



Venting Guide for Aboveground Storage Tanks

This guide is intended for reference use only. All final details of design and construction must meet the requirements of federal, state and local codes. In case where plan approval is required, such approval must be obtained from the authority having jurisdiction before any work is performed. The equipment presented in the Guide applies only to shop fabricated tanks.

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References

- NFPA 30 "Flammable and Combustible Liquids Code" 2003 Edition
National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02269
- UL 142 "Steel Aboveground Tanks" 9th Edition, December 28, 2006
UL Standards for Safety—UL Publication Stock, 333 Pfingsten Road, Northbrook, IL
60062, Tel (847) 272-8800
- API Std 2000 "Venting Atmospheric & Low Pressure Storage Tanks"
American Petroleum Institute—Fifth Edition, April 1998
1120 L Street, Northwest, Washington, DC 20005 Order #822-20000
- PEI RP200 "Recommended Practices for Installation of Aboveground Storage Systems for
Motor Vehicle Fueling"
Petroleum Equipment Institute, 2003 Edition, P.O. Box 2380, Tulsa, OK,
Tel (918) 494-9696
- Morrison 325 East 24th Street, Dubuque, Iowa 52001. Tel (563) 583-5701

Background Information

The Morrison Venting Guide was created to assist in equipment selection for aboveground storage tanks. Examples on the next two pages illustrate a vent selection process. It is best to work through the examples before attempting to use any of the tables in this book.

Tables include examples for standard sized tanks. The venting capacity charts and wetted area tables were taken directly from NFPA 30 and UL 142.

The vent selection chapter includes venting capacities of specific Morrison vents. This data was obtained from results of laboratory testing and engineering calculations. Catalog pages of the Morrison equipment follow the vent capacity chart.

Definitions

Emergency Venting — Venting sufficient to relieve excessive internal pressure in storage tanks caused by exposure fires. Venting rate may exceed requirements of normal atmospheric and product transfer effects. In such cases, the construction of the tank will determine if additional venting capacity must be provided.

Atmospheric Tank — A storage tank that has been designed to operate at pressures from atmospheric through 1.0 PSIG (760 mm Hg through 812 mm Hg) measured at the top of the tank (NFPA 30 Pg. 30-13). Pressure not to exceed 1.0 PSIG under normal operation, and 2.5 PSIG under emergency conditions (PEI RP-200).

Pressure Relieving Devices — Defined in NFPA 30 4.2.5.2.3, where entire dependence for emergency relief is placed upon pressure relieving devices, the total venting capacity of both normal and emergency vents shall be enough to prevent rupture of

the shell or bottom of the tank if vertical, or of the shell or heads if horizontal.

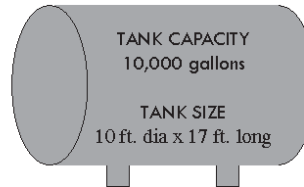
Wetted Area — Exposed surface or shell area of a tank used in determining the venting requirements needed for that size tank in event of an exposure fire. In a horizontal tank, the wetted area is calculated as 75% of the exposed surface area. In a vertical tank, the wetted area is calculated as the first 30 ft. above grade of the exposed shell area of the tank.

CFH — Abbreviation for Cubic Feet per Hour used to quantify or measure the airflow and degree of pressure relief for venting calculations.

Vent Capacity — The maximum rate of airflow (CFH) recorded under test conditions at a maximum pressure of 2.5 PSI for specific sized emergency vents. This capacity rating is often required to be indicated on the vent itself.

Vent Selection/Capacity Example 1

Horizontal Cylindrical Storage Tank



STEP 1 Precalculated Data for Common Sizes

Find tank size on Table A which can be found on page 5. Table lists wetted area and CFH for common sized horizontal tanks. For a 10' x 17' tank – wetted area = 518 sq. ft. and required vent capacity = 360,840 CFH. Proceed to Step 5.

STEP 2 Wetted Area Table

If tank size is NOT listed on Table A, page 5, wetted area can also be found on Table D, page 8. Follow grid for this example – 10' diameter x 17' length = 518 sq. ft. Proceed to Step 4.

STEP 3 Calculate Wetted Area

If the tank size is NOT on either chart, wetted area can be calculated. For Horizontal Tanks, wetted area = 75% of the total exposed surface area.

For a 10' x 17' tank:

$0.75[2(\text{area of each end}) + (\text{area of shell})] = \text{wetted area}$

$\pi = 3.14$, $d = \text{diameter}$, $L = \text{length}$, $WA = \text{wetted area}$

$$WA = 0.75[(\pi d^2 \div 2) + (\pi dL)]$$

$$0.75[(3.14)(10^2) \div 2 + (3.14)(10)(17)]$$

$$WA = 518 \text{ sq. ft.}$$

STEP 4 Determine CFH Requirement

Use Table F: Venting Capacity Chart on page 10. Wetted area must be known (518 sq. ft.). Since 518 is between 500 and 600 on the chart, interpolation is needed and is done as follows:

	600 sq. ft.	392,000	CFH
	500 sq. ft.	<u>354,000</u>	CFH
Difference =	100 sq. ft.	38,000	CFH

$$\frac{38,000}{100} = \frac{\quad \times}{(518-500)} \quad \times = 6,840 \text{ CFH}$$

Total CFH Required: $(6,840 + 354,000) = 360,840 \text{ CFH}$

STEP 5 Vent Selection

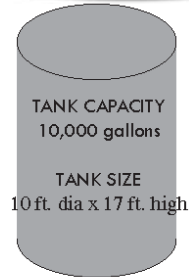
Options based on size of piping, type of product, flow requirements, required venting capacity and mounting. For the sake of this example, use 2" piping, Class 1B liquid. The normal vent size should be no smaller than the system piping, so a Morrison 2" Fig. 548 (20,200 CFH) is selected.

Total required venting capacity for this tank example was determined to be 360,840 CFH. Normal venting and emergency venting may be combined to reach this total. Morrison Vent Capacities are listed on Table H, page 12. Since the 6" Emergency Vent (278,660 CFH) can not provide enough additional capacity to meet the requirement, an 8" Emergency Vent (504,818 CFH) is selected. In specifying pressure settings, it is recommended that the Emergency Vent NOT be less than the normal vent. Therefore, the vent specification for this example is as follows:

Normal Vent - 2" Fig 548	20,200	CFH
(8 oz pressure - 1 oz vacuum)		
Emergency Vent - 8" Fig 244	<u>504,818</u>	CFH
(16 oz pressure)		
Total Venting Provided	525,018	CFH

Vent Selection/Capacity Example 2

Vertical Cylindrical Storage Tank



STEP 1 Precalculated Data for Common Sizes

Find tank size on Table A which can be found on page 5. Table lists wetted area and CFH for common sized vertical tanks. For a 10' x 17' tank – wetted area = 534 sq. ft. and required vent capacity = 366,920 CFH. Proceed to Step 5.

STEP 2 Wetted Area Table

If tank size is NOT listed on Table A, page 5, wetted area can also be found on Table D, page 8. Follow grid for this example – 10' diameter x 17' height = 534 sq. ft. Proceed to Step 4.

STEP 3 Calculate Wetted Area

If the tank size is NOT on either chart, wetted area can be calculated. For Vertical Tanks, wetted area = area of shell to elevation not more than 30 ft. above the bottom.

For a 10' x 17' tank:

Wetted Area = (area of shell)

$\pi = 3.14$, d = diameter, L = length, WA = wetted area

$$WA = (\pi d)L$$

$$(3.14)(10)(17)$$

$$WA = 534 \text{ sq. ft.}$$

STEP 4 Determine CFH Requirement

Use Table F: Venting Capacity Chart on page 10. Wetted area must be known (534 sq. ft.). Since 534 is between 500 and 600 on the chart, interpolation is needed and is done as follows:

	600 sq. ft.	392,000	CFH
	500 sq. ft.	354,000	CFH
Difference =	100 sq. ft.	38,000	CFH

$$\frac{38,000}{100} = \frac{\quad \times}{(534-500)} \quad \times = 12,920 \text{ CFH}$$

Total CFH Required: (12,920 + 354,000) = 366,920 CFH

STEP 5 Vent Selection

Options based on size of piping, type of product, flow requirements, required venting capacity and mounting. For the sake of this example, use 2" piping, Class 1B liquid. The normal vent size should be no smaller than the system piping, so a Morrison 2" Fig. 548 (20,200 CFH) is selected.

Total required venting capacity for this tank example was determined to be 366,920 CFH. Normal venting and emergency venting may be combined to reach this total. Morrison Vent Capacities are listed on Table H, page 12. Since the 6" Emergency Vent (278,660 CFH) can not provide enough additional capacity to meet the requirement, an 8" Emergency Vent (504,818 CFH) is selected. In specifying pressure settings, it is recommended that the Emergency Vent NOT be less than the normal vent. Therefore, the vent specification for this example is as follows:

Normal Vent - 2" Fig 548 (8 oz pressure - 1 oz vacuum)	20,200	CFH
Emergency Vent - 8" Fig 244 (16 oz pressure)	504,818	CFH
Total Venting Provided	525,018	CFH

Vent Selection/Capacity Example 3

Horizontal Rectangular Storage Tank

TANK CAPACITY
10,000 gallons

TANK SIZE
274"L x 130"W x 65"H
(22'-10"L x 10'-10"W x 5'5"H)

STEP 1 Precalculated Data for Common Sizes

Find tank size on Table C which can be found on page 7. Table lists wetted area and CFH for common sized tanks. For a 274"L x 130"W x 65"H (22'10"L x 10'-10"W x 5'5"H) tank – wetted area = 612 sq. ft. and required vent capacity = 396,320 CFH. Proceed to Step 4.

STEP 2 Wetted Area Table

If tank size is NOT listed on Table C, page 7, wetted area can be calculated. For Horizontal Rectangular Tanks, wetted area = exposed shell area excluding the top surface of the tank.

For a 274"L x 130"W x 65"H tank:

$$\text{Wetted area} = (L \times W) + 2(L \times H) + 2(W \times H)$$

144

L = length, W = width, H = height

$$\frac{(274 \times 130) + 2(274 \times 65) + 2(130 \times 65)}{144}$$

Wetted Area = 612 Sq. ft.

STEP 3 Determine CFH Requirement

Use Table F: Venting Capacity Chart on page 10. Wetted area must be known (612 sq. ft.). Since 534 is between 600 and 700 on the chart, interpolation is needed and is done as follows:

	700 sq. ft.	428,000	CFH
	600 sq. ft.	<u>392,000</u>	CFH
Difference =	100 sq. ft.	36,000	CFH

$$\frac{36,000}{100} = \frac{x}{(612-600)} \quad x = 4,320 \text{ CFH}$$

Total CFH Required: (4,320 + 392,000) = 396,320 CFH

STEP 5 Vent Selection

Options based on size of piping, type of product, flow requirements, required venting capacity and mounting. For the sake of this example, use 2" piping, Class 1B liquid. The normal vent size should be no smaller than the system piping, so a Morrison 2" Fig. 548 (20,200 CFH) is selected.

Total required venting capacity for this tank example was determined to be 396,320 CFH. Normal venting and emergency venting may be combined to reach this total. Morrison Vent Capacities are listed on Table H, page 12. Since the 6" Emergency Vent (278,660 CFH) can not provide enough additional capacity to meet the requirement, an 8" Emergency Vent (504,818 CFH) is selected. In specifying pressure settings, it is recommended that the Emergency Vent NOT be less than the normal vent. Therefore, the vent specification for this example is as follows:

Normal Vent - 2" Fig 548 (8 oz pressure - 1 oz vacuum)	20,200	CFH
Emergency Vent - 8" Fig 244 (16 oz pressure)	<u>504,818</u>	CFH
Total Venting Provided	525,018	CFH

Table A: Pre-Calculated Data

Horizontal Cylindrical Tanks

TANK			WETTED AREA (Sq Ft)	REQ'D VENT CAPACITY (CFH)	EMERGENCY VENT SIZE (Inches)
CAPACITY (Gallons)	DIAMETER (Ft or In)	LENGTH (Ft-In)			
280	36"	5'-2"	47	49,520	3
300	38"	5'-0"	49	51,640	3
500	48"	5'-5"	69	72,650	4
530	46"	6'-0"	71	74,750	4
550	48"	6'-0"	75	78,950	4
1,000	48"	10'-8"	119	124,950	5
1,000	64"	6'-0"	109	114,450	5
1,500	64"	9'-0"	147	154,350	5
2,000	64"	12'-0"	184	193,200	6
2,500	64"	15'-0"	222	223,320	6
3,000	64"	18'-0"	259	243,680	6
3,000	6'-0"	14'-0"	240	233,400	6
4,000	64"	24'-0"	335	281,100	8
4,000	6'-0"	19'-0"	311	270,060	6
5,000	8'-0"	13'-4"	326	276,960	6
6,000	8'-0"	16'-0"	376	300,480	8
8,000	8'-0"	21'-4"	477	344,340	8
10,000	8'-0"	27'-0"	584	385,920	8
10,000	9'-0"	21'-0"	540	369,200	8
10,000	10'-0"	17'-0"	518	360,840	8
10,000	10'-6"	15'-7"	515	359,700	8
12,000	8'-0"	32'-0"	678	420,080	8
12,000	9'-0"	25'-0"	625	401,000	8
12,000	10'-0"	20'-6"	600	392,000	8
12,000	11'-0"	17'-0"	583	385,540	8
15,000	8'-0"	40'-0"	829	470,990	8
15,000	10'-6"	23'-5"	703	429,020	8
20,000	10'-0"	34'-2"	922	499,820	8
20,000	10'-6"	31'-0"	896	491,760	8
20,000	11'-0"	28'-0"	868	483,080	8
25,000	10'-6"	38'-6"	1,082	537,530	10
30,000	10'-6"	46'-3"	1,274	568,100	10

Table B: Pre-Calculated Data

Vertical Cylindrical Tanks

TANK			WETTED AREA (Sq Ft)	REQ'D VENT CAPACITY (CFH)	EMERGENCY VENT SIZE (Inches)
CAPACITY (Gallons)	DIAMETER (Ft or In)	LENGTH (Ft-In)			
280	36"	5'-2"	48	50,580	3
300	38"	5'-0"	49	51,640	3
500	48"	5'-5"	68	71,600	4
530	46"	6'-0"	72	75,800	4
550	48"	6'-0"	75	78,950	4
1,000	48"	10'-8"	134	140,700	5
1,000	64"	6'-0"	100	105,000	5
1,500	64"	9'-0"	151	158,550	5
2,000	64"	12'-0"	201	213,100	6
2,500	64"	15'-0"	251	239,520	6
3,000	64"	18'-0"	301	265,460	6
3,000	6'-0"	14'-0"	263	245,760	6
4,000	64"	24'-0"	402	312,840	8
4,000	6'-0"	19'-0"	358	291,840	8
5,000	8'-0"	13'-4"	335	281,100	8
6,000	8'-0"	16'-0"	402	312,840	8
8,000	8'-0"	21'-4"	536	367,680	8
10,000	8'-0"	27'-0"	678	420,080	8
10,000	9'-0"	21'-0"	593	389,340	8
10,000	10'-0"	17'-0"	534	366,920	8
10,000	10'-6"	15'-7"	514	359,320	8
12,000	8'-0"	32'-0"	754	446,360	8
12,000	9'-0"	25'-0"	706	430,040	8
12,000	10'-0"	20'-6"	644	407,840	8
12,000	11'-0"	17'-0"	587	387,060	8
15,000	8'-0"	40'-0"	754	446,360	8
15,000	10'-6"	23'-5"	764	449,760	8
20,000	10'-0"	34'-2"	942	506,020	10
20,000	10'-6"	31'-0"	990	520,900	10
20,000	11'-0"	28'-0"	967	513,770	10
25,000	10'-6"	38'-6"	990	520,900	10
30,000	10'-6"	46'-3"	990	520,900	10

Table C: Pre-Calculated Data

Horizontal Rectangular Tanks

TANK				WETTED AREA (Sq Ft)	REQ'D VENT CAPACITY (CFH)	EMERGENCY VENT SIZE (Inches)
CAPACITY (Gallons)	LENGTH (Ft-In)	WIDTH (Ft-In)	HEIGHT (Ft-In)			
125	6'-8"	2'-9"	1'-0"	37	38,950	3
186	2'-8"	2'-8"	3'-6"	44	46,340	3
250	4'-4"	4'-0"	1'-11"	49	51,640	3
250	6'-8"	2'-9"	1'-11"	54	56,900	3
500	7'-6"	3'-0"	3'-0"	86	90,560	4
500	10'-0"	3'-6"	2'-0"	89	93,740	4
1,000	9'-8"	4'-8"	3'-0"	131	137,550	5
1,000	10'-0"	4'-7"	3'-	133	139,650	5
2,000	10'-2"	6'-11"	3'-10"	201	211,560	6
2,000	10'-8"	6'-4"	4'-0"	204	213,240	6
2,500	10'-2"	6'-11"	4'-9"	233	229,480	6
3,000	8'-6"	6'-10"	7'-2"	278	253,560	6
3,000	13'-9"	5'-5"	5'-5"	282	255,640	6
4,000	11'-4"	6'-10"	7'-2"	338	282,480	8
4,000	18'-2"	5'-5"	5'-5"	354	289,920	8
5,000	22'-9"	5'-5"	5'-5"	428	323,760	8
6,000	13'-8"	10'-10"	5'-5"	413	317,460	8
6,000	16'-5"	6'-10"	7'-2"	445	330,900	8
6,000	27'-4"	5'-5"	5'-5"	503	355,140	8
8,000	18'-2"	10'-10"	5'-5"	511	358,180	8
8,000	21'-11"	6'-10"	7'-2"	562	377,560	8
10,000	22'-10"	10'-10"	5'-5"	612	396,320	8
10,000	27'-5"	6'-10"	7'-2"	678	420,080	8
12,000	27'-4"	10'-10"	5'-5"	710	431,400	8
12,000	32'-11"	6'-10"	7'-2"	795	460,300	8

Table D: Approximate Wetted Areas

Horizontal Cylindrical Tanks

Tank Diameter	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft	8 Ft	9 Ft	10 Ft	11 Ft	12 Ft	Tank Diameter	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft	8 Ft	9 Ft	10 Ft	11 Ft	12 Ft		
Tank Length	Approximate Wetted Area of Tanks With Flat Heads, Square Feet											Tank Length	Approximate Wetted Area of Tanks With Flat Heads, Square Feet										
3 Ft	32											38 Ft					685	791	902	1013	1129	1244	
4 Ft	39	55										39 Ft					701	810	923	1036	1155	1272	
5 Ft	46	65	88									40 Ft					718	828	944	1060	1181	1301	
6 Ft	53	74	100	128								41 Ft					734	847	966	1083	1207	1329	
7 Ft	60	84	112	142	173							42 Ft					751	866	987	1107	1233	1357	
8 Ft	67	93	124	156	190	226						43 Ft					767	885	1008	1130	1259	1385	
9 Ft	74	102	136	170	206	245	286					44 Ft					904	1029	1154	1284	1414		
10 Ft	81	112	147	184	223	264	308	353				45 Ft					923	1051	1178	1310	1442		
11 Ft	88	121	159	198	239	283	329	377	428			46 Ft					941	1072	1201	1336	1470		
12 Ft	95	131	171	213	256	301	350	400	454	509		47 Ft					960	1093	1225	1362	1498		
13 Ft	102	140	183	227	272	320	371	424	480	537		48 Ft					979	1114	1248	1388	1527		
14 Ft	109	150	194	241	289	339	393	447	506	565		49 Ft					998	1135	1272	1414	1555		
15 Ft	116	159	206	255	305	358	414	471	532	594		50 Ft						1157	1295	1440	1583		
16 Ft	123	169	218	269	322	377	435	495	558	622		51 Ft						1178	1319	1466	1612		
17 Ft	130	178	230	283	338	395	456	518	584	650		52 Ft						1199	1342	1492	1640		
18 Ft	137	188	242	298	355	414	477	542	610	678		53 Ft						1220	1366	1518	1668		
19 Ft		197	253	312	371	433	499	565	636	707		54 Ft						1246	1389	1544	1696		
20 Ft		206	265	326	388	452	520	589	662	735		55 Ft						1263	1413	1570	1725		
21 Ft		216	277	340	404	471	541	612	688	763		56 Ft							1437	1593	1753		
22 Ft		225	289	354	421	490	562	636	714	792		57 Ft							1460	1622	1781		
23 Ft		235	300	368	437	508	584	659	740	820		58 Ft							1484	1648	1809		
24 Ft		244	312	383	454	527	605	683	765	848		59 Ft							1507	1674	1839		
25 Ft			324	397	470	546	626	706	791	876		60 Ft							1531	1700	1866		
26 Ft			336	411	487	565	647	730	817	905		61 Ft									1726	1894	
27 Ft			347	425	503	584	668	754	843	933		62 Ft									1752	1923	
28 Ft			359	440	520	603	690	777	869	961		63 Ft									1778	1951	
29 Ft			371	454	536	621	711	801	895	989		64 Ft									1803	1979	
30 Ft			383	468	553	640	732	824	921	1018		65 Ft									1829	2007	
31 Ft			395	482	569	659	753	848	947	1046		66 Ft									1855	2036	
32 Ft				496	586	678	775	871	973	1074		67 Ft										2064	
33 Ft				510	602	697	796	895	999	1103		68 Ft										2092	
34 Ft				524	619	715	817	918	1025	1131		69 Ft										2120	
35 Ft				539	635	734	838	942	1051	1159		70 Ft										2149	
36 Ft				553	652	753	860	966	1077	1187		71 Ft										2177	
37 Ft				567	668	772	881	989	1103	1216		72 Ft										2205	

SI Units: 1 Ft = 0.30 m; 1 sq ft = 0.09 sq m
 Source for Chart: NFPA 30, 2003 Edition, Table B-4

Table E: Approximate Wetted Areas

Vertical Cylindrical Tanks

(Area of Shell to Elevation Not More Than 30 Ft. Above Bottom)

Tank Diameter	3 Ft	4 Ft	5 Ft	6 Ft	7 Ft	8 Ft	9 Ft	10 Ft	11 Ft	12 Ft
Tank	Wetted Area, Square Feet									
3 Ft	28									
4 Ft	38	50								
5 Ft	47	63	79							
6 Ft	56	76	94	113						
7 Ft	66	88	110	132	154					
8 Ft	75	101	127	151	176	201				
9 Ft	85	113	141	170	198	226	255			
10 Ft	94	126	157	189	220	251	283	314		
11 Ft	103	139	173	208	242	276	311	345	381	
12 Ft	113	151	188	227	264	301	340	377	415	452
13 Ft		164	204	246	286	326	368	408	450	490
14 Ft		176	220	265	308	351	396	440	484	528
15 Ft		189	236	284	330	377	424	471	519	566
16 Ft		202	251	302	352	402	453	502	554	603
17 Ft			267	321	374	427	481	534	588	641
18 Ft			283	340	396	452	510	565	623	679
19 Ft			298	359	418	477	538	597	657	716
20 Ft			314	378	440	502	566	628	692	754
21 Ft				397	462	527	594	659	727	792
22 Ft				416	484	552	623	691	761	829
23 Ft				435	506	577	651	722	796	867
24 Ft				454	528	602	679	757	830	905
25 Ft					550	628	708	785	865	943
26 Ft					572	653	736	816	900	980
27 Ft					594	678	764	848	934	1018
28 Ft					616	703	792	879	969	1056
29 Ft						728	821	911	1003	1093
30 Ft						753	849	942	1038	1131

SI Units: 1 Ft = 0.30 m; 1 sq ft = 0.09 sq m

Source for Chart: UL 142, 9th Edition, Table A-3

Table F: Emergency Venting Capacity

Wetted Surface (Sq Ft.)	Venting Capacity (CFH)	Minimal Opening Nominal Pipe Size (Inches)
20	21,100	2
30	31,600	2
40	42,100	3
50	52,700	3
60	63,200	3
70	73,700	4
80	84,200	4
90	94,800	4
100	105,000	4
120	126,000	5
140	147,000	5
160	168,000	5
180	190,000	5
200	211,000	6
250	239,000	6
300	265,000	6
350	288,000	8
400	312,000	8
500	354,000	8
600	392,000	8
700	428,000	8
800	462,000	8
900	493,000	8
1000	524,000	10
1200	557,000	10
1400	587,000	10
1600	614,000	10
1800	639,000	10
2000	662,000	10
2400	704,000	10
2800 and over	742,000	10

- At 14.7 psia and 60° F (101.4 kPa and 16° C)
- Interpolate for intermediate values.
- These values taken from NFPA 30, Table 4.2.5.2.3
- These pipe sizes apply only to open vent pipes to the specified diameter not more than 12 inches (0.3m) long and a pressure in tank of not more than 2.5 psig (17.1 kPa).
- If tank is to be equipped with a venting device or flame arrester, the vent opening is to accommodate the venting device or flame arrester in accordance with the listed CFH.

Normal Venting Recommendations

NFPA 30 — 2003

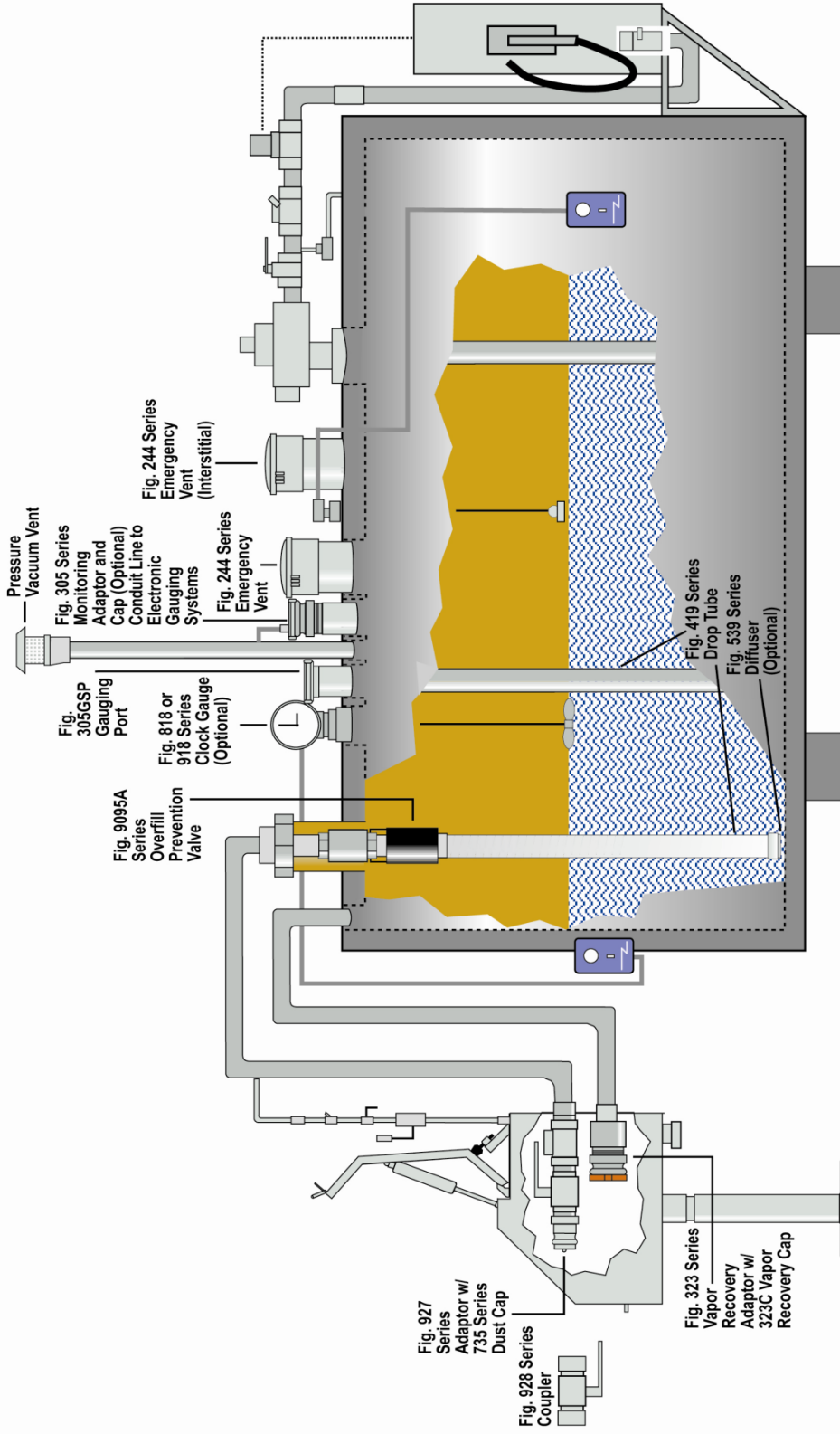
4.2.5.1.2 Normal vents shall be sized to be at least as large as the filling or withdrawal connection, whichever is larger, but in no case less than 1-1/4 in. (3 cm) nominal inside diameter.

Table G: Gallon Capacity Per Foot of Length

Diameter (Inches)	U.S. Gallons Per Ft Length	Diameter (Inches)	U.S. Gallons Per Ft Length	Diameter (Inches)	U.S. Gallons Per Ft Length
24	23.50	65	172.38	106	458.30
25	25.50	66	177.72	107	467.70
26	27.58	67	183.15	108	475.89
27	29.74	68	188.66	109	485.00
28	31.99	69	194.25	110	493.70
29	34.31	70	199.92	111	502.70
30	36.72	71	205.67	112	511.90
31	39.21	72	211.51	113	521.40
32	41.78	73	217.42	114	530.24
33	44.43	74	223.42	115	540.00
34	47.16	75	229.50	116	549.50
35	49.98	76	235.66	117	558.51
36	52.88	77	241.90	118	568.00
37	55.86	78	248.23	119	577.80
38	58.92	79	254.63	120	587.52
39	62.06	80	261.12	121	597.70
40	65.28	81	267.69	122	607.27
41	68.58	82	274.34	123	617.26
42	71.97	83	281.07	124	627.00
43	75.44	84	287.88	125	638.20
44	78.99	85	294.78	126	647.74
45	82.62	86	301.76	127	658.60
46	86.33	87	308.81	128	668.47
47	90.13	88	315.95	129	678.95
48	94.00	89	323.18	130	690.30
49	97.96	90	330.48	131	700.17
50	102.00	91	337.86	132	710.90
51	106.12	92	345.33	133	721.71
52	110.32	93	352.88	134	732.60
53	114.61	94	360.51	135	743.58
54	118.97	95	368.22	136	754.64
55	123.42	96	376.01	137	765.78
56	127.95	97	383.89	138	776.99
57	132.56	98	391.84	139	788.30
58	137.25	99	399.88	140	799.68
59	142.02	100	408.00	141	811.14
60	146.88	101	416.00	142	822.69
61	151.82	102	424.48	143	834.32
62	156.83	103	433.10	144	846.03
63	161.93	104	441.80		
64	167.12	105	449.82		

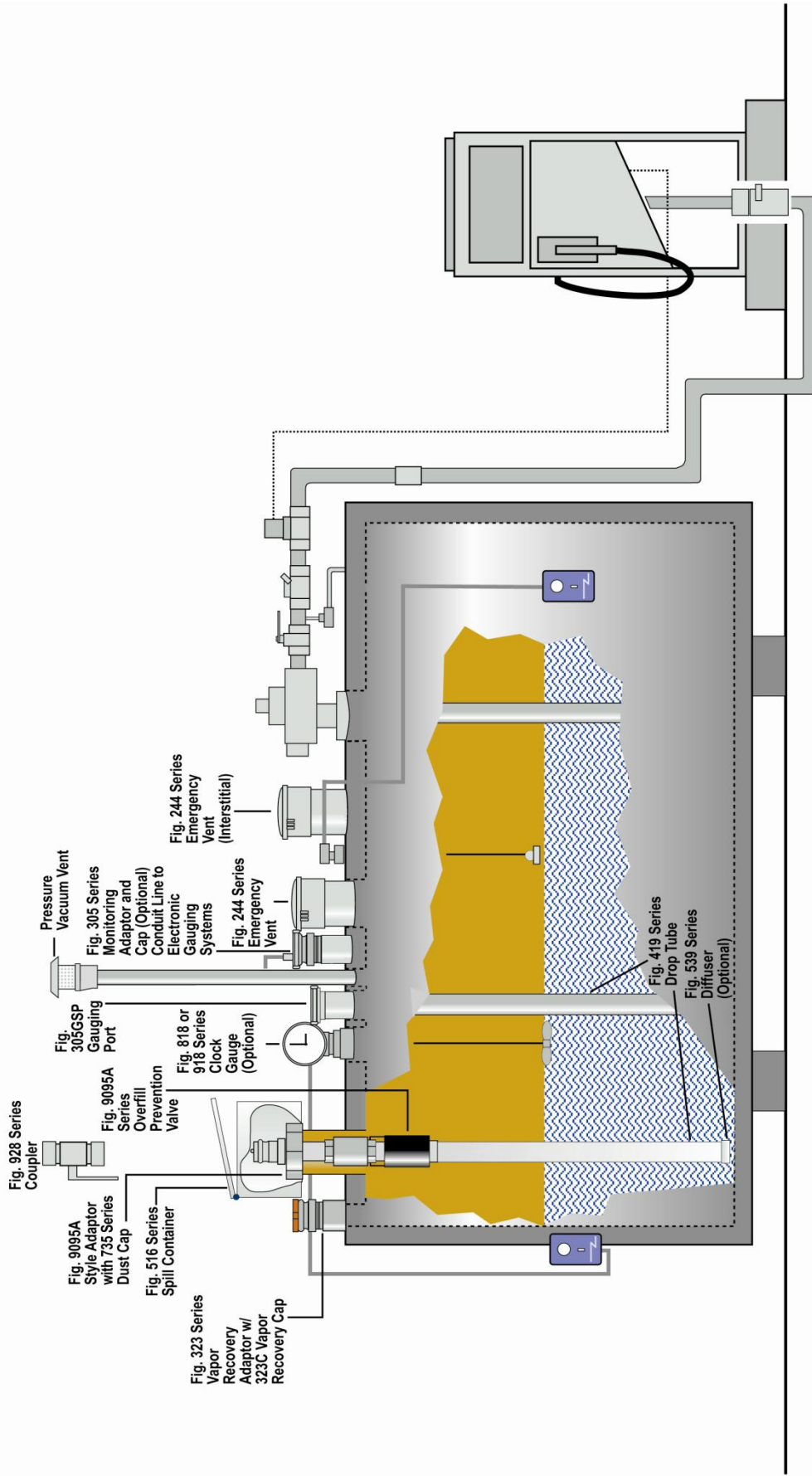
Aboveground Fuel Storage System With Vapor Recovery Components

Protected Double-Wall Tank With Remote Fill



Aboveground Fuel Storage System With Vapor Recovery Components

Protected Double-Wall Tank With Direct Fill



Aboveground Fuel Storage - Suction System

Protected tank with top fill and top mounted pump

