grade level by a sidewalk, street, alley or driveway.~~
- ~~3. A hazardous or insanitary location or a refrigeration machinery room as defined in the Arkansas International Mechanical Code.~~
- ~~4. A room or space, the volume of which is less than 25 per cent of the entire volume served by such system. Where connected by a permanent opening having an area sized in accordance with Section 618.2, adjoining rooms or spaces shall be considered as a single room or space for the purpose of determining the volume of such rooms or spaces.~~

~~**Exception:** The minimum volume requirement shall not apply where the amount of return air taken from a room or space is less than or equal to the amount of supply air delivered to such room or space.~~

- ~~5. A room or space containing an appliance where such a room or space serves as the sole source of return air.~~

~~**Exception:** This shall not apply where:~~

- ~~1. The appliance is a direct-vent appliance or an appliance not requiring a vent in accordance with Section 501.8.~~
- ~~2. The room or space complies with the following requirements:~~
  - ~~2.1. The return air shall be taken from a room or space having a volume exceeding 1 cubic foot for each 10 Btu/h (9.6 L/W) of combined input rating of all fuel-burning appliances therein.~~
  - ~~2.2. The volume of supply air discharged back into the same space shall be approximately equal to the volume of return air taken from the space.~~
  - ~~2.3. Return air inlets shall not be located within 10 feet (3048 mm) of any appliance firebox or draft hood in the same room or space.~~

3. Rooms or spaces containing solid fuel-burning appliances, provided that return-air inlets are located not less than 10 feet (3048 mm) from the firebox of such appliances.
6. A closet, bathroom, toilet room, kitchen, garage, ~~mechanical room~~, boiler room ~~or~~ furnace room or unconditioned attic.

Exceptions:

1. Where return air intakes are located not less than 10 feet (3048 mm) from cooking appliances and serve only the kitchen area, taking return air from a kitchen area shall not be prohibited.
2. Dedicated forced air systems serving only a garage shall not be prohibited from obtaining return air from the garage.
3. A crawl space by means of direct connection to the return side of a forced-air system. Transfer openings in the crawl space enclosure shall not be prohibited.

**618.46-Screen.** Required outdoor air inlets for residential portions of a building shall be covered with a screen having 1/4-inch (6.4 mm) openings. Required outdoor air inlets serving a non-residential portion of a building shall be covered with screen having openings larger than 1/4 inch (6.4 mm) and not larger than 1 inch (25 mm).

**618.57 Return-air limitation.** Return air from one dwelling unit shall not be discharged into another dwelling unit.

618.6 Furnace plenums and air ducts. Where a furnace is installed so that supply ducts carry air circulated by the furnace to areas outside of the space containing the furnace, the return air shall be handled by a duct(s) sealed to the furnace casing and terminating outside of the space containing the furnace.

## SECTION 619 CONVERSION BURNERS

**619.1 Conversion burners.** The installation of conversion burners shall conform to ANSI Z21.8.

## SECTION 620 UNIT HEATERS

**620.1 General.** Unit heaters shall be tested in accordance with ANSI Z83.8/CSA 2.6 and shall be installed in accordance with the manufacturer's installation instructions.

**620.2 Support.** Suspended-type unit heaters shall be supported by elements that are designed and constructed to accommodate the weight and dynamic loads. Hangers and brackets shall be of noncombustible material.

**620.3 Ductwork.** Ducts shall not be connected to a unit heater unless the heater is listed for such installation.

**620.4 Clearance.** Suspended-type unit heaters shall be installed with clearances to combustible materials of not less than 18 inches (457 mm) at the sides, 12 inches (305 mm) at the bottom and 6 inches (152 mm) above the top where the unit heater has an internal draft hood or 1 inch (25 mm) above the top of the sloping side of the vertical draft hood.

Floor-mounted-type unit heaters shall be installed with clearances to combustible materials at the back and one side only of not less than 6 inches (152 mm). Where the flue gases are vented horizontally, the 6-

inch (152 mm) clearance shall be measured from the draft hood or vent instead of the rear wall of the unit heater. Floor-mounted-type unit heaters shall not be installed on combustible floors unless listed for such installation.

Clearances for servicing all unit heaters shall be in accordance with the manufacturer's installation instructions.

**Exception:** Unit heaters listed for reduced clearance shall be permitted to be installed with such clearances in accordance with their listing and the manufacturer's instructions.

620.5 Installation in commercial garages and air-craft hangars. Unit heaters installed in garages for more than three motor vehicles or in aircraft hangars shall be installed in accordance with Sections 305.9, 305.10 and 305.11.

## SECTION 621 UNVENTED ROOM HEATERS

**621.1 General.** Unvented room heaters shall be tested in accordance with ANSI Z21.11.2 and shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions. ~~Unvented room heaters utilizing fuels other than fuel gas shall be regulated by this code.~~

**621.2 Prohibited use.** Except as provided for in Section 102.2 of the *Arkansas Fuel Gas Code*, one or more unvented room heaters shall not be used as the sole source of comfort heating in a unit.

**621.3 Input rating.** Unvented room heaters shall not have an input rating in excess of 40,000 Btu/h (11.7 kW).

**621.4 Prohibited locations.** Unvented room heaters shall not be installed within occupancies in Groups A, E and I. The location of unvented room heaters shall also comply with Section 303.3. Unvented room heaters in bathrooms shall have an input rating of 6,000 Btu/h (1.76 kW) or less. Unvented room heaters in bedrooms shall have an input rating of 10,000 Btu/h (2.96 kW) or less.

**621.5 Room or space volume.** The aggregate input rating of all unvented appliances installed in a room or space shall not exceed 20 Btu/h per cubic foot (207 W/m<sup>3</sup>) of volume of such room or space. Where the room or space in which the equipment is installed is directly connected to another room or space by a doorway, archway or other opening of comparable size that cannot be closed, the volume of such adjacent room or space shall be permitted to be included in the calculations.

**621.6 Oxygen-depletion safety system.** Unvented room heaters shall be equipped with an oxygen-depletion-sensitive safety shutoff system. The system shall shut off the gas supply to the main and pilot burners when the oxygen in the surrounding atmosphere is depleted to the percent concentration specified by the manufacturer, but not lower than 18 percent. The system shall not incorporate field adjustment means capable of changing the set point at which the system acts to shut off the gas supply to the room heater.

**621.7 Unvented decorative room heaters.** An unvented decorative room heater shall not be installed in a factory-built fireplace unless the fireplace system has been specifically tested, listed and labeled for such use in accordance with UL 127.

**621.7.1 Ventless firebox enclosures.** Ventless firebox enclosures used with unvented decorative room heaters shall be listed as complying with ANSI Z21.91.

## SECTION 622 VENTED ROOM HEATERS

**622.1 General.** Vented room heaters shall be tested in accordance with ANSI Z21.86/CSA 2.32, shall be designed and equipped as specified in Section 602.2 and shall be installed in accordance with the manufacturer's installation instructions.

## SECTION 623 COOKING APPLIANCES

**623.1 Cooking appliances.** Cooking appliances that are designed for permanent installation, including ranges, ovens, stoves, broilers, grills, fryers, griddles, hot plates and barbecues, shall be tested in accordance with ANSI Z21.1, ANSI Z21.58/CSA 1.6 or ANSI Z83.11/CSA 1.8 and shall be installed in accordance with the manufacturer's installation instructions.

**623.2 Prohibited location.** Cooking appliances designed, tested, listed and labeled for use in commercial occupancies shall not be installed within dwelling units or within any area where domestic cooking operations occur.

### Exceptions:

1. Appliances that are also listed as domestic cooking appliances.
2. Where the installation is designed by a licensed Professional Engineer, in compliance with the manufacturer's installation instructions.

**623.3 Domestic appliances.** Cooking appliances installed within dwelling units and within areas where domestic cooking operations occur shall be listed and labeled as household-type appliances for domestic use.

**623.4 Domestic range installation.** Domestic ranges installed on combustible floors shall be set on their own bases or legs and shall be installed with clearances of not less than that shown on the label.

**623.5 Open-top broiler unit hoods.** A ventilating hood shall be provided above a domestic open-top broiler unit, unless otherwise listed for forced down draft ventilation.

**623.5.1 Clearances.** A minimum clearance of 24 inches (610 mm) shall be maintained between the cooking top and combustible material above the hood. The hood shall be at least as wide as the open-top broiler unit and be centered over the unit.

**623.6 Commercial cooking appliance venting.** Commercial cooking appliances, other than those exempted by Section 501.8, shall be vented by connecting the appliance to a vent or chimney in accordance with this code and the appliance manufacturer's instructions or the appliance shall be vented in accordance with Section 505.1.1.

**623.7 Vertical clearance above cooking top.** Household cooking appliances shall have a vertical clearance above the cooking top of not less than 30 inches (760 mm) to combustible material and metal cabinets. A minimum clearance of 24 inches (610 mm) is permitted where one of the following is installed:

1. The underside of the combustible material or metal cabinet above the cooking top is protected with not less than 1/4-inch (6.4 mm) insulating millboard covered with sheet metal not less than 0.0122 inch (0.3 mm) thick.
2. A metal ventilating hood constructed of sheet metal not less than 0.0122 inch (0.3 mm) thick is installed above the cooking top with a clearance of not less than 1/4 inch (6.4 mm) between the hood and the underside of the combustible material or metal cabinet. The hood shall have a width not less than the appliance.
3. A listed cooking appliance or microwave oven is installed over a listed cooking appliance and in compliance with the terms of the manufacturer's installation instructions for the upper appliance.

## SECTION 624 WATER HEATERS

**624.1 General.** Water heaters shall be tested in accordance with ANSI Z 21.10.1/CSA 4.1 and ANSI Z 21.10.3/CSA 4.3 and shall be installed in accordance with the manufacturer's installation instructions. Water heaters utilizing fuels other than fuel gas shall be regulated by the *Arkansas Mechanical Code*.

**624.1.1 Installation requirements.** The requirements for water heaters relative to sizing, relief valves, drain pans and scald protection shall be in accordance with the *Arkansas Plumbing Code*.

**624.2 Water heaters utilized for space heating.** Water heaters utilized both to supply potable hot water and provide hot water for space-heating applications shall be listed and labeled for such applications by the manufacturer and shall be installed in accordance with the manufacturer's installation instructions and the *Arkansas Plumbing Code*.

## SECTION 625 ~~(AFGC)~~ REFRIGERATORS

**625.1 General.** Refrigerators shall be tested in accordance with ANSI Z21.19/CSA 1.4 and shall be installed in accordance with the manufacturer's installation instructions.

Refrigerators shall be provided with adequate clearances for ventilation at the top and back, and shall be installed in accordance with the manufacturer's instructions. If such instructions are not available, at least not less than 2 inches (51 mm) shall be provided between the back of the refrigerator and the wall and at least not less than 12 inches (305 mm) above the top.

## SECTION 626 GAS-FIRED TOILETS

**626.1 General.** Gas-fired toilets shall be tested in accordance with ANSI Z21.61 and installed in accordance with the manufacturer's installation instructions.

**626.2 Clearance.** A gas-fired toilet shall be installed in accordance with its listing and the manufacturer's instructions, provided that the clearance shall in any case be sufficient to afford ready access for use, cleanout and necessary servicing.



## SECTION 627 (AFGC) AIR-CONDITIONING EQUIPMENT

**627.1 General.** Gas-fired air-conditioning equipment shall be tested in accordance with ANSI Z21.40.1/CGA 2.91 or ANSI Z21.40.2/CGA 2.92 and shall be installed in accordance with the manufacturer's installation instructions.

**627.2 Independent piping.** Gas piping serving heating equipment shall be permitted to also serve cooling equipment where such heating and cooling equipment cannot be operated simultaneously (see Section 402).

**627.3 Connection of gas engine-powered air conditioners.** To protect against the effects of normal vibration in service, gas engines shall not be rigidly connected to the gas supply piping.

**627.4 Clearances for indoor installation.** Air-conditioning ~~equipment-appliances~~ installed in rooms other than alcoves and closets shall be installed with clearances not less than those specified in Section 308.3 except that air-conditioning ~~appliances equipment~~ listed for installation at lesser clearances than those specified in Section 308.3 shall be permitted to be installed in accordance with such listing and the manufacturer's instructions and air-conditioning ~~appliances equipment~~ listed for installation at greater clearances than those specified in Section 308.3 shall be installed in accordance with such listing and the manufacturer's instructions.

Air-conditioning ~~equipment-appliances~~ installed in rooms other than alcoves and closets shall be permitted to be installed with reduced clearances to combustible material, provided that the combustible material is protected in accordance with Table 308.2.

**627.5 Alcove and closet installation.** Air-conditioning ~~equipment-appliances~~ installed in spaces such as alcoves and closets shall be specifically listed for such installation and installed in accordance with the terms of such listing. The installation clearances for air-conditioning ~~appliances equipment~~ in alcoves and closets shall not be reduced by the protection methods described in Table 308.2.

**627.6 Installation.** Air-conditioning ~~appliances equipment~~ shall be installed in accordance with the manufacturer's instructions. Unless the ~~equipment-appliance~~ is listed for installation on a combustible surface such as a floor or roof, or unless the surface is protected in an approved manner, ~~appliances equipment~~ shall be installed on a surface of noncombustible construction with noncombustible material and surface finish and with no combustible material against the underside thereof.

**627.7 Plenums and air ducts.** A plenum supplied as a part of the air-conditioning ~~appliance equipment~~ shall be installed in accordance with the ~~equipment-appliance~~ manufacturer's instructions. Where a plenum is not supplied with the ~~equipment appliance~~, such plenum shall be installed in accordance with the fabrication and installation instructions provided by the plenum and ~~equipment-appliance~~ manufacturer. The method of connecting supply and return ducts shall facilitate proper circulation of air.

Where the air-conditioning ~~equipment-appliance~~ is installed within a space separated from the spaces served by the ~~equipment-appliance~~, the air circulated by the ~~equipment-appliance~~ shall be conveyed by ducts that are sealed to the casing of the ~~equipment-appliance~~ and that separate the circulating air from the combustion and ventilation air.

**627.8 Refrigeration coils.** A refrigeration coil shall not be installed in conjunction with a forced-air furnace where circulation of cooled air is provided by the furnace blower, unless the blower has sufficient capacity to overcome the external static resistance imposed by the duct system and cooling coil at the air throughput necessary for heating or cooling, whichever is greater. Furnaces shall not be located upstream from cooling units, unless the cooling unit is designed or equipped so as not to develop excessive temperature or pressure. Refrigeration coils shall be installed in parallel with or on the downstream side of central furnaces to avoid condensation in the heating element, unless the furnace has been specifically listed for downstream installation. With a parallel flow arrangement, the dampers or other means used to control flow of air shall be sufficiently tight to prevent any circulation of cooled air through the furnace.

Means shall be provided for disposal of condensate and to prevent dripping of condensate onto the heating element.

**627.9 Cooling units used with heating boilers.** Boilers, where used in conjunction with refrigeration systems, shall be installed so that the chilled medium is piped in parallel with the heating boiler with appropriate valves to prevent the chilled medium from entering the heating boiler. Where hot water heating boilers are connected to heating coils located in air-handling units where they might be exposed to refrigerated air circulation, such boiler piping systems shall be equipped with flow control valves or other automatic means to prevent gravity circulation of the boiler water during the cooling cycle.

**627.10 Switches in electrical supply line.** Means for interrupting the electrical supply to the air-conditioning ~~equipment-appliance~~ and to its associated cooling tower (if supplied and installed in a location remote from the air conditioner) shall be provided within sight of and not over 50 feet (15 240 mm) from the air conditioner and cooling tower.

## SECTION 628 ILLUMINATING APPLIANCES

**628.1 General.** Illuminating appliances shall be tested in accordance with ANSI Z21.42 and shall be installed in accordance with the manufacturer's installation instructions.

**628.2 Mounting on buildings.** Illuminating appliances designed for wall or ceiling mounting shall be securely attached to substantial structures in such a manner that they are not dependent on the gas piping for support.

**628.3 Mounting on posts.** Illuminating appliances designed for post mounting shall be securely and rigidly attached to a post. Posts shall be rigidly mounted. The strength and rigidity of posts greater than 3 feet (914 mm) in height shall be at least equivalent to that of a 2½-inch-diameter (64 mm) post constructed of 0.064-inch-thick (1.6-mm) steel or a 1-inch (25.4 mm) Schedule 40 steel pipe. Posts 3 feet (914 mm) or less in height shall not be smaller than ¾-inch (19.1 mm) Schedule 40 steel pipe. Drain openings shall be provided near the base of post where it is possible for water to collect inside them.

**628.4 Appliance pressure regulators.** Where an appliance pressure regulator is not supplied with an illuminating appliance and the service line is not equipped with a service pressure regulator, an appliance pressure regulator shall be installed in the line to the illuminating appliance. For multiple installations, one regulator of adequate capacity shall be permitted to serve more than one illuminating appliance.

## SECTION 629 SMALL CERAMIC KILNS

**629.1 General.** ~~Kilns shall be installed in accordance with the manufacturer's instructions and the provisions of this code. Kilns shall comply with Section 301.3. Ceramic kilns with a maximum interior volume of 20 cubic feet (0.566 m<sup>3</sup>) and used for hobby and noncommercial purposes shall be installed in accordance with the manufacturer's installation instructions and the provisions of this code.~~

## SECTION 630 INFRARED RADIANT HEATERS

**630.1 General.** Infrared radiant heaters shall be tested in accordance with ANSI ~~Z83.6~~ Z83.19 or Z83.20 and shall be installed in accordance with the manufacturer's installation instructions.

**630.2 Support.** Infrared radiant heaters shall be fixed in a position independent of gas and electric supply lines. Hangers and brackets shall be of noncombustible material.

**630.3 Combustion and ventilation air.** Where unvented infrared heaters are installed, natural or mechanical means shall provide outdoor ventilation air at a rate of not less than 4 cfm per 1,000 Btu/h (0.38 m<sup>3</sup>/min/kW) of the aggregate input rating of all such heaters installed in the space. Exhaust openings for removing flue products shall be above the level of the heaters.

**630.4 Installation in commercial garages and air-craft hangars.** Overhead infrared heaters installed in garages for more than three motor vehicles or in aircraft hangars shall be installed in accordance with Sections 305.9, 305.10 and 305.11.

## SECTION 631 BOILERS

**631.1 Standards.** Boilers shall be listed in accordance with the requirements of ANSI Z21.13 ~~CSA 4.9~~ or UL 795. If applicable, the boiler shall be designed and constructed in accordance with the requirements of ASME CSD-1 and as applicable, the ASME *Boiler and Pressure Vessel Code*, Sections I, II, IV, V and IX and NFPA 85.

**631.2 Installation.** In addition to the requirements of this code, the installation of boilers shall be in accordance with the manufacturer's instructions and the *Arkansas Department of Labor*. Operating instructions of a permanent type shall be attached to the boiler. Boilers shall have all controls set, adjusted and tested by the installer. A complete control diagram together with complete boiler operating instructions shall be furnished by the installer. The manufacturer's rating data and the name-plate shall be attached to the boiler.

**631.3 Clearance to combustible materials.** Clearances to combustible materials shall be in accordance with Section 308.4.

## SECTION 632 EQUIPMENT INSTALLED IN EXISTING UNLISTED BOILERS

**632.1 General.** Gas equipment installed in existing unlisted boilers shall comply with Section 631.1 and shall be installed in accordance with the manufacturer's instructions and the *Arkansas Department of Labor*.

## SECTION 633 STATIONARY FUEL-CELL POWER SYSTEMS

**[F] 633.1 General.** Stationary fuel-cell power systems having a power output not exceeding 10 MW shall be tested in accordance with ANSI CSA America FC 1 and shall be installed in accordance with the manufacturer's installation instructions and NFPA 853 and the Arkansas Prevention Fire Code.

## SECTION 634 CHIMNEY DAMPER OPENING AREA

**634.1 Free opening area of chimney dampers.** Where an unlisted decorative appliance for installation in a vented fireplace is installed, the fireplace damper shall have a permanent free opening equal to or greater than specified in Table 634.1.

## SECTION 635 ~~Deleted~~

## SECTION 636 OUTDOOR DECORATIVE APPLIANCES

**636.1 General.** Permanently fixed-in-place outdoor decorative appliances shall be tested in accordance with ANSI Z21.97 and shall be installed in accordance with the manufacturer's instructions.

**TABLE 634.1**  
**FREE OPENING AREA OF CHIMNEY DAMPER FOR VENTING FLUE GASES**  
**FROM UNLISTED DECORATIVE APPLIANCES FOR INSTALLATION IN VENTED FIREPLACES**

CHIMNEY HEIGHT (feet)	MINIMUM PERMANENT FREE OPENING (square inches) <sup>a</sup>						
	8	13	20	29	39	51	64
	Appliance input rating (Btu per hour)						
6	7,800	14,000	23,200	34,000	46,400	62,400	80,000
8	8,400	15,200	25,200	37,000	50,400	68,000	86,000
10	9,000	16,800	27,600	40,400	55,800	74,400	96,400
15	9,800	18,200	30,200	44,600	62,400	84,000	108,800
20	10,600	20,200	32,600	50,400	68,400	94,000	122,200
30	11,200	21,600	36,600	55,200	76,800	105,800	138,600

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 square inch = 645.16mm<sup>2</sup>, 1 British thermal unit per hour = 0.2931 W.

- a. The first six minimum permanent free openings (8 to 51 square inches) correspond approximately to the cross-sectional areas of chimneys having diameters of 3 through 8 inches, respectively. The 64-square-inch opening corresponds to the cross-sectional area of standard 8-inch by 8-inch chimney tile.

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**CHAPTER 7**  
**DELETED**

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## CHAPTER 8

# REFERENCED STANDARDS

### User note:

*About this chapter: Chapter 8 lists the full title, edition year and address of the promulgator for all standards that are referenced in the code. The section numbers in which the standards are referenced are also listed.*

*This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.8.*

## ANSI

American National Standards Institute  
25 West 43rd Street  
4th Floor  
New York, NY 10036

### ANSI FC 1—2012: Stationery Fuel Cell Power Systems

633.1

### ANSI NGV 5.1—2015: Residential Fueling Appliances

413.4.1

### LC 1/CSA 6.26—2013: Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing (CSST)

403.5.5

### ANSI LC-4/CSA 6.32—2012: Press-connect Metallic Fittings for Use in Fuel Gas Distribution Systems

403.10.1, 403.10.2, 403.10.3

### Z21.1—2010: Household Cooking Gas Appliances

623.1

### Z21.8—94 (R2002): Installation of Domestic Gas Conversion Burners

619.1

### Z21.10.1/CSA 4.1—2012: Gas Water Heaters—Volume I—Storage, Water Heaters with Input Ratings of 75,000 Btu per Hour or Less

624.1

### Z21.10.3/CSA 4.3—2011: Gas Water Heaters—Volume III—Storage, Water Heaters with Input Ratings above 75,000 Btu per Hour, Circulating and Instantaneous

624.1

### Z21.11.2—2011: Gas-fired Room Heaters—Volume II—Unvented Room Heaters

624.1

### Z21.13/CSA 4.9—2011: Gas-fired Low-pressure Steam and Hot Water Boilers

631.1

### Z21.15/CSA 9.1—2009: Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves

Table 409.1.1

### Z21.19/CSA 1.4—02(R2007): Refrigerators Using Gas (R1999) Fuel

625.1

### Z21.24/CSA 6.10—2006: Connectors for Gas Appliances

411.1, 411.3

### Z21.40.1/CGA 2.91—1996 (R2011): Gas-fired Heat Activated Air Conditioning and Heat Pump Appliances

627.1

### Z21.40.2/CGA 2.92—1996 (R2011): Gas-fired Work Activated Air Conditioning and Heat Pump Appliances (Internal Combustion)

627.1

### Z21.42—2014: Gas-fired Illuminating Appliances

628.1

## REFERENCED STANDARDS

### ANSI—continued

Z21.47/CSA 2.3—2012: Gas-fired Central Furnaces

618.1

Z21.50/CSA 2.22—2016: Vented Gas Fireplaces

604.1

Z21.54—2009: Gas Hose Connectors for Portable Outdoor Gas-fired Appliances

411.1

Z21.56/CSA 4.7—2017: Gas-fired Pool Heaters

617.1

Z21.58/CSA 1.6—2013: Outdoor Cooking Gas Appliances

623.1

Z21.60/CSA 2.26—2012: Decorative Gas Appliances for Installation in Solid-fuel Burning Fireplaces

602.1

Z21.61—1983 (R2004): Gas-fired Toilets

626.1

Z21.69/CSA 6.16—2009: Connectors for Movable Gas Appliances

411.1.1, 411.1.4

Z21.75/CSA 6.27—2007: Connectors for Outdoor Gas Appliances and Manufactured Homes

411.1, 411.2

Z21.80/CSA 6.22—2011: Line Pressure Regulators

410.1

Z21.84—2012: Manually Lighted, Natural Gas Decorative Gas Appliances for Installation in Solid Fuel Burning Fireplaces

602.1, 602.2

Z21.86/CSA 2.32—2008: Vented Gas-fired Space Heating Appliances

608.1, 609.1, 622.1

Z21.88/CSA 2.33—2016: Vented Gas Fireplace Heaters

605.1

Z21.91—2007: Ventless Firebox Enclosures for Gas-fired Unvented Decorative Room Heaters

621.7.1

Z21.93/CSA 6.30—2013: Excess Flow Valves for Natural and LP Gas with Pressures up to 5 psig

410.4

Z21.97—2012: Outdoor Decorative Appliances

636.1

Z83.4/CSA 3.7—2012: Nonrecirculating Direct-gas-fired Industrial Air Heaters

611.1

Z83.8/CSA 2.6—2009: Gas Unit Heater, Gas Packaged Heater, Gas Utility Heaters and Gas-fired Duct Furnaces

610.1, 620.1

Z83.11/CSA 1.8—2013: Gas Food Service Equipment

623.1

Z83.18—2012: Recirculating Direct Gas-fired Industrial Air Heaters

612.1

Z83.19—2001(R2009): Gas-fired High-intensity Infrared Heaters

630.1

Z83.20—2008: Gas-fired Low-intensity Infrared Heaters

630.1

## **ASME**

American Society of Mechanical Engineers

Two Park Avenue  
New York, NY 10016-5990

B1.20.1—2013: Pipe Threads, General Purpose (inch)

403.9

B16.1—2010: Gray Iron Pipe Flanges and Flanged Fittings, Class 25, 125 and 250

403.12.1

**ASME—continued**

**B16.5—2015: Pipe Flanges and Flanged Fittings: NPS  $\frac{1}{2}$  through NPS 24 Metric/Inch Standard**  
403.12.2

**B16.24—2016: Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500 and 2500**  
403.12.3

**B16.42—2016: Ductile Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300**  
403.12.4

**B16.47—2016: Large Diameter Steel Flanges: NPS 26 through NPS 60 Metric/Inch Standard**  
403.12.2

**B16.33—2012: Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psig (Sizes  $\frac{1}{2}$  through 2)**  
Table 409.1.1

**B16.44—2012: Manually Operated Metallic Gas Valves for Use in Aboveground Piping Systems up to 5 psi**  
Table 409.1.1

**B36.10M—(R2015): Welded and Seamless Wrought-steel Pipe**  
403.4.2

**BPVC—2015: ASME Boiler & Pressure Vessel Code (2007 Edition)**  
631.1.

**CSD-1—2016: Controls and Safety Devices for Automatically Fired Boilers**  
631.1

**ASTM**

ASTM International

100 Barr Harbor Drive, P.O. Box C700  
West Conshohocken, PA 19428-2959

**A53/A53M—12: Specification for Pipe, Steel, Black and Hot Dipped Zinc-coated Welded and Seamless**  
403.4.2

**A106/A106M—14: Specification for Seamless Carbon Steel Pipe for High-temperature Service**  
403.4.2

**A254—12: Specification for Copper Brazed Steel Tubing**  
403.5.1

**A268—10: Standard Specification for Seamless and Welded Ferritic and Martensitic Stainless Steel Tubing for General Service**  
403.5.2

**A269—15: Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service**  
403.5.2

**A312—15: Standard Specification for Seamless, Welded and Heavily Cold Worked Austenitic Stainless Steel Pipes**  
403.4.2

**B88—14: Specification for Seamless Copper Water Tube**  
403.5.3

**B210—12: Specification for Aluminum and Aluminum-alloy Drawn Seamless Tubes**  
403.5.4

**B241/B241M—12e1: Specification for Aluminum and Aluminum-alloy, Seamless Pipe and Seamless Extruded Tube**  
403.4.4, 403.5.4

**B280—13: Standard Specification for Seamless Copper Tube for Air-Conditioning and Refrigeration Field Service**  
403.5.3

**C315—07(2011): Specification for Clay Flue Liners and Chimney Pots**  
501.12

**D2513—14e1: Specification for Polyethylene (PE) Gas Pressure Pipe, Tubing and Fittings**  
403.6, 403.6.1, 403.11, 404.17.2

**E136—16: Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C**  
202

**ASTM—continued**

**F1973—13e1: Standard Specification for Factory Assembled Anodeless Risers and Transition Fittings in Polyethylene (PE) and Polyamide 11 (PA11) and Polyamide 12 (PA12) Fuel Gas Distribution Systems**

404.17.2

**F2945—15: Standard Specification for Polyamide 11 Gas Pressure Pipe, Tubing and Fittings**

403.6

## **CSA**

CSA Group

8501 East Pleasant Valley Road  
Cleveland, OH 44131-5516

**CSA 8—93: Requirements for Gas-fired Log Lighters for Wood Burning Fireplaces**

603.1

**ANSI/CSA NGV 5.1—2015: Residential Fueling Appliances**

413.4.1

## **DOTn**

U. S. Department of Transportation

400 Seventh St. SW  
Washington, DC 20590

**49 CFR, Parts 192.281(e) & 192.283 (b)—(2009): Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards**

403.6.1

## **ICC**

International Code Council, Inc.

500 New Jersey Ave, NW  
6th Floor  
Washington, DC 20001

**IBC—18: International Building Code®**

102.2.1, 201.3, 301.10, 301.11, 301.12, 301.14, 302.1, 302.2, 305.6, 306.5.1, 306.6, 401.1.1, 412.6,  
413.3, 413.3.1, 501.1, 501.3, 501.12, 501.15.4, 501.15.4.1, 609.3, 614.10, 633.1, 635.1, 706.2

**IECC—18: International Energy Conservation Code®**

301.2

**IFC—18: International Fire Code®**

201.3, 401.2, 412.1, 412.6, 412.7, 412.7.3, 412.8, 413.1, 413.3, 413.3.1, 413.5, 413.9.2.5, 633.1, 701.1,  
701.2, 703.2, 703.2.2, 703.3.8, 703.4, 703.5, 704.1.2, 704.3, 704.4, 706.2, 706.3, 707.1, 707.2, 708.1

**IMC—18: International Mechanical Code®**

101.2.5, 201.3, 301.1.1, 301.13, 304.11, 307.1, 307.5, 501.1, 614.2, 614.10, 618.3, 621.1, 624.1, 631.2,  
632.1, 703.1.2

**IPC—18: International Plumbing Code®**

201.3, 301.6, 307.3, 624.1.1, 624.2

**IRC—18: International Residential Code®**

101.2, 703.2.1

# MSS

Manufacturers Standardization Society

of

the Valve and Fittings Industry  
127 Park Street,  
NE Vienna,  
VA 22180

ANSI SP 58—2009: Pipe Hangers and Supports—Materials, Design and Manufacture  
407.2

# NFPA

National Fire Protection

Association  
1 Batterymarch  
Park Quincy, MA  
02169-7471

30A—18: Code for Motor Fuel Dispensing Facilities and Repair Garages  
305.4, 305.10

37—18: Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines  
616.1

70—17: National Electrical Code  
306.3.1, 306.4.1, 306.5.2, 309.2, 310.2.4, 413.9.2.4,

82—14: Incinerators, Waste and Linen Handling Systems and Equipment  
503.2.5, T503.4, 607.1

85—15: Boiler and Combustion Systems Hazards Code  
631.1

88A—15: Parking Structures  
305.9

211—16: Standard for the Chimneys, Fireplaces, Vents and Solid Fuel-burning Appliances  
503.5.2, 503.5.3, 503.5.6.1, 503.5.6.3

409—16: Standard for the Aircraft Hangars  
305.11

853—15: Installation of Stationary Fuel Cell Power Systems  
633.1

# UL

UL

LLC

333 Pfingsten  
Road Northbrook,  
IL 60062

103—2010: Factory-built Chimneys, Residential Type and Building Heating Appliances—with Revisions through July 2012  
503.5.1, 506.1

127—2011: Factory-built Fireplaces—with Revisions through May 2015  
621.7

378—2006: Draft Equipment  
503.3.3

441—2010: Gas Vents—with Revisions through June 2014  
502.1, 503.6.1

641—2010: Type L Low-temperature Venting Systems—with Revisions through June 2013  
502.1

651—2011: Schedule 40 and 80 Rigid PVC Conduit and Fittings—with Revisions through May 2014  
403.6.3

## REFERENCED STANDARDS

### UL—continued

795—2011: Commercial-industrial Gas Heating Equipment—with Revisions through November 2013  
610.1, 618.1, 631.1

959—2010: Medium Heat Appliance Factory-built Chimneys—with Revisions through June 2014  
506.3

1618—09: Wall Protectors, Floor Protectors and Hearth Extensions—with Revisions through October 2015  
308.2

1738—2010: Venting Systems for Gas Burning Appliances, Categories II, III and IV—with Revisions through November 2014  
502.1, 503.4.1

1777—2007: Chimney Liners—with Revisions through October 2015  
501.12, 501.15.4

2200—2012: Stationary Engine Generator Assemblies—with Revisions through July 2015  
616.1

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## CHAPTER 8

# REFERENCED STANDARDS

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title, and the section or sections of this document that reference the standard. The application of the referenced standards shall be as specified in Section 102.8.



American National Standards Institute -  
25 West 43rd Street  
Fourth Floor

Standard  
reference

Referenced  
in code  
number

		ANSI A13.1-96
ANSI CSA-America FC 1-03	Stationery Fuel Cell Power Systems . . . . .	633.1
LC 1—97	Interior Gas Piping Systems Using Corrugated Stainless Steel Tubing with Addenda LC1a-1999 and LC1b-2001 . . . . .	403.5.4
Z21.1—03	Household Cooking Gas Appliances with Addenda Z21.1a-2003 and Z21.1b-2003 . . . . .	623.1
Z21.5.1—02	Gas Clothes Dryers—Volume I—Type 1 Clothes Dryers with Addenda Z21.5.1a-2003 . . . . .	613.1
Z21.5.2—01	Gas Clothes Dryers—Volume II—Type 2 Clothes Dryers with Addenda Z21.5.2a-2003 and Z21.5.2b-2003 . . . . .	613.1, 614.3
Z21.8—94 (R2002)	Installation of Domestic Gas Conversion Burners . . . . .	619.1
Z21.10.1—04	Gas Water Heaters—Volume I—Storage, Water Heaters with Input Ratings of 75,000 Btu per Hour or Less— with Addenda Z21.10.1a-2002 . . . . .	624.1
Z21.10.3—01	Gas Water Heaters—Volume III—Storage, Water Heaters with Input Ratings Above 75,000 Btu per hour, Circulating and Instantaneous—with Addenda Z21.10.3a-2003 and Z21.10.3b-2004 . . . . .	624.1
Z21.11.2—02	Gas-fired Room Heaters—Volume II—Unvented Room Heaters with Addenda Z21.11.2a-2003 . . . . .	621.1
Z21.13—04	Gas-fired Low-Pressure Steam and Hot Water Boilers . . . . .	631.1
Z21.15—97 (R2003)	Manually Operated Gas Valves for Appliances, Appliance Connector Valves, and Hose End Valves with Addenda Z21.15a-2001 (R2003) . . . . .	409.1.1
Z21.19—02	Refrigerators Using Gas (R1999) Fuel . . . . .	625.1
Z21.24—97	Connectors for Gas Appliances . . . . .	411.1
Z21.40.1—96 (R2002)	Gas-fired Heat Activated Air Conditioning and Heat Pump Appliances—with Addendum Z21.40.1a-1997 (R2002) . . . . .	627.1
Z21.40.2—96 (R2002)	Gas-fired Work Activated Air Conditioning and Heat Pump Appliances (Internal Combustion)—with Addendum Z21.40.2a-97 (R2002) . . . . .	627.1
Z21.42—93 (R2002)	Gas-fired Illuminating Appliances . . . . .	628.1
Z21.47—03	Gas-fired Central Furnaces . . . . .	618.1
Z21.50—03	Vented Gas Fireplaces—with Addenda Z21.50a-2003 . . . . .	604.1
Z21.56—01	Gas-fired Pool Heaters—with Addenda Z21.56a-2004 and Z21.56b-2004 . . . . .	616.1
Z21.58—95 (R2002)	Outdoor Cooking Gas Appliances—with Addendum Z21.58a-1998 (R2002) and Z21.58b-2002 . . . . .	623.1
Z21.60—03	Decorative Gas Appliances for Installation in Solid-fuel Burning Fireplaces—with Addenda Z21.60a-2003 . . . . .	602.1
Z21.61—83 (R 1996)	Toilets, Gas-fired . . . . .	625.1
Z21.69—02	Connectors for Movable Gas Appliances—with Addenda Z21.69a-2003 . . . . .	411.1
Z21.75/CSA 6.27—01	Connectors for Outdoor Gas Appliances and Manufactured Homes . . . . .	411.1, 411.2
Z21.80—03	Line Pressure Regulators . . . . .	410.1
Z21.84—02	Manually Lighted, Natural Gas Decorative Gas Appliances for Installation in Solid Fuel Burning Fireplaces—with Addenda Z21.84a-2003 . . . . .	602.1, 602.2
Z21.86—04	Gas-fired Vented Space Heating Appliances—with Addenda Z21.86a-2002 and Z21.86b-2002 . . . . .	608.1, 609.1, 622.1
Z21.88—02	Vented Gas Fireplace Heaters with Addenda Z21.88a-2003 and Z21.88b-2004 . . . . .	605.1
Z21.91—01	Ventless Firebox Enclosures for Gas-fired Unvented Decorative Room Heaters . . . . .	621.7.1
Z83.4—03	Non-Recirculating Direct Gas-fired Industrial Air Heaters . . . . .	611.1
Z83.6—90 (R 1998)	Gas-fired Infrared Heaters . . . . .	630.1
Z83.8—02	Gas Unit Heaters and Gas-fired Duct Furnaces—with Addenda Z83.8a-2003 . . . . .	620.1
Z83.11—02	Gas Food Service Equipment—with Addenda Z83.11a-2004 . . . . .	623.1

Z83.18—00



American Society of Mechanical Engineers  
Three Park Avenue

Standard  
reference

Referenced  
in-code  
number

2001) Pipe Threads, General Purpose (inch).....	403.9	
B16.1—98	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125 and 250 .....	403.12
B16.20—98	Metallic Gaskets for Pipe Flanges Ring-joint, Spiral-wound, and Jacketed—with Addendum B16.20a-2000 .....	403.12
B31.3—02	Process Piping .....	704.1.2.4, 704.12, 705.2, 705.3
B16.33—02	Manually Operated Metallic Gas Valves for Use in Gas Piping Systems up to 125 psig (Sizes <sup>1</sup> / <sub>2</sub> through 2) .....	409.1.1
B16.44-01	Manually Operated Metallic Gas Valves for Use in House Piping Systems .....	409.1.1
B31.3—99	Process Piping .....	704.1.2, 705.2, 705.3
B36.10M—00	Welded and Seamless Wrought-steel Pipe .....	403.4.2
BPVC—01	ASME Boiler & Pressure Vessel Code (2001 Edition) (Section I, II, IV, V & IX) .....	630.1, 703.2.2, 703.3.3, 703.3.4

CSD-1—02

(Reaffirmed)



ASTM International  
100 Barr Harbor Drive

Referenced  
in-code  
number

		A 53/A 53M—02
	Specification for Seamless Carbon Steel Pipe for High-temperature Service .....	403.4.2
	Specification for Copper Braze Steel Tubing .....	403.5.1
	Specification for Electric Resistance-welded Coiled Steel Tubing for Gas and Fuel Oil Lines .....	403.5.1
B 88—03		
	Specification for Aluminum and Aluminum-alloy Drawn Seamless Tubes .....	403.5.3
	Specification for Aluminum and Aluminum-alloy, Seamless Pipe and Seamless Extruded Tube .....	403.4.4, 403.5.3
B 280—03	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service .....	403.5.2
C 64—72 (1977)	Withdrawn No Replacement (Specification for Fireclay Brick Refractories for .....	503.10.2.5
C 315—02		
D 2513—04a	Specification for Clay Flue Linings .....	501.12
A 254—97 (2002)	Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings .....	403.6, 403.6.1, 403.11, 404.14.2
A 539—99		

Standard  
reference

C 315—02  
D 2513—04a  
A 254—97 (2002)  
A 539—99

B 210—02  
B 241/B 241M—02

Specification for Seamless Copper Water Tube .....

number

C111—00



Standard  
reference



Compressed Gas Association  
1725 Jefferson Davis Highway, 5th Floor

Standard  
reference

Referenced  
in-code  
number

S 1.2—(1995)	Pressure Relief Device Standards—Part 2—Cargo and Portable Tanks for Compressed Gases .....	703.3
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Standard  
reference

CSA America Inc.  
8501 E. Pleasant Valley Rd.

Referenced  
in code  
Part number

FCI-03	Stationary Fuel Cell Power Systems .....	633.1
CSA Requirement 3-88	Manually Operated Gas Valves for Use in House Piping Systems .....	409.1.1

ANSI — CSA — America  
CSA 8 — 93



Standard  
reference

Department of Transportation  
400 Seventh St. SW.

Referenced  
in code  
number

192.281(e) &		
192.283(b)	Transportation of Natural and Other Gas by Pipeline: Minimum Federal Safety Standards .....	403.6.1

49  
CFR, Parts  
49 CFR Parts 100-180



Standard  
reference

International Code Council  
500 New Jersey Ave. NW  
Washington, DC 20001

Referenced  
in code  
number

	305.6, 306.6, 401.1.1, 412.6, 413.3, 413.3.1, 501.1, 501.3, 501.12, 501.15.4, 609.3, 614.2, 706.1, 706.3	
ADMIN — 06	International Code Council Electrical Code — Administrative Provisions .....	201.3, 306.3.1, 306.4.1, 306.5.2, 309.2, 413.8.2.4, 703.6
IEBC — 06	International Existing Building Code <sup>®</sup> .....	101.2
IECC — 06	International Energy Conservation Code <sup>®</sup> .....	301.2
IFC — 06	International Fire Code <sup>®</sup> .....	201.3, 303.4, 401.2, 412.1, 412.6, 412.7, 412.7.3, 412.8,

IBC — 06

413.1, 413.3, 413.3.1, 413.4, 413.8.2.5, 701.1, 701.2, 703.2, 703.2.2,  
703.3.8, 703.4, 703.5, 704.1.2, 704.3, 704.4, 706.2, 706.3.4, 706.3.5, 706.3.6, 707.2, 707.1, 708.1

IMC—06 International Mechanical Code® ..... 101.2.5, 201.3, 301.1.1, 301.13, 304.11, 501.1,  
614.2, 618.5, 621.1, 624.1, 631.2, 632.1, 703.1.2, 706.3.2

IPC—06 International Plumbing Code® ..... 201.3, 301.6, 624.1.1, 624.2

IRC—06

## MSS

Manufacturers Standardization Society of  
the Valve and Fittings Industry

Standard reference		Referenced in code number
		SP-6—01 SP-58—93

## NFPA

National Fire Protection Association

1 Batterymarch Pike

P.O. Box 9101

Standard reference number	Title	Referenced in code section number
30A—03	Code for Motor Fuel Dispensing Facilities and Repair Garages	305.5
37—02	Installation and Use of Stationary Combustion Engines and Gas Turbines	616.1

### NFPA—continued

50A—99	Gaseous Hydrogen Systems at Consumer Sites	706.1
51—02	Design and Installation of Oxygen-Fuel Gas Systems for Welding, Cutting, and Allied Processes	414.1
58—04	Liquefied Petroleum Gas Code	401.2, 402.6.1, 403.6.2, 403.11
82—04	Incinerators, Waste and Liquid Handling Systems and Equipment	607.1
85—04	Boiler and Combustion Systems Hazards Code	631.1
211—03	Chimneys, Fireplaces, Vents, and Solid Fuel-burning Appliances	503.5.2, 503.5.3, 503.5.6.1, 503.5.6.3

853—03

## UL

Underwriters Laboratories Inc.

333 Pfingsten Road

Standard reference		Referenced in code number
103—2001	Factory-built Chimneys, Residential Type and Building Heating Appliances— with Revisions through December 2003	506.1
127—99	Factory-built Fireplaces—with Revisions through November 1999	621.7
441—96	Gas Vents—with Revisions through December 1999	502.1
641—95	Type L Low-temperature Venting Systems—with Revisions through April 1999	502.1
651—05	Schedule 40 and Schedule 80 Rigid PVC Conduit and Fittings	403.6.3
795—99	Commercial Industrial Gas Heating Equipment	610.1, 618.1, 631.1
959—01	Medium Heat Appliance Factory-built Chimneys	506.3
1738—00	Venting Systems for Gas-Burning Appliances, Categories II, III and IV with Revisions through December 2000	502.1
1777—04	Standard for Chimney Liners	501.12, 501.15.4

## APPENDIX A

# SIZING AND CAPACITIES OF GAS PIPING

This appendix is informative and is not part of the code.

### User note:

About this appendix: Appendix A provides commentary, guidance and examples for sizing of gas piping systems.

**A.1 General piping considerations.** The first goal of determining the pipe sizing for a fuel gas piping system is to make sure that there is sufficient gas pressure at the inlet to each appliance. The majority of systems are residential and the appliances will all have the same, or nearly the same, requirement for minimum gas pressure at the appliance inlet. This pressure will be about 5-inch water column (w.c.) (1.25 kPa), which is enough for proper operation of the appliance regulator to deliver about 3.5-inches water column (w.c.) (875 kPa) to the burner itself. The pressure drop in the piping is subtracted from the source delivery pressure to verify that the minimum is available at the appliance.

There are other systems, however, where the required inlet pressure to the different appliances may be quite varied. In such cases, the greatest inlet pressure required must be satisfied, as well as the farthest appliance, which is almost always the critical appliance in small systems.

There is an additional requirement to be observed besides the capacity of the system at 100-percent flow. That requirement is that at minimum flow, the pressure at the inlet to any appliance does not exceed the pressure rating of the appliance regulator. This would seldom be of concern in small systems if the source pressure is  $\frac{1}{2}$  psi (14-inch w.c.) (3.5 kPa) or less but it should be verified for systems with greater gas pressure at the point of supply.

To determine the size of piping used in a gas piping system, the following factors must be considered:

- (1) Allowable loss in pressure from point of delivery to equipment.
- (2) Maximum gas demand.
- (3) Length of piping and number of fittings.
- (4) Specific gravity of the gas.
- (5) Diversity factor.

For any gas piping system, or special appliance, or for conditions other than those covered by the tables provided in this code, such as longer runs, greater gas demands or greater pressure drops, the size of each gas piping system should be determined by standard engineering practices acceptable to the code official.

### **A.2 Description of tables.**

**A.2.1 General.** The quantity of gas to be provided at each outlet should be determined, whenever possible, directly from the manufacturer's gas input Btu/h rating of the appliance that will be installed. In case the ratings of the appliances to be installed are not known, Table 402.2 shows the approximate consumption (in Btu per hour) of certain types of typical household appliances.

To obtain the cubic feet per hour of gas required, divide the total Btu/h input of all appliances by the average Btu heating value per cubic feet of the gas. The average Btu per cubic feet of the gas in the area of the installation can be obtained from the serving gas supplier.

**A.2.2 Low pressure natural gas tables.** Capacities for gas at low pressure [less than 2.0 psig (13.8 kPa gauge)] in cubic feet per hour of 0.60 specific gravity gas for different sizes and lengths are shown in Table 402.4(2) for iron pipe or equivalent rigid pipe; in Table 402.4(7) for smooth wall semi rigid tubing; and Table 402.4(19) for polyethylene plastic pipe. Corrugated stainless steel tubing shall be sized in accordance with the manufacturer's instructions and Section 403.5.4. Tables 402.4(2), 402.4(7) and 402.4(19) are based on a pressure drop of 0.5-inch w.c. (125 Pa).

**A.2.3 Undiluted liquified petroleum tables.** Deleted.

**A.2.4 Natural gas specific gravity.** Gas piping systems that are to be supplied with gas of a specific gravity of 0.70 or less can be sized directly from the tables provided in this code, unless the code official specifies that a gravity factor be applied. Where the specific gravity of the gas is greater than 0.70, the gravity factor should be applied.

Application of the gravity factor converts the figures given in the tables provided in this code to capacities for another gas of different specific gravity. Such application is accomplished by multiplying the capacities given in the tables by the multipliers shown in Table A.2.4. In case the exact specific gravity does not appear in the table, choose the next higher value specific gravity shown.

**TABLE A.2.4**  
**MULTIPLIERS TO BE USED WITH TABLES 402.4(1)**  
**THROUGH 402.4(22) WHERE THE SPECIFIC GRAVITY**  
**OF THE GAS IS OTHER THAN 0.60**

SPECIFIC GRAVITY	MULTIPLIER	SPECIFIC GRAVITY	MULTIPLIER
.35	1.31	1.00	0.78
.40	1.23	1.10	0.74
.45	1.16	1.20	0.71
.50	1.10	1.30	0.68
.55	1.04	1.40	0.66
.60	1.00	1.50	0.63
.65	0.96	1.60	0.61
.70	0.93	1.70	0.59
.75	0.90	1.80	0.58
.80	0.87	1.90	0.56
.85	0.84	2.00	0.55
.90	0.82	2.10	0.54

**TABLE A.2.2**  
**EQUIVALENT LENGTHS OF PIPE FITTINGS AND VALVES**

		SCREWED FITTINGS <sup>1</sup>				90° WELDING ELBOWS AND SMOOTH BENDS <sup>2</sup>					
		45°/EII	90°/EII	180° close return bends	Tee	R/d = 1	R/d = 1 1/3	R/d = 2	R/d = 4	R/d = 6	R/d = 8
<b>k factor =</b>		0.42	0.90	2.00	1.80	0.48	0.36	0.27	0.21	0.27	0.36
<b>L/d' ratio<sup>4</sup> n =</b>		1 4	30	67	60	16	12	9	7	9	12
Nominal pipe size, inches	Inside diameter d, inches, Schedule 40 <sup>6</sup>	<b>L = Equivalent Length In Feet of Schedule 40 (Standard-weight) Straight Pipe<sup>6</sup></b>									
1/2	0.622	0.73	1.55	3.47	3.10	0.83	0.62	0.47	0.36	0.47	0.62
3/4	0.824	0.96	2.06	4.60	4.12	1.10	0.82	0.62	0.48	0.62	0.82
1	1.049	1.22	2.62	5.82	5.24	1.40	1.05	0.79	0.61	0.79	1.05
1 1/4	1.380	1.61	3.45	7.66	6.90	1.84	1.38	1.03	0.81	1.03	1.38
1 1/2	1.610	1.88	4.02	8.95	8.04	2.14	1.61	1.21	0.94	1.21	1.61
2	2.067	2.41	5.17	11.5	10.3	2.76	2.07	1.55	1.21	1.55	2.07
2 1/2	2.469	2.88	6.16	13.7	12.3	3.29	2.47	1.85	1.44	1.85	2.47
3	3.068	3.58	7.67	17.1	15.3	4.09	3.07	2.30	1.79	2.30	3.07
4	4.026	4.70	10.1	22.4	20.2	5.37	4.03	3.02	2.35	3.02	4.03
5	5.047	5.88	12.6	28.0	25.2	6.72	5.05	3.78	2.94	3.78	5.05
6	6.065	7.07	15.2	33.8	30.4	8.09	6.07	4.55	3.54	4.55	6.07
8	7.981	9.31	20.0	44.6	40.0	10.6	7.98	5.98	4.65	5.98	7.98
10	10.02	11.7	25.0	55.7	50.0	13.3	10.0	7.51	5.85	7.51	10.0
12	11.94	13.9	29.8	66.3	59.6	15.9	11.9	8.95	6.96	8.95	11.9
14	13.13	15.3	32.8	73.0	65.6	17.5	13.1	9.85	7.65	9.85	13.1
16	15.00	17.5	37.5	83.5	75.0	20.0	15.0	11.2	8.75	11.2	15.0
18	16.88	19.7	42.1	93.8	84.2	22.5	16.9	12.7	9.85	12.7	16.9
20	18.81	22.0	47.0	105.0	94.0	25.1	18.8	14.1	11.0	14.1	18.8
24	22.63	26.4	56.6	126.0	113.0	30.2	22.6	17.0	13.2	17.0	22.6

(continued)

**TABLE A.2.2—continued**  
**EQUIVALENT LENGTHS OF PIPE FITTINGS AND VALVES**

		MITER ELBOWS <sup>3</sup> (No. of miters)					WELDING TEES		VALVES (screwed, flanged, or welded)			
		1-45°	1-60°	1-90°	2-90° <sup>5</sup>	3-90° <sup>5</sup>	Forged	Miter <sup>3</sup>	Gate	Globe	Angle	Swing Check
<b>k factor =</b>		0.45	0.90	1.80	0.60	0.45	1.35	1.80	0.21	10	5.0	2.5
<b>L/d<sup>4</sup> ratio<sup>4</sup> n =</b>		15	30	60	20	15	45	60	7	333	167	83
Nominal pipe size, inches	Inside diameter d, inches, Schedule 40 <sup>6</sup>	L = Equivalent Length In Feet of Schedule 40 (Standard-weight) Straight Pipe <sup>6</sup>										
1/2	0.622	0.78	1.55	3.10	1.04	0.78	2.33	3.10	0.36	17.3	8.65	4.32
3/4	0.824	1.03	2.06	4.12	1.37	1.03	3.09	4.12	0.48	22.9	11.4	5.72
1	1.049	1.31	2.62	5.24	1.75	1.31	3.93	5.24	0.61	29.1	14.6	7.27
1 1/4	1.380	1.72	3.45	6.90	2.30	1.72	5.17	6.90	0.81	38.3	19.1	9.58
1 1/2	1.610	2.01	4.02	8.04	2.68	2.01	6.04	8.04	0.94	44.7	22.4	11.2
2	2.067	2.58	5.17	10.3	3.45	2.58	7.75	10.3	1.21	57.4	28.7	14.4
2 1/2	2.469	3.08	6.16	12.3	4.11	3.08	9.25	12.3	1.44	68.5	34.3	17.1
3	3.068	3.84	7.67	15.3	5.11	3.84	11.5	15.3	1.79	85.2	42.6	21.3
4	4.026	5.04	10.1	20.2	6.71	5.04	15.1	20.2	2.35	112.0	56.0	28.0
5	5.047	6.30	12.6	25.2	8.40	6.30	18.9	25.2	2.94	140.0	70.0	35.0
6	6.065	7.58	15.2	30.4	10.1	7.58	22.8	30.4	3.54	168.0	84.1	42.1
8	7.981	9.97	20.0	40.0	13.3	9.97	29.9	40.0	4.65	222.0	111.0	55.5
10	10.02	12.5	25.0	50.0	16.7	12.5	37.6	50.0	5.85	278.0	139.0	69.5
12	11.94	14.9	29.8	59.6	19.9	14.9	44.8	59.6	6.96	332.0	166.0	83.0
14	13.13	16.4	32.8	65.6	21.9	16.4	49.2	65.6	7.65	364.0	182.0	91.0
16	15.00	18.8	37.5	75.0	25.0	18.8	56.2	75.0	8.75	417.0	208.0	104.0
18	16.88	21.1	42.1	84.2	28.1	21.1	63.2	84.2	9.85	469.0	234.0	117.0
20	18.81	23.5	47.0	94.0	31.4	23.5	70.6	94.0	11.0	522.0	261.0	131.0
24	22.63	28.3	56.6	113.0	37.8	28.3	85.0	113.0	13.2	629.0	314.0	157.0

For SI: 1 foot = 305 mm, 1 degree = 0.01745 rad.

**Note:** Values for welded fittings are for conditions where bore is not obstructed by weld spatter or backing rings. If appreciably obstructed, use values for "Screwed Fittings."

1. Flanged fittings have three-fourths the resistance of screwed elbows and tees.
2. Tabular figures give the extra resistance due to curvature alone to which should be added the full length of travel.
3. Small size socket-welding fittings are equivalent to miter elbows and miter tees.
4. Equivalent resistance in number of diameters of straight pipe computed for a value of  $(f - 0.0075)$  from the relation  $(n - k/4f)$ .
5. For condition of minimum resistance where the centerline length of each miter is between  $d$  and  $2\frac{1}{2}d$ .
6. For pipe having other inside diameters, the equivalent resistance can be computed from the above  $n$  values.

Source: Crocker, S. *Piping Handbook*, 4th ed., Table XIV, pp. 100–101. Copyright 1945 by McGraw-Hill, Inc. Used by permission of McGraw-Hill Book Company.

**A.2.5 Higher pressure natural gas tables.** Capacities for gas at pressures 2.0 psig (13.8 kPa) or greater in cubic feet per hour of 0.60 specific gravity gas for different sizes and lengths are shown in Tables 402.4(35) and 402.4(37) for iron pipe or equivalent rigid pipe; Tables 402.4(409) and 402.4(12) and 402.4(14) for semi rigid tubing and Tables 402.4(2021) and 402.4(22) for polyethylene plastic pipe. Corrugated stainless steel tubing shall be sized in accordance with the manufacturer's instructions and Section 403.5.4.

### A.3 Use of capacity tables.

**A.3.1 Longest length method.** This sizing method is conservative in its approach by applying the maximum operating conditions in the system as the norm for the system and by setting the length of pipe used to size any given part of the piping system to the maximum value.

To determine the size of each section of gas piping in a system within the range of the capacity tables, proceed as follows (also see sample calculations included in this Appendix):

- (1) Divide the piping system into appropriate segments consistent with the presence of tees, branch lines and main runs. For each segment, determine the gas load (assuming all appliances operate simultaneously) and its overall length. An allowance (in equivalent length of pipe) as determined from Table A.2.2 shall be considered for piping segments that include four or more fittings.
- (2) Determine the gas demand of each appliance to be attached to the piping system. Where Tables 402.4(2) through 402.4(2022) are to be used to select the piping size, calculate the gas demand in terms of cubic feet per hour for each piping system outlet.
- (3) Determine the length of piping from the point of delivery to the most remote outlet in the building/piping system.
- (4) In the appropriate capacity table, select the row showing the measured length or the next longer length if the table does not give the exact length. This is the only length used in determining the size of any section of gas piping. If the gravity factor is to be applied, the values in the selected row of the table are multiplied by the appropriate multiplier from Table A.2.4.
- (5) Use this horizontal row to locate ALL gas demand figures for this particular system of piping.
- (6) Starting at the most remote outlet, find the gas demand for that outlet in the horizontal row just selected. If the exact figure of demand is not shown, choose the next larger figure left in the row.
- (7) Opposite this demand figure, in the first row at the top, the correct size of gas piping will be found.
- (8) Proceed in a similar manner for each outlet and each section of gas piping. For each section of piping, determine the total gas demand supplied by that section.

When a large number of piping components (such as elbows, tees and valves) are installed in a pipe run, additional pressure loss can be accounted for by the use of equivalent lengths. Pressure loss across any piping component can be equated to the pressure drop through a length of pipe. The equivalent length of

a combination of only four elbows/tees can result in a jump to the next larger length row, resulting in a significant reduction in capacity. The equivalent lengths in feet shown in Table A.2.2 have been computed on a 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 inches by  $n/12$ , or the actual inside diameter in feet by  $n$  ( $n$  can be read from the table heading). The equivalent length values can be used with reasonable accuracy for copper or brass fittings and bends although the resistance per foot of copper or brass pipe is less than that of steel. For copper or brass valves, however, the equivalent length of pipe should be taken as 45 percent longer than the values in the table, which are for steel pipe.

### A.3.2 Branch length method. Deleted.

**A.3.3 Hybrid pressure method.** The sizing of a 2 psi (13.8 kPa) gas piping system is performed using the traditional Longest Length Method but with modifications. The 2 psi (13.8 kPa) system consists of two independent pressure zones, and each zone is sized separately. The Hybrid Pressure Method is applied as follows:

The sizing of the 2 psi (13.8 kPa) section (from the meter to the line regulator) is as follows:

- (1) Calculate the gas load (by adding up the name plate ratings) from all connected appliances. (In certain circumstances the installed gas load may be increased up to 50 percent to accommodate future addition of appliances.) Ensure that the line regulator capacity is adequate for the calculated gas load and that the required pressure drop (across the regulator) for that capacity does not exceed  $3/4$  psi (5.2 kPa) for a 2 psi (13.8 kPa) system. If the pressure drop across the regulator is too high (for the connected gas load), select a larger regulator.
- (2) Measure the distance from the meter to the line regulator located inside the building.
- (3) If there are multiple line regulators, measure the distance from the meter to the regulator furthest removed from the meter.
- (4) The maximum allowable pressure drop for the 2 psi (13.8 kPa) section is 1 psi (6.9 kPa).
- (5) Referring to the appropriate sizing table (based on piping material) for 2 psi (13.8 kPa) systems with a 1 psi (6.9 kPa) pressure drop, find this distance in the first column, or the closest larger distance if the exact distance is not listed.
- (6) Trace across this row until the gas load is found or the closest larger capacity if the exact capacity is not listed.
- (7) Read up the table column to the top row and select the appropriate pipe size.
- (8) If there are multiple regulators in this portion of the piping system, each line segment must be sized for its actual gas load, but using the longest length previously determined above.

The low pressure section (all piping downstream of the line regulator) is sized as follows:

- (1) Determine the gas load for each of the connected appliances.
- (2) Starting from the line regulator, divide the piping system into a number of connected segments and/or independent parallel piping segments, and determine the amount of gas that each segment would carry assuming that all appliances were operated simultaneously. An allowance (in equivalent length of pipe) as determined from Table A.2.2 should be considered for piping segments that include four or more fittings.
- (3) For each piping segment, use the actual length or longest length (if there are sub-branchlines) and the calculated gas load for that segment and begin the sizing process as follows:
  - (a) Referring to the appropriate sizing table (based on operating pressure and piping material), find the longest length distance in the first column or the closest larger distance if the exact distance is not listed. The use of alternative operating pressures and/or pressure drops will require the use of a different sizing table, but will not alter the sizing methodology. In many cases, the use of alternative operating pressures and/or pressure drops may require the approval of the code official.
  - (b) Trace across this row until the appliance gas load is found or the closest larger capacity if the exact capacity is not listed.
  - (c) Read up the table column to the top row and select the appropriate pipe size.
  - (d) Repeat this process for each segment of the piping system.

**A.3.4 Pressure drop per 100 feet method.** Deleted.

**A.4 Use of sizing equations.** Deleted.

**A.5 Pipe and tube diameters.**

**A.6 Use of sizing charts.** Deleted.

**TABLE A.5.1  
SCHEDULE 40 STEEL PIPE STANDARD SIZES**

NOMINAL SIZE (in.)	INTERNAL DIAMETER (in.)	NOMINAL SIZE (in.)	INTERNAL DIAMETER (in.)
1/4	0.364	1 1/2	1.610
3/8	0.493	2	2.067
1/2	0.622	2 1/2	2.469
3/4	0.824	3	3.068
1	1.049	3 1/2	3.548
1 1/4	1.380	4	4.026

**TABLE A.5.2  
COPPER TUBE STANDARD SIZES**

TUBE TYPE	NOMINAL OR STANDARD SIZE (inches)	INTERNAL DIAMETER (inches)
K	1/4	0.305
L	1/4	0.315
ACR (D)	3/8	0.315
ACR (A)	3/8	0.311
K	3/8	0.402
L	3/8	0.430
ACR (D)	1/2	0.430
ACR (A)	1/2	0.436
K	1/2	0.527
L	1/2	0.545
ACR (D)	5/8	0.545
ACR (A)	5/8	0.555
K	5/8	0.652
L	5/8	0.666
ACR (D)	3/4	0.666
ACR (A)	3/4	0.680
K	3/4	0.745
L	3/4	0.785
ACR	7/8	0.785
K	1	0.995
L	1	1.025
ACR	1 1/8	1.025
K	1 1/4	1.245
L	1 1/4	1.265
ACR	1 3/8	1.265
K	1 1/2	1.481
L	1 1/2	1.505
ACR	1 7/8	1.505
K	2	1.959
L	2	1.985
ACR	2 1/8	1.985
K	2 1/2	2.435
L	2 1/2	2.465
ACR	2 3/8	2.465
K	3	2.907
L	3	2.945
ACR	3 1/8	2.945

For SI: 1 inch = 25.4 mm.



**A.76.1 Example 1: Longest length method.** Determine the required pipe size of each section and outlet of the piping system shown in Figure A.7.1, with a designated pressure drop of 0.5-inch w.c. (125 Pa) using the Longest Length Method. The gas to be used has 0.60 specific gravity and a heating value of 1,000 Btu/ft<sup>3</sup> (37.5 MJ/m<sup>3</sup>).

(1) Maximum gas demand for *Outlet A*:

$$\frac{\text{Consumption (rating plate input)}}{\text{Btu of gas}} =$$

$$\frac{35,000 \text{ Btu per hour rating}}{1,000 \text{ Btu per cubic foot}} = 35 \text{ cubic feet per hour} = 35 \text{ cfh}$$

Maximum gas demand for *Outlet B*:

$$\frac{\text{Consumption}}{\text{Btu of gas}} = \frac{75,000}{1,000} = 75 \text{ cfh}$$

Maximum gas demand for *Outlet C*:

$$\frac{\text{Consumption}}{\text{Btu of gas}} = \frac{35,000}{1,000} = 35 \text{ cfh}$$

Maximum gas demand for *Outlet D*:

$$\frac{\text{Consumption}}{\text{Btu of gas}} = \frac{100,000}{1,000} = 100 \text{ cfh}$$

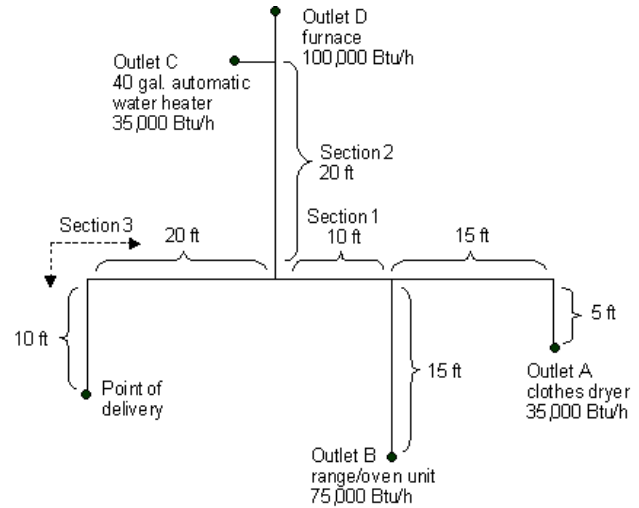
(2) The length of pipe from the *point of delivery* to the most remote *outlet* (A) is 60 feet (18 288 mm). This is the only distance used.

(3) Using the row marked 60 feet (18 288 mm) in Table 402.4(2):

- (a) *Outlet A*, supplying 35 cfh (0.99 m<sup>3</sup>/hr), requires 1/2-inch pipe.
- (b) *Outlet B*, supplying 75 cfh (2.12 m<sup>3</sup>/hr), requires 3/4-inch pipe.
- (c) Section 1, supplying *Outlets A and B*, or 110 cfh (3.11 m<sup>3</sup>/hr), requires 3/4-inch pipe.
- (d) Section 2, supplying *Outlets C and D*, or 135 cfh (3.82 m<sup>3</sup>/hr), requires 3/4-inch pipe.
- (e) Section 3, supplying *Outlets A, B, C and D*, or 245 cfh (6.94 m<sup>3</sup>/hr), requires 1-inch pipe.

(4) If a different gravity factor is applied to this example, the values in the row marked 60 feet (18 288 mm) of Table 402.4(2) would be multiplied by the appropriate multiplier from Table A.2.4 and the resulting cubic feet per hour values would be used to size the *piping*.

## A.7 Examples of piping system design and sizing



**FIGURE A.7.1**  
**PIPING PLAN SHOWING A STEEL PIPING SYSTEM**

**A.7.2 Example 2: Hybrid or dual pressure systems.** Deleted.

**A.7.3 Example 3: Branch length method.** Deleted.

**A.7.4 Example 4: Modification to existing piping system.**  
Deleted.

**A.7.5 Example 5: Calculating pressure drops due to temperature changes.** Deleted.

**A.7.6 Example 6: Pressure drop per 100 feet of pipe method.**  
Deleted.