

Venting Guide *for Aboveground Storage Tanks*

A Guide Used To Assist
In Equipment Selection for
Aboveground Storage Tanks



www.morrisonbros.com

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 cases 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.

Contents

I.	Background Information	Page
	Introduction	2
	Definitions	2
II.	Example Calculations for Vent Selection	
	Horizontal Cylindrical Storage Tank	3
	Vertical Cylindrical Storage Tank	4
	Horizontal Rectangular Storage Tank	5
III.	Calculation Tables	
	Precalculated-Horizontal Cylindrical Tanks	6
	Precalculated-Vertical Cylindrical Storage Tanks	7
	Precalculated-Horizontal Rectangular Storage Tanks	8
	Wetted Areas for Horizontal Cylindrical Tanks	9
	Wetted Areas for Vertical Cylindrical Tanks	10
	Emergency Venting Capacity	11
	Gallon Capacity per Foot of Length	12
IV.	Vent Selection	
	Morrison Vents-Capacities	13
	Vent Combination Examples	14
	Morrison Equipment	15
V.	Aboveground Fuel Storage Diagrams	
	Pressure Systems	24
	Suction Systems	26
	Bulk Storage	28

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.

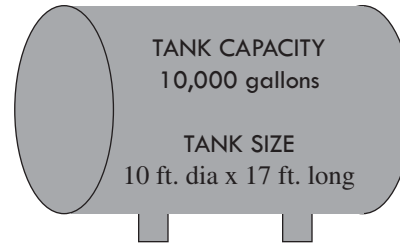
Wetted Area — Exposed surface or shell area of a tank used in determining the venting requirements needed for that size tank in event of an exposure fire. In a horizontal tank, the wetted area is calculated as 75% of the exposed surface area. In a vertical tank, the wetted area is calculated as the first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

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

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

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 (246,130 CFH) can not provide enough additional capacity to meet the requirement, an 8" Emergency Vent (462,000 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:

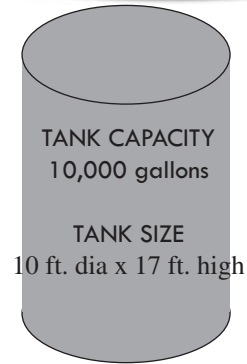
Normal Vent - 2" Fig 548 (8 oz pressure - 1 oz vacuum)	20,200	CFH
Emergency Vent - 8" Fig 244 (16 oz pressure)	<u>462,000</u>	CFH
Total Venting Provided	482,200	CFH

STEP 6 Verification

Refer to Table I on page 13 showing vent combinations and verify the total CFH figure. Also refer to the product illustrations on pages 23-28 and verify the selection for correct option on material compatibility and mounting requirements.

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)

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

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

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

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

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

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

Total CFH Required: $(12,920 + 354,000) = 366,920 \text{ CFH}$

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 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 (246,130 CFH) can not provide enough additional capacity to meet the requirement, an 8" Emergency Vent (462,000 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>462,000</u>	CFH
Total Venting Provided	482,200	CFH

STEP 6 Verification

Refer to Table I on page 13 showing vent combinations and verify the total CFH figure. Also refer to the product illustrations on pages 23-28 and verify the selection for correct option on material compatibility and mounting requirements.

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 (246,130 CFH) can not provide enough additional capacity to meet the requirement, an 8” Emergency Vent (462,000 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>462,000</u>	CFH
Total Venting Provided	482,200	CFH

STEP 6 Verification

Refer to Table I on page 13 showing vent combinations and verify the total CFH figure. Also refer to the product illustrations on pages 23-28 and verify the selection for correct option on material compatibility and mounting requirements.

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	6
1,000	64"	6'-0"	109	114,450	4
1,500	64"	9'-0"	147	154,350	6
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	6H
4,000	6'-0"	19'-0"	311	270,060	6H
5,000	8'-0"	13'-4"	326	276,960	6H
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	8FL
15,000	10'-6"	23'-5"	703	429,020	8
20,000	10'-0"	34'-2"	922	499,820	8FL
20,000	10'-6"	31'-0"	896	491,760	8FL
20,000	11'-0"	28'-0"	868	483,080	8FL
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	6
1,000	64"	6'-0"	100	105,000	4
1,500	64"	9'-0"	151	158,550	6
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	6H
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	6H
5,000	8'-0"	13'-4"	335	281,100	6H
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			HEIGHT (Ft-In)	WETTED AREA (Sq Ft)	REQ'D VENT CAPACITY (CFH)	EMERGENCY VENT SIZE (Inches)
CAPACITY (Gallons)	LENGTH (Ft-In)	WIDTH (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	6
1,000	10'-0"	4'-7"	3'-0"	133	139,650	6
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	6H
3,000	13'-9"	5'-5"	5'-5"	282	255,640	6H
4,000	11'-4"	6'-10"	7'-2"	338	282,480	6H
4,000	18'-2"	5'-5"	5'-5"	354	289,920	6H
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 FL

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 arrestor, the vent opening is to accommodate the venting device or flame arrestor 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		

Table H: Vent Capacity

SIZE	FIG. NO.	MT. CON.	DESCRIPTION	PRESSURE oz/sq in.	CAPACITY CFH	DATA SOURCE
2"	351S	Female Thds	Flame Arrester	0	22,000	Tested at Ohio State Univ. by O. E. Buxton Jr. 1967
2"	351S/748A	Female Thds	Flame Arrester/Vent	2	15,500	Based on ISU Test of 2" 351S/548-748 - 8 oz by Kavanagh, 1990
2"	351S/748A	Female Thds	Flame Arrester/Vent	4	15,500	Based on ISU Test of 2" 351S/548-748 - 8 oz by Kavanagh, 1990
2"	351S/748A	Female Thds	Flame Arrester/Vent	6	15,500	Based on ISU Test of 2" 351S/548-748 - 8 oz by Kavanagh, 1990
2"	351S/748A	Female Thds	Flame Arrester/Vent	8	15,500	Tested at Iowa State Univ. by P. Kavanagh, 1990
2"	351S/748A	Female Thds	Flame Arrester/Vent	12	13,000	Based on ISU Test of 2" 351S/548-748 - 16 oz by Kavanagh, 1990
2"	351S/748A	Female Thds	Flame Arrester/Vent	16	13,000	Tested at Iowa State Univ. by P. Kavanagh, 1990
1-1/2"	354	Female Slip On	Updraft Vent	0	27,650	Tested at Iowa State University by P. Kavanagh, 1990
2"	354	Female Slip On	Updraft Vent	0	27,650	Tested at Univ. Wisconsin Platteville by L. Lee, 1988
3"	354	Female Slip On	Updraft Vent	0	59,000	Tested at Univ. Wisconsin Platteville by L. Lee, 1996
4"	354	Female Thds	Updraft Vent	0	116,900	Tested at Continental Disc Corp, 1997
2"	548-748	Female Thds	Pressure Vacuum Vent	2	20,200	Based on ISU Test of 2" 548 - 8 oz by Kavanagh, 1960
2"	548-748	Female Thds	Pressure Vacuum Vent	4	20,200	Based on ISU Test of 2" 548 - 8 oz by Kavanagh, 1960
2"	548-748	Female Thds	Pressure Vacuum Vent	6	20,200	Based on ISU Test of 2" 548 - 8 oz by Kavanagh, 1960
2"	548-748	Female Thds	Pressure Vacuum Vent	8	20,200	Tested at Iowa State Univ. by P. Kavanagh, 1960
2"	548-748	Female Thds	Pressure Vacuum Vent	12	18,600	Approx. Calculated C.F.H.
2"	548-748	Female Thds	Pressure Vacuum Vent	16	18,000	Tested at Iowa State Univ. by P. Kavanagh, 1960
2"	749	Female Thds/Slip On	Pressure Vacuum Vent	8	8,500	Tested at Univ. Wisconsin Platteville by L. Lee, 1988
2"	749	Female Thds/Slip On	Pressure Vacuum Vent	12	8,500	Tested at Univ. Wisconsin Platteville by L. Lee, 1988
2"	749 CRB	Female Thds/Slip On	Pressure Vacuum Vent	1.70	11,000	Tested at Univ. Wisconsin Platteville by L. Lee, 1996
3"	548	Female Thds/Slip On	Pressure Vacuum Vent	2	43,000	Based on ISU Test of 3" 548 - 8 oz by Kavanagh, 1990
3"	548	Female Thds	Pressure Vacuum Vent	4	43,000	Based on ISU Test of 3" 548 - 8 oz by Kavanagh, 1990
3"	548	Female Thds	Pressure Vacuum Vent	6	43,000	Based on ISU Test of 3" 548 - 8 oz by Kavanagh, 1990
3"	548	Female Thds	Pressure Vacuum Vent	8	43,000	Tested at Iowa State University by P. Kavanagh, 1990
3"	548	Female Thds	Pressure Vacuum Vent	12	40,000	Based on ISU Test of 3" 548 - 16 oz by P. Kavanagh, 1990
3"	548	Female Thds	Pressure Vacuum Vent	16	40,000	Tested at Iowa State University by P. Kavanagh, 1990
2"	244OM	Male Thds	Emergency Vent	8	21,100	Approx. Calculated C.F.H.
3"	244 OM	Male Thds	Emergency Vent	8	59,900	Tested at Continental Disc Corp, 1997
4"	244M	Male Thds	Emergency Vent	8	109,250	Based on Continental Disc Corp Test of 4" 16 oz 244, 1997
4"	244M	Male Thds	Emergency Vent	16	109,250	Based on Continental Disc Corp Test of 4" 16 oz 244, 1997
4"	244 Series	Female Thds	Emergency Vent	8	119,750	Based on Continental Disc Corp Test of 4" 16 oz 244, 1997
4"	244 Series	Female Thds	Emergency Vent	16	119,750	Based on Continental Disc Corp Test of 4" 16 oz 244, 1997
6"	244	Female Thds	Emergency Vent	8	246,130	Based on Continental Disc Corp Test of 6" 16 oz 244, 1997
6"	244	Female Thds	Emergency Vent	16	246,130	Tested at Continental Disc Corp, 1997
6"	244F	Flanged	Emergency Vent	8	298,750	Based on Continental Disc Corp Test of 6" 16 oz 244H, 1997
6"	244F	Flanged	Emergency Vent	16	298,750	Based on Continental Disc Corp Test of 6" 16 oz 244H, 1997
6"	244OH	Male/Female Thds	Emergency Vent	8	298,750	Based on Continental Disc Corp Test of 6" 16 oz 244H, 1997
6"	244OH	Male/Female Thds	Emergency Vent	16	298,750	Based on Continental Disc Corp Test of 6" 16 oz 244H, 1997
6"	244M	Male Thds	Emergency Vent	8	246,130	Based on Continental Disc Corp Test of 6" 16 oz 244H, 1997
6"	244M	Male Thds	Emergency Vent	16	246,130	Based on Continental Disc Corp Test of 6" 16 oz 244H, 1997
8"	244	Female Thds	Female Emergency Vent	8	462,000	UL Calc based on Continental Disc Corp. Test of 244 Series, 1997
8"	244	Female Thds	Female Emergency Vent	16	462,000	UL Calc based on Continental Disc Corp. Test of 244 Series, 1997
8"	244F	Flanged	Emergency Vent	8	509,550	UL Calc based on Continental Disc Corp. Test of 244 Series, 1997
8"	244F	Flanged	Emergency Vent	16	509,550	UL Calc based on Continental Disc Corp. Test of 244 Series, 1997
8"	244M	Male Thds	Male Emergency Vent	8	453,300	UL Calc based on Continental Disc Corp. Test of 244 Series, 1997
8"	244M	Male Thds	Male Emergency Vent	16	453,300	UL Calc based on Continental Disc Corp. Test of 244 Series, 1997
10"	244F	Flanged	Flanged Emergency Vent	2.5	808,350	UL Calc based on Continental Disc Corp. Test of 244 Series, 1997
10"	244F	Flanged	Flanged Emergency Vent	8	808,350	UL Calc based on Continental Disc Corp. Test of 244 Series, 1997
10"	244F	Flanged	Flanged Emergency Vent	16	808,350	UL Calc based on Continental Disc Corp. Test of 244 Series, 1997
2" & 3"	922	Female Thds	Pressure Vacuum Vent Alarm	8	24,656	Tested at Continental Disc Corp, 1997

Table I: Vent Combination Examples

	MORRISON VENTS	CFH		MORRISON VENTS	CFH
1.	2" Fig. 548 - 4 oz P	20,200	8.	3" Fig. 548 - 4 oz P	43,000
	4" Fig. 244 - 8 oz P	<u>119,750</u>		4" Fig. 244 - 8 oz P	<u>119,750</u>
	TOTAL CFH	139,950		TOTAL CFH	162,750
2.	2" Fig. 548 - 8 oz P	20,200	9.	3" Fig. 548 - 8 oz P	43,000
	6" Fig. 244 - 16 oz P	<u>246,130</u>		6" Fig. 244 - 16 oz P	<u>246,130</u>
	TOTAL CFH	266,330		TOTAL CFH	289,130
3.	2" Fig. 548 - 8 oz P	20,200	10.	3" Fig. 548 - 8 oz P	43,000
	8" Fig. 244 - 16 oz P	<u>462,000</u>		8" Fig. 244 - 16 oz P	<u>462,000</u>
	TOTAL CFH	482,200		TOTAL CFH	505,000
4.	2" Fig. 548 - 8 oz P	20,200	11.	3" Fig. 548 - 8 oz P	43,000
	10" Fig. 244 - 16 oz P	<u>808,350</u>		10" Fig. 244F - 16 oz P	<u>808,350</u>
	TOTAL CFH	828,550		TOTAL CFH	851,350
5.	2" Fig. 548 - 8 oz P	20,200	12.	3" Fig. 548 - 8 oz P	43,000
	10" Fig. 244F - 8 oz P	<u>808,350</u>		10" Fig. 244F - 8 oz P	<u>808,350</u>
	TOTAL CFH	828,550		TOTAL CFH	851,350
6.	2" Fig. 548 - 8 oz P	20,200	13.	3" Fig. 548 - 8 oz P	43,000
	10" Fig. 244F - 2.5 oz P	<u>808,350</u>		10" Fig. 244F - 2.5 oz P	<u>808,350</u>
	TOTAL CFH	828,550		TOTAL CFH	851,350
7.	2" Fig. 548 - 8 oz P	20,200	14.	3" Fig. 548 - 8 oz P	43,000
	2" Fig. 922 - 8 oz P	<u>24,656</u>		2" Fig. 922 - 8 oz P	<u>24,656</u>
	TOTAL CFH	44,856		TOTAL CFH	67,650

244 Series



Emergency Vent

Emergency vent (pressure relief only) used on aboveground storage tanks, as a code requirement that helps prevent the tanks from becoming over-pressurized and rupturing if exposed to fire. UL listed except for 2".



Fig.244



Fig.244M

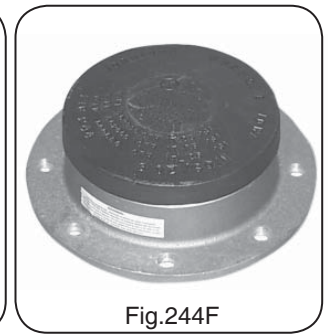


Fig.244F

Description

The 244 emergency vent consists of a body and a black powder coated cover (2" not powder coated) that moves up and down on a center pin. Pressure inside the tank forces the cover to lift up off the vent seat, allowing air to exhaust. The center pin guides the movement. When pressure falls the cover lowers back down onto seat and the vent is automatically reset.

Code Compliance

When properly sized for the tank, this vent will conform to the requirements of NFPA 30, 30A, UL 142, UL 2244, API 2000, and PEI RP200.

WARNING...The 244 emergency vent is for "emergency pressure relief only" and must be used in conjunction with a "normal vent" or pressure vacuum vent such as a Morrison Fig. 354, 548, 748 or 749.

WARNING...The 244 emergency vent must be properly sized and selected for each specific tank application in order to meet the proper "venting capacity" requirements. See the Morrison Vent Guide for further instructions.

Material and Configuration Options

Aluminum Body or Iron Body...suffix (I) indicates iron.

Metal-to-Metal Seat (brass) or Soft Seat (Viton®)...suffix (O) indicates o-ring.

Male/Female NPT/BSP or Flanged Mounting Connection...suffix (M) indicates male, and suffix (F) indicates flanged.

Opening Pressure Setting...settings indicated are approximate.

T= Tall Body...8" only order for use on tite wrapped tanks.

Emergency vent should be set higher than the normal vent so the normal vent operates first.

Use 16 oz. o-ring to comply with pressure decay test. Contact factory for assistance.

Fig. No.	Size	Opening Pressure Setting (oz/sq in)	Ship Weight (lbs)	Venting Capacity (*Estimated CFH @ 2.5 PSI)	Mounting Connection	
244 & 244O	4"	8.0	10.65	119,750	Female NPT/BSP	
		16.0	21.00	119,750	Female NPT	
	6"	8.0	15.50	246,130	Female NPT/BSP	
		16.0	33.15	246,130	Female NPT	
	8"	8.0	34.70	462,000	Female NPT	
		16.0	68.00	462,000	Female NPT	
244F & 244OF	6"	8.0	24.8	298,750	Flanged	
		16.0	44.2	298,750	Flanged	
	8"	8.0	42.00	509,550	Flanged	
		16.0	75.00	509,550	Flanged	
	10"	2.5	32.00	808,350	Flanged	
		8.0	71.00	808,350	Flanged	
		16.0	125.00	808,350	Flanged	
	244M & 244OM	<i>(2" and 3" OM only)</i>				
		2"	8.0	1.0	21,100*	Male NPT/BSP
		3"	8.0	5.75	59,900	Male NPT/BSP
			16.0	11.55	119,750	Male NPT
		4"	8.0	21.25	119,750	Male NPT/BSP
16.0			35.00	246,130	Male NPT	
6"		8.0	19.45	246,130	Male NPT/BSP	
		16.0	35.00	246,130	Male NPT	
8"		8.0	34.00	453,300	Male NPT	
		16.0	68.00	453,300	Male NPT	
244OH	6"	8.0	21.50	298,750	Female NPT	
		16.0	41.40	298,750	Female NPT	
244OMH	6"	8.0	23.00	298,750	Male NPT	
		16.0	42.9	298,750	Male NPT	

Fig. No.	Size	Opening Pressure Setting (oz/sq in)	Ship Weight (lbs)	Venting Capacity (*Estimated CFH @ 2.5 PSI)	Mounting Connection	
244OI	4"	8.0	13.65	119,750	Female NPT	
		16.0	24.00	119,750	Female NPT	
	6"	8.0	20.63	246,130	Female NPT	
		16.0	38.28	246,130	Female NPT	
	8"	8.0	44.33	462,000	Female NPT	
		16.0	77.63	462,000	Female NPT	
244OMI	<i>(3" OMI only)</i>					
	3"	8.0	8.00	59,900	Male NPT	
	4"	8.0	16.36	119,750	Male NPT	
		16.0	26.06	119,750	Male NPT	
	6"	8.0	27.76	246,130	Male NPT	
		16.0	43.31	246,130	Male NPT	
	8"	8.0	34.63	453,300	Male NPT	
		16.0	75.36	453,300	Male NPT	
	244OMT	8"	8.0	40.5	453,300	Male NPT
			16.00	71.5	453,300	Male NPT

WARNING...Do not fill or unload fuel from a storage tank unless it is certain that the tank vents will operate properly. Morrison tank vents are designed only for use on shop fabricated atmospheric tanks which have been built and tested in accordance with UL 142, NFPA 30 & 30A, and API 650 and in accordance with all applicable local, state and federal laws. In normal operation, dust and debris can accumulate in vent openings and block air passages. Certain atmospheric conditions such as a sudden drop in temperature, below freezing temperatures, and freezing rain can cause moisture to enter the vent and freeze which can restrict internal movement of vent mechanisms and block air passages. All storage tank vent air passages must be completely free of restriction and all vent mechanisms must have free movement in order to insure proper operation. Any restriction of airflow can cause excessive pressure or vacuum to build up in the storage tank, which can result in structural damage to the tank, fuel spillage, property damage, fire, injury, and death. Monthly inspection, and immediate inspection during freezing conditions, by someone familiar with the proper operation of storage tank vents, is required to insure venting devices are functioning properly before filling or unloading a tank. Normal vents such as pressure vacuum and updraft vents for aboveground storage tanks should be sized according to NFPA 30 (2008) 21.4.3

244A

Flanged Adaptor

The 244A can be used with either Fig. 244F or Fig. 143A.

Construction Details

Carbon steel welded rim and skirt.



Size	Weight
6" (eight 7/8" holes on 9½" B.C.)	12.0 lbs
8" (eight 7/8" holes on 11¾" B.C.)	19.0 lbs
10" (twelve 1" holes on 14¼" B.C.)	20.0 lbs

244C

Companion Flange

The 244C can be used with either Fig. 244F or Fig. 143A.

Construction Details

Cast iron with NPT "center port" I.D.

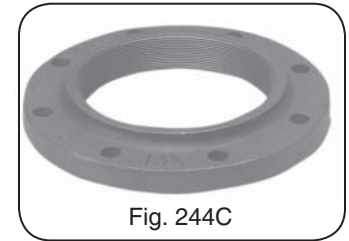


Fig. 244C

Size	Weight
8" (eight 7/8" holes on 11¾" B.C. w/8" NPT I.D.)	27.0 lbs
10" (twelve 1" holes on 14¼" B.C. w/10" NPT I.D.)	36.0 lbs

244N

Pipe Nipple

Available (T.O.E.) Threaded One End or (T.B.E.) Threaded Both Ends.



Fig. 244N

Construction Details

Carbon steel —NPT

Size	Weight
4" x 8"	7.00 lbs
6" x 8"	13.0 lbs
8" x 8"	20.0 lbs
8" x 12"	28.0 lbs

548 Series

Pressure/Vacuum Vent

With Gauge Hatch...for “normal” venting of above-ground storage tanks. Allows tank to “breathe” during filling and discharging operations. Pressure/vacuum poppets seal vapors in the tank when pressure is equalized. This vent must be used in conjunction with an emergency vent and it is RECOMMENDED that the opening pressure setting is set below that of the emergency vent so the normal vent operates first. Settings are approximate.



Fig. 548

Construction Details

Fig. 548...brass body and hood Brass (raised) metal-to-metal seats/poppets.

Fig. 548A...aluminum body and hood. Brass (raised) metal-to-metal seats/poppets. 2" available with British Pipe Threads.

Standard Features

1. Threaded gauge hatch for manual gauging access.
2. Horizontal discharge with field-adjustable, tripolar orientation.

Size	Pressure Setting (oz/sq in)	Vacuum Setting (oz/sq in)	Fig. 548 Ship Weight (lbs)	Fig. 548A Ship Weight (lbs)	Venting Capacity (CFH) (@2.5 PSI)
2"	2.0	1.0	13.25	7.00	20,200
	4.0	1.0	13.75	8.75	20,200
	6.0	1.0	14.25	8.50	20,200
	8.0	1.0	14.75	9.50	20,200
	12.0	1.0	15.75	10.50	18,600
	16.0	1.0	17.00	11.25	18,600
3"	2.0	1.0	26.25	12.25	43,000
	4.0	1.0	27.25	13.75	43,000
	6.0	1.0	28.25	15.00	43,000
	8.0	1.0	28.75	15.75	43,000
	12.0	1.0	29.25	15.75	40,000
	16.0	1.0	33.25	20.50	40,000

WARNING...Do not fill or unload fuel from a storage tank unless it is certain that the tank vents will operate properly. Morrison tank vents are designed only for use on shop fabricated atmospheric tanks which have been built and tested in accordance with UL 142, NFPA 30 & 30A, and API 650 and in accordance with all applicable local, state and federal laws. In normal operation, dust and debris can accumulate in vent openings and block air passages. Certain atmospheric conditions such as a sudden drop in temperature, below freezing temperatures, and freezing rain can cause moisture to enter the vent and freeze which can restrict internal movement of vent mechanisms and block air passages. All storage tank vent air passages must be completely free of restriction and all vent mechanisms must have free movement in order to insure proper operation. Any restriction of airflow can cause excessive pressure or vacuum to build up in the storage tank, which can result in structural damage to the tank, fuel spillage, property damage, fire, injury, and death. Monthly inspection, and immediate inspection during freezing conditions, by someone familiar with the proper operation of storage tank vents, is required to insure venting devices are functioning properly before filling or unloading a tank.

Normal vents such as pressure vacuum and updraft vents for above-ground storage tanks should be sized according to NFPA 30 (2008) 21.4.3

748A Series

Pressure/Vacuum Vent

For “normal” venting of above-ground storage tanks. Allows tank to “breathe” during filling and discharging operations. Pressure/vacuum poppets seal vapors in the tank when pressure is equalized. This vent must be used in conjunction with an emergency vent and it is RECOMMENDED that the opening pressure setting is set below that of the emergency vent so the normal vent operates first. Settings are approximate.



Fig. 748

Construction Details

Brass (raised) metal-to-metal seats/poppets; Aluminum body and hood.

Standard Features

1. Horizontal discharge with field-adjustable, tripolar orientation.
2. Optional pressure discharge NPT hood.

Size	Pressure Setting (oz/sq in)	Vacuum Setting (oz/sq in)	Fig. 748A Ship Weight (lbs)	Venting Capacity (CFH) (@2.5 PSI)
2"	2.0	1.0	6.75	20,200
	4.0	1.0	7.5	20,200
	6.0	1.0	8.25	20,200
	8.0	1.0	9.25	20,200
	12.0	1.0	10.50	18,600
	16.0	1.0	11.00	18,600

748ALT

Pressure-Vacuum Vent

For Ag-Chemical...vent valve used with aqua-ammonia and ag-chemical products allowing tank to “breathe” during filling/discharging operations. Poppets seal vapors in the tank when pressure is equalized. Settings are approximate.

Construction Details

Size...2" NPT
 Body and Cap...aluminum
 Poppets...Teflon® coated aluminum
 Screens...stainless steel

Option (must specify)...male NPT connection for dryer application
 Option...pressure discharge NPT hood



Fig. 748ALT

Pressure Setting (oz/sq in)	Vacuum Setting (oz/sq in)	Ship Weight (lbs)	Venting Capacity (CFH) (@ 2.5 PSI)
8.0	1.0	5.5	20,200
16.0	1.0	5.5	18,000
32.0	1.0	5.5	NA

800.289.7371 Acterra Group, Inc.

749 Series

Pressure/Vacuum Vent

Vent valve used on underground and low volume aboveground tanks for motor fueling. Vent allows tank to "breathe" during filling and discharging operations. Poppets seal vapors in the tanks when pressure is equalized. Settings are approximate.

Fig. 749...2" NPT

Fig. 749S...2" slip-on style

Fig. 749CRB...2" NPT CARB approval (95-15A) for stage I and II (8 oz for stage I only). Viton® o-rings on pressure poppet.

Fig. 749CRBS...2" slip-on style CARB approval (95-15A) for stage I and II (8 oz for stage I only). Viton® o-rings on pressure poppet.

Fig. 749BSP...same as Fig. 749, but with British pipe threads.



Fig. 749

Construction Details

Body...aluminum
 Pressure Poppet...aluminum
 Vacuum Poppet...brass
 Pipe Seal...Buna-N
 Screen...brass

Fig. No.	Pressure Setting (oz/in ²)	Vacuum Setting (oz/in ²)	Ship Weight (lbs)	Venting Capacity (CFH) (@ 2.5 PSI)
749	8.0	0.5	1.0	8,500
749S	12.0	0.5	1.0	8,500
749CRB	3"W.C.	8" W.C.	1.45	11,000
749CRBS	8 oz	5 oz	1.45	
749BSP	8.0	0.5	1.0	8,500
	12.0	0.5	1.0	8,500

WARNING... Fig. 749 P/V vent must only be used in conjunction with motor fueling and/or low capacity flow. Fluid handling in lines larger than that used for retail service stations can cause tank to rupture or implode.

922

Combination Vent/Overfill Alarm

The Fig. 922 Combination Vent/Overfill Alarm is a fully mechanical, high intensity audible alarm that alerts you when your tank is near full while also allowing your tank to breathe during filling and dispensing operations. The unit is equipped with a whistle which incorporates a 2" or 3" full port pressure/vacuum vent. The unit can be set to activate at 90% fill height by adjusting the cable length to the float device. The adjustment tool is provided. The unit attaches to a 2" or 3" N.P.T. pipe mounted on the tank. Minimum fill rate for alarm to operate is 20 GPM.

2" Pressure relief setting 6 oz/in² or 8 oz/in²

2" Vacuum relief setting 1 oz/in²

2" Venting capacity (CFH)... 30,120 or 30,300

2" Weight..... 7.5 lbs

3" Pressure relief setting 6 oz/in² or 8 oz/in²

3" Vacuum relief setting 1 oz/in²

3" Venting capacity (CFH)... 43,020 or 44,160

3" Weight..... 5.25 lbs

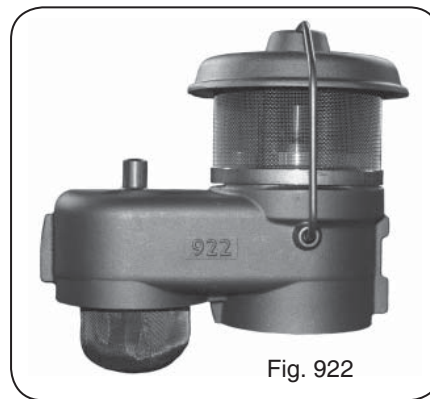


Fig. 922

Construction Details

Body...anodized aluminum
 Screens...stainless steel
 Rainguard...anodized aluminum
 Seals...Viton®
 Ball...Teflon
 Float...stainless steel

WARNING... In order for the Fig. 922 to function properly all emergency vents, fill connections, tank openings and piping connections must be airtight. Emergency vent should be set at least 2 oz. higher than the Fig. 922.

NOTE... 922 not for use on vapor recovery

WARNING... Do not fill or unload fuel from a storage tank unless it is certain that the tank vents will operate properly. Morrison tank vents are designed only for use on shop fabricated atmospheric tanks which have been built and tested in accordance with UL 142, NFPA 30 & 30A, and API 650 and in accordance with all applicable local, state and federal laws. In normal operation, dust and debris can accumulate in vent openings and block air passages. Certain atmospheric conditions such as a sudden drop in temperature, below freezing temperatures, and freezing rain can cause moisture to enter the vent and freeze which can restrict internal movement of vent mechanisms and block air passages. All storage tank vent air passages must be completely free of restriction and all vent mechanisms must have free movement in order to insure proper operation. Any restriction of airflow can cause excessive pressure or vacuum to build up in the storage tank, which can result in structural damage to the tank, fuel spillage, property damage, fire, injury, and death. Monthly inspection, and immediate inspection during freezing conditions, by someone familiar with the proper operation of storage tank vents, is required to insure venting devices are functioning properly before filling or unloading a tank. Normal vents such as pressure vacuum and updraft vents for aboveground storage tanks should be sized according to NFPA 30 (2008) 21.4.3

351S

Flame Arrester

Open (non-pressure vacuum type) flame arrester to help prevent the transmission of heat and/or an ignition source into the tank.

Size	Weight
2" NPT	31.0 lbs



Fig. 351S

Construction Details

Body...cast iron
Cover...cast iron
Cap...brass
Arrester Plates...stainless steel

Standard Features

1. Gauge opening cap.
2. Vapor relief capacity at 2.5 PSI = 22,000 CFH

Restrictions and Warning

1. Do not use with acetylene, carbon disulfide, etheleneoxide or hydrogen gases. For use with normal hydrocarbon flames such as gasoline in air.
2. Routine inspection is required to ensure airways are clear and free of debris. Blocked airways can cause structural deformation of the tank.

354

Updraft Vent

"Open" vent used on underground and aboveground tanks for motor fueling. Vent allows tank to "breathe" during filling/dispensing operations.



Fig. 354

Construction Details

Body...aluminum
Cap...aluminum
Screen...40 mesh brass

Size (slip-on)	Ship Weight (lbs)	Venting Capacity (CFH)
1½"	0.75	27,650
2"	0.75	27,650
3"	1.50	59,000
4"	2.25	116,900

NOTE...Open vents will allow unrestricted evaporation of product.

351S & 748A

Flame Arrester

With 748A Vent...pressure vacuum type flame arrester to help prevent the transmission of heat and/or an ignition source into the tank.

Fig. 748A...same vent featured in pressure/vacuum vent section.



Fig. 351S w/748A

Construction Details

Fig.351S...Flame arrester
Fig. 748A...Pressure/vacuum vent

Size	Pressure Setting (oz/sq in)	Vacuum Setting (oz/sq in)	Fig. 748 Ship Weight (lbs)	Venting Capacity (CFH) (@2.5 PSI)
2"	2.0	1.0	42.00	15,500
	4.0	1.0	42.50	15,500
	6.0	1.0	42.75	15,500
	8.0	1.0	43.50	15,500
	12.0	1.0	44.50	13,000
	16.0	1.0	45.75	13,000

155S

Double Outlet Vent

Aluminum T-style vent used primarily on small fuel oil storage tanks. Outlet ports on either side of the inlet with 20 mesh stainless steel screen keeps debris out of the airway.

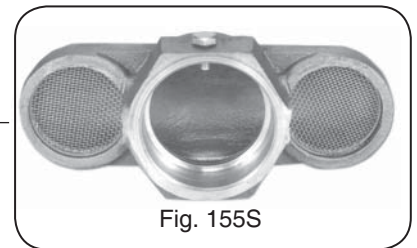


Fig. 155S

Fig. 155...threaded (NPT)

Fig. 155BSP...2" with British Pipe Threads

Fig. 155FA...2" with flash arrester

Fig. 155S...slip-on

Size	Weight
¾"	.25 lbs
1"	.50 lbs
1¼"	.50 lbs
1½"	.75 lbs
2"	1.0 lbs
3"	2.5 lbs

NOTE...Open vents will allow unrestricted evaporation of product.

WARNING...Do not fill or unload fuel from a storage tank unless it is certain that the tank vents will operate properly. Morrison tank vents are designed only for use on shop fabricated atmospheric tanks which have been built and tested in accordance with UL 142, NFPA 30 & 30A, and API 650 and in accordance with all applicable local, state and federal laws. In normal operation, dust and debris can accumulate in vent openings and block air passages. Certain atmospheric conditions such as a sudden drop in temperature, below freezing temperatures, and freezing rain can cause moisture to enter the vent and freeze which can restrict internal movement of vent mechanisms and block air passages. All storage tank vent air passages must be completely free of restriction and all vent mechanisms must have free movement in order to insure proper operation. Any restriction of airflow can cause excessive pressure or vacuum to build up in the storage tank, which can result in structural damage to the tank, fuel spillage, property damage, fire, injury, and death. Monthly inspection, and immediate inspection during freezing conditions, by someone familiar with the proper operation of storage tank vents, is required to insure venting devices are functioning properly before filling or unloading a tank. Normal vents such as pressure vacuum and updraft vents for aboveground storage tanks should be sized according to NFPA 30 (2008) 21.4.3

818 Series

Clock Gauge

Patent 5144836...for measuring liquid level in aboveground storage tanks. Gauge mounts on top of tank and is activated by a float connected to a cable. Readout is on a 12 hour clock face.

Small hand = feet or meters
Large hand = inches or centimeters
Gauge can be read 20-30 ft away to within 1/8". Maximum measurement is 12 ft.

Fig. 818F...with female threads.

Fig. 818MET...with metric face.

Fig. 818MEF...with metric face and female threads.

Fig. 818MEB...with metric face and British pipe threads.

Fig. 818I...floating suction gauge.

Indicates change in liquid level.



Fig. 818



Fig. 818MET

Construction Details

Body...aluminum with 2" NPT/BSP Male/Female connection

Float...stainless steel

Cable...stainless steel

Standard Features

1. Vapor tight construction.
2. Swivel 360° for desired orientation.
3. High level/low level decals for application on lens cover.
4. Float fits through a 2" schedule 40 and 80 pipe nipple, and works with a Fig. 419, 2" Morrison drop tube.

Options (must specify)

1. Metric face plate (range = 3 m, 60 cm).
2. Extension leader for extended mounting above the tank.

918TCP

Overfill Alarm

Provides an audible alarm for either a high or low level warning. Incorporates an alarm box and a single-point level sensor. Contains a battery powered, intrinsically safe, alarm unit that is mounted remote from gauge.

The single point level sensor is immersed in the tank through a 2" NPT Female opening and is supported by a nylon liquid tight cable connector, Teflon tubing and wire.

The high or low activation point is set at the factory. The order length should be equal to the distance from the top of the 2" tank opening to the desired activation level.

The low level activation point can be set up to 113". The interstitial monitor level can be set up to 113" as well. Available with either 0-53" probe or 53"-113" probe.

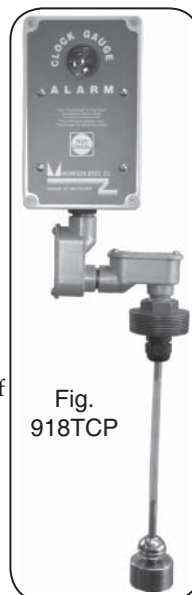


Fig. 918TCP

918 Series

Clock Gauge Alarm

Utilizes the Fig. 818 style clock gauge with a built-in high level warning alarm. Contains a battery powered, intrinsically safe, alarm unit that is mounted remote from gauge. Alarm is set for desired level during installation and can be reset at any time for a change in alarm level requirements. Patent Number 5144836 and 5649450.

Fig. 918F...with female threads.

Fig. 918SS...with stainless steel parts for some chemicals.

Fig. 918MEB...with metric face and British pipe threads.

Fig. 918MET...with metric face.

Fig. 918MEF...with metric face and female threads.

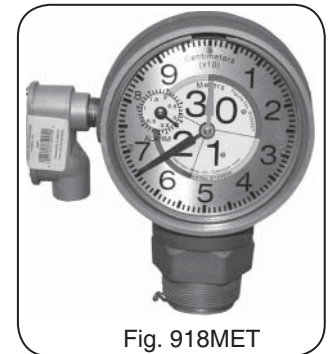


Fig. 918MET

Construction Details

Gauge Unit...Fig. 818 clock gauge style (same standard and optional features). Fig. 918 gauge has alarm dial and internal switch. Alarm dial is accessible on the clock face. Electrical junction box and lead wires for remote mounting are also included.

Alarm Unit... Plastic weatherproof housing, 90 decibel high pitched "beep" cycle alarm. Features a push-button test switch. Powered by two 9 volt batteries (included). **Only alarm box is UL Listed.**

Construction Details

Sensor...The single point level sensor is immersed in the tank through a 2" NPT female opening and is supported by a nylon liquid tight cable connector, Teflon tubing and wire.

Alarm Box... Weatherproof, intrinsically safe, 90 decibel alarm that operates on two 9-volt batteries. It features a membrane-type test/cancel button.

Only alarm box is UL Listed.

Float and Weight... Stainless steel.

FMMASO-91 Series

Overfill Prevention Valve for Used Oil Systems

Patent 5007450...valve with optional alarm for use on used oil evacuation systems which use an air operated pump.



Operation

1. Valve installs in 2" bung opening at the top of the tank. Air supply is routed through the valve before going to the pump.
2. The valve will close off air supply to the pump when liquid level reaches 90% of tank capacity. Air is diverted to the audible signal on models FMMASO-91S and FMMASO-91EXS.
3. The valve will reset as liquid is removed from the tank and air pressure to the valve is turned off.

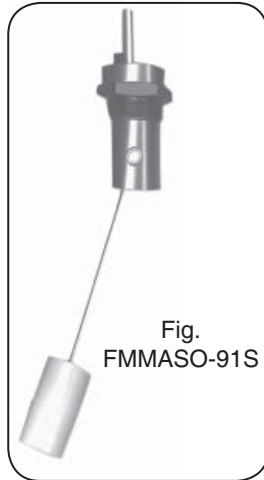


Fig. FMMASO-91S

Specifications

Valve Body and Collar...anodized aluminum
 Float...polypropylene
 Float Rod and Valve Spool...brass
 O-ring seals...Viton®
 Hardware... stainless and plated steel

Installation Collar...2" NPT
 Air inlet and outlet...¼" NPT
 Overall length (including float and audible signal)...20"
 Shipping weight...2.0 lbs
 Shipping weight (Fig. FMMASO-91EX)...4.5 lbs

Models

Fig. (FMMASO-91)...standard valve *without* audible signal.
 Fig. (FMMASO-91S)...standard valve *with* audible signal. BSP Part Number FMMASOB-91S.
 Fig. (FMMASO-91EX)...same as Fig. FMMASO-91, but with extended body for use on double wall or vaulted tanks.
 Fig. (FMMASO-91EXS)...same as Fig. FMMASO-91EX, but with audible signal.
 Fig. (FMMATO-91)...high level turn-on for sump applications (no signal).

618

Simplex Tank Gauge

Used for measuring liquid level in aboveground storage tanks. Best suited for vertical tanks over 12 ft high. Gauge readout by tape which passes over an indicator mounted at 3 ft height on the side of the tank. Activated mechanically by a float that rests on the liquid level. Float is connected to a cable that runs up through the top of the tank, across two pulleys, and down the side of the tank to the indicator position.

Construction Details

Tape sizes available: tape for up to 31' tank and tape for 31' to 50' tank

Standard Features

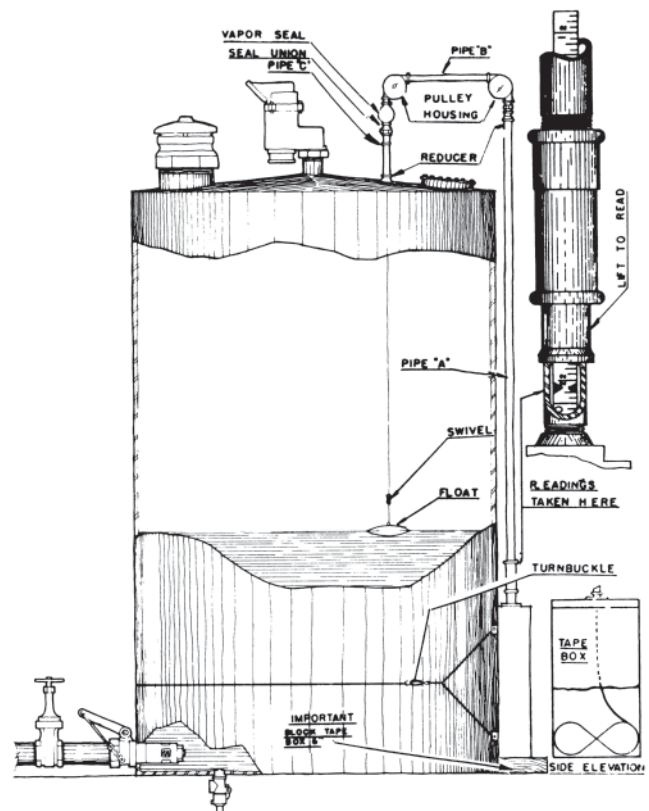
1. Round copper float
2. Tape
3. Stainless steel cable
4. Vapor seal

Options (must specify)

1. Round stainless steel float with swivel (10¹/₈" diameter).
2. Brass cylindrical float (1¾" diameter, 32" long) with center swivel.
3. Stainless steel cylindrical float (1¾" diameter, 32" long) with center swivel.
4. Metric not available.

NOTE...Installation instructions are included, piping is not included.

NOTE...Cylindrical floats will pass through a 2" opening.



9095A



AST Overfill Prevention Valve

Patent 5832953...installed at the fill port of an aboveground storage tank. Used in a tight fill application, the valve terminates flow of product when the liquid level reaches a preset warning level (90-95% full). The valve is installed on a standard NPT male connection when used with the quick disconnect or female adaptor. The 2" valve can be used in conjunction with the Morrison Fig. 518 and 515 lines of AST spill containers for added spill protection. When installed to manufacturers requirements, the OPV valve can help eliminate environmentally hazardous spills. All models are supplied with an adaptor to mount to Morrison Fig. 419 aluminum drop tubes. A test mechanism is also sold separately. The test mechanism allows a technician to pull on the test line at any time during the filling process to actuate the float and stop the fill. This allows a technician to verify the valve is working properly. ULC listed. Fig 9095A-AV...compatible with aviation fuel



Fig. 9095A

Size	Weight
2" valve w/2" male quick disconnect x 4" female threads*	14.1 lbs
2" valve w/2" female threads x 4" female threads	14.1 lbs
2" valve w/2" male quick disconnect remote fill adaptor	12.6 lbs
2" valve w/3" male quick disconnect x 4" female threads	14.1 lbs
2" valve w/3" female threads x 4" female threads	14.1 lbs
3" valve w/3" male quick disconnect x 6" female threads*	29.0 lbs
3" valve w/3" female threads x 6" female threads	38.0 lbs
3" valve w/3" male quick disconnect remote fill adaptor	26.0 lbs

*BSP Threads Available

Construction Details

Adaptor...aluminum (hard-coat anodized)
 Female adaptor...ductile iron
 Body...anodized aluminum
 Plunger and dashpot...brass or nickel plated
 Shaft, linkages and hardware...stainless steel
 Piping...steel (epoxy coated)

Features

1. Adjustable float (1½")...for setting the precise level of shutoff in the field and allowing it to be done using standard length pipe nipples.
2. Immediate and cushioned shutoff...full flow up to within 1-2 seconds of closing and no abrupt kickback or jolt, or startling noise in the line when valve closes.
3. One piece adaptor/coupler casting...no extra seams and joints to leak when top portion is under pressure from closing.
4. Dry disconnect...after shut off product is allowed to automatically drain from the highest point so fill nozzle can be removed without spilling.
5. Simple mechanics...minimum moving parts. Shutoff is activated by basic hydraulic principle with no springs, levers or complicated sequence leading to closure.

Code Compliance

NFPA 30, 30A, UFC, BOCA, SBCCI/SFC and PEI RP200.

NOTE...For use on clean product only. Not suitable for motor oil.

Size	Maximum Pressure	Maximum Flow	Maximum Viscosity
2"	100PSI	125gpm	150 Centistokes
3"	100PSI	300gpm	60 Centistokes

9095S



AST Overfill Prevention Valve

Designed for use on low profile tanks that require a high level shut-off. The valve terminates the fill when the product reaches the preset level. The valve can be retrofitted on existing tanks and fits into a 2" opening. A tight fill connection is required for operation.

Sold with either a 2" Part F Male Threaded Adaptor or a 2" Part A Female Threaded Adaptor.

Typical flow rate is 53 GPM at 30 PSI.

Size	Maximum Pressure	Maximum Viscosity
2"	100PSI	150 Centistokes

NOTE...For use on clean product only. Not suitable for motor oil.

NOTE...Cannot be installed in a drop tube.



Fig. 9095S

Construction Details

Adaptor...aluminum (hard-coat anodized)
 Body...anodized aluminum
 Float...polypropylene
 Plunger and dashpot...brass
 Upper tube and float guard...brass
 Shut off mechanism...anodized aluminum

Features

1. Adjustable float...for setting the precise level of shutoff in the field. The vertical float allows for installation in openings in proximity to the tank walls.
2. Immediate and cushioned shutoff...full flow up to within 1-2 seconds of closing and no abrupt kickback or jolt, or startling noise in the line when valve closes.
3. Dry disconnect...after shut off product is allowed to automatically drain from the highest point so fill nozzle can be removed without spilling.
4. Simple mechanics...minimum moving parts. Shutoff is activated by basic hydraulic principle with no springs, levers or complicated sequence leading to closure.

517 Series

3½ Gallon AST Spill Container

Installed on aboveground storage tanks for the purpose of containing small spills and drips from the fill nozzle. 3½ gallon capacity. Steel construction. Lockable and white powder coated. ULC listed.



Fig. 517



Fig. 517...spill containment. Male (NPT) x Male (NPT) connection.

Fig. 517F...spill containment. Female (NPT) x Female (NPT) connection.

Fig. 517WO...waste oil containment—Removable screen on inside of container so used filters, etc. can be allowed to drain. Male NPT riser connection.

Size	Weight
2" (517, 517F, and 517WO)	10.5 lbs
4" (517, 517F, and 517WO)	11.0 lbs

518 Series

7½ Gallon AST Spill Container

Installed on aboveground storage tanks for the purpose of containing small spills and drips from the fill nozzle. 7½ gallon capacity. Lockable with drain valve and vented lid. Connects to 4" male (NPT) riser, and is white powder coated. Female NPT x Female NPT.



Fig. 518



Fig. 518CC...same as 518 only with center tank mount opening.

Fig. 518M...2" or 4" Male.

Size	Weight
2"	20.0 lbs
4"	26.0 lbs

Construction Details

Body and lid (14 ga.)...steel
 Drain Valve...brass
 Drain O-ring...Viton®



Fig. 515

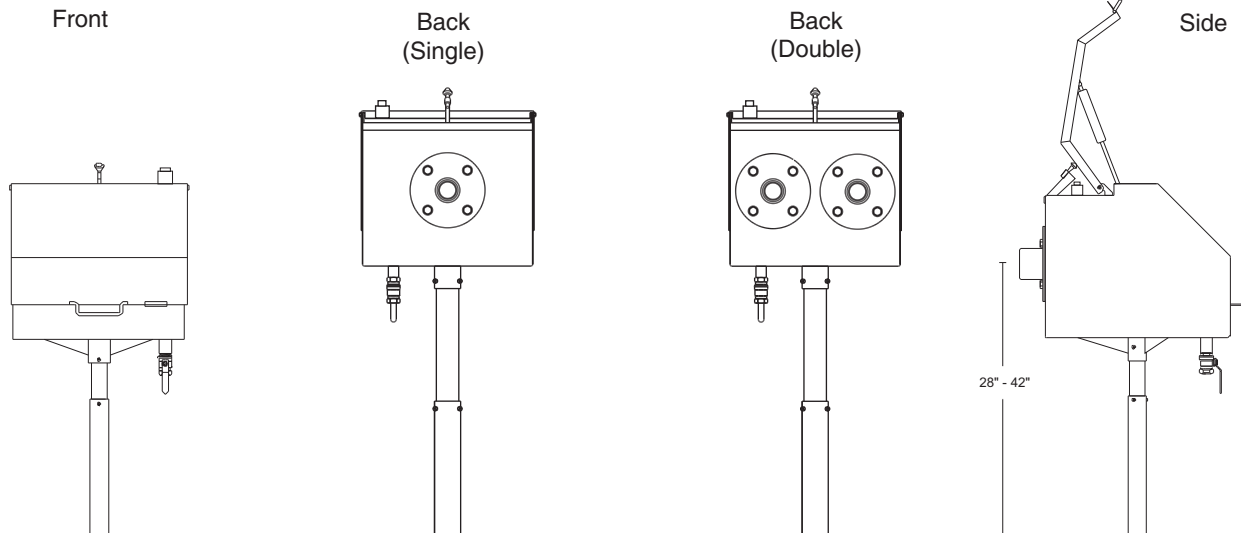


515 Series

AST Remote Spill Container

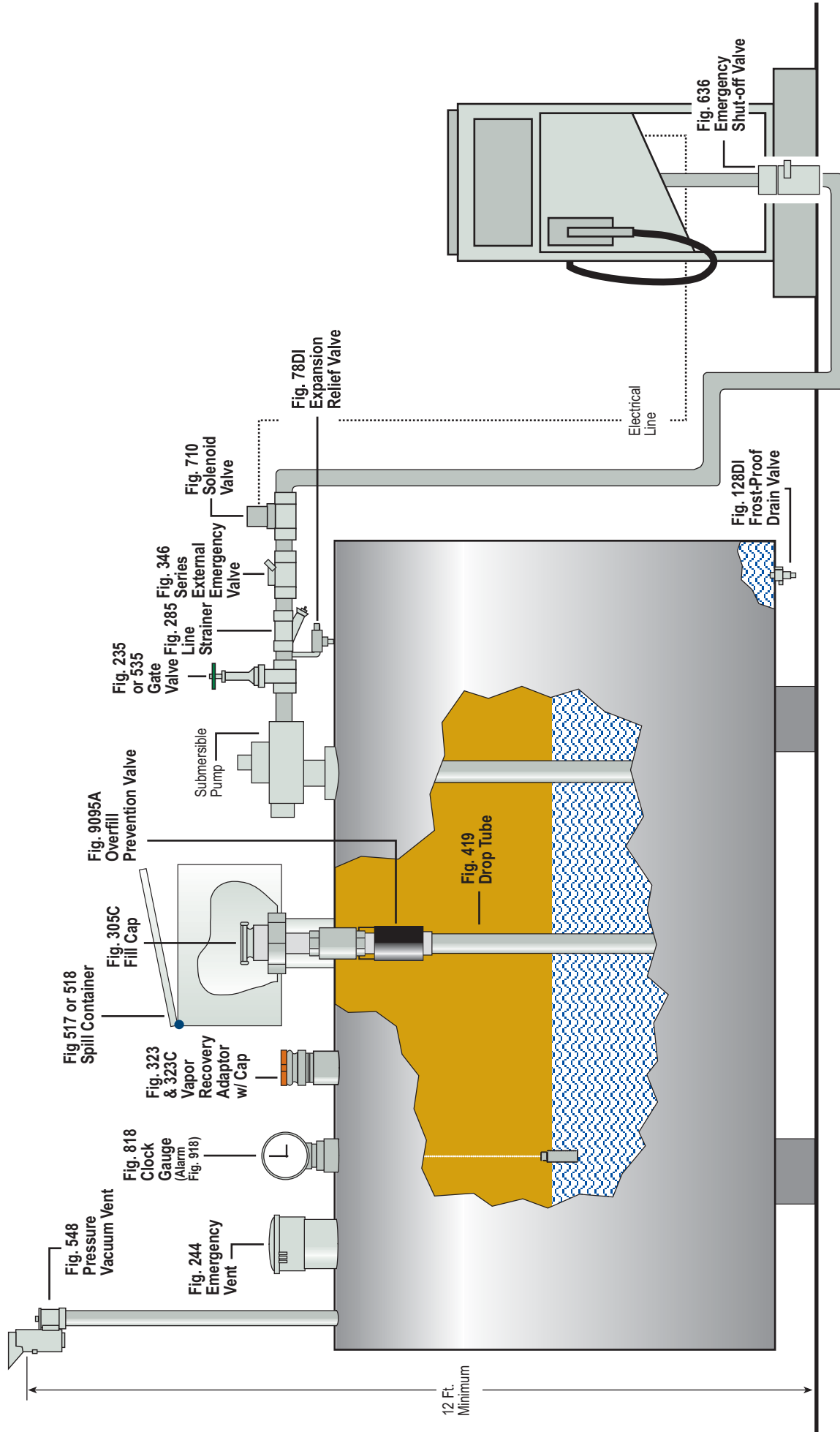
For use on aboveground storage tanks for the purpose of containing fuel spillage during remote tank filling operations. 15 gallon capacity. 12 gauge steel construction. Lockable lid, and powder coated white for durability. 1" NPT drain with locking ball valve included. Choice of one or two fill ports, 2", 3", 4" or combination. 2" bung for pump. Single column base is easily adjustable.

Fig. 515OEM...same as 515 but without the pedestal and no rear ports, with top fill openings and with 4, ½" weld taps on the back. The 515OEM is not ULC Listed.



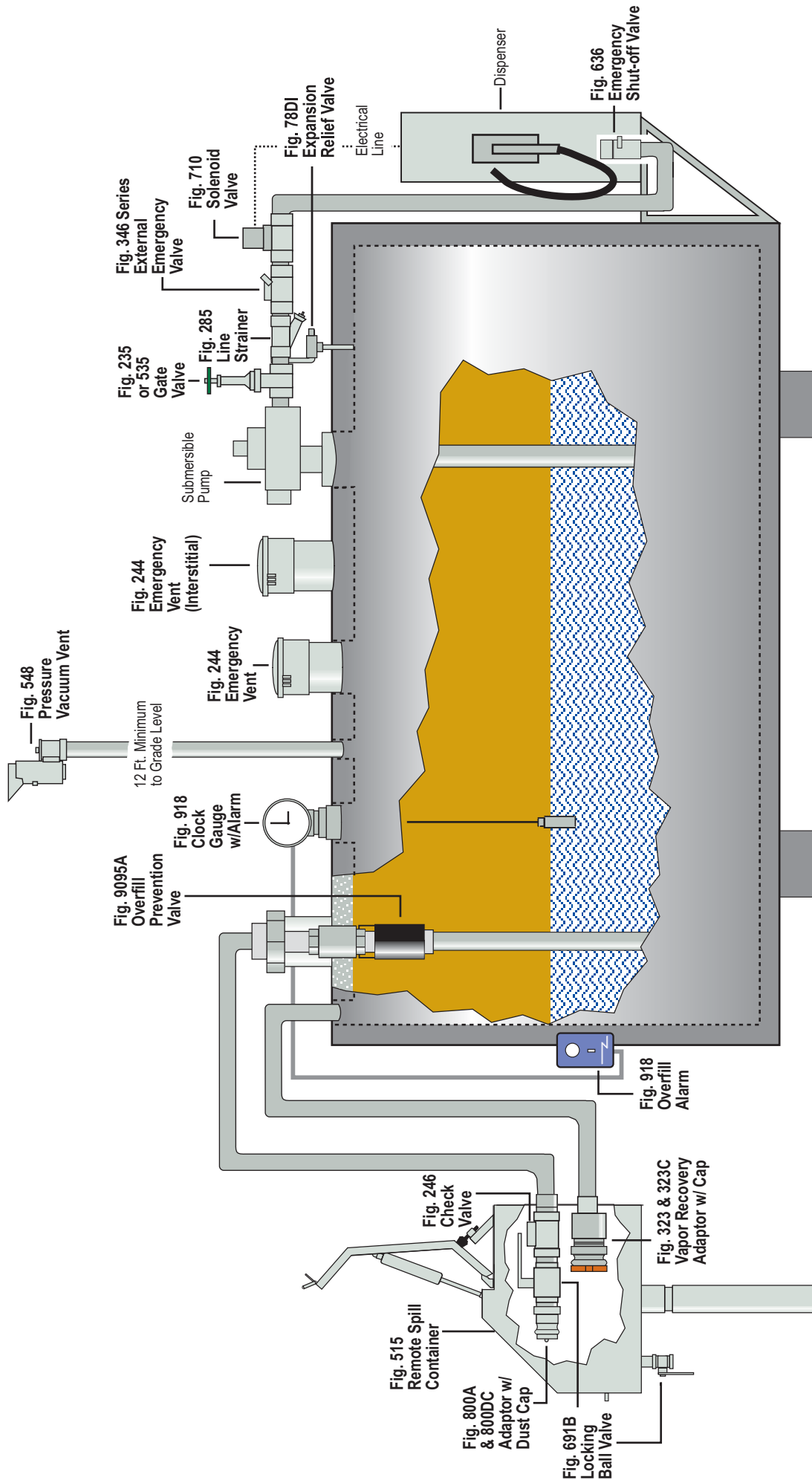
Aboveground Fuel Storage - Pressure System

Horizontal cylindrical tank with top fill and remote dispenser



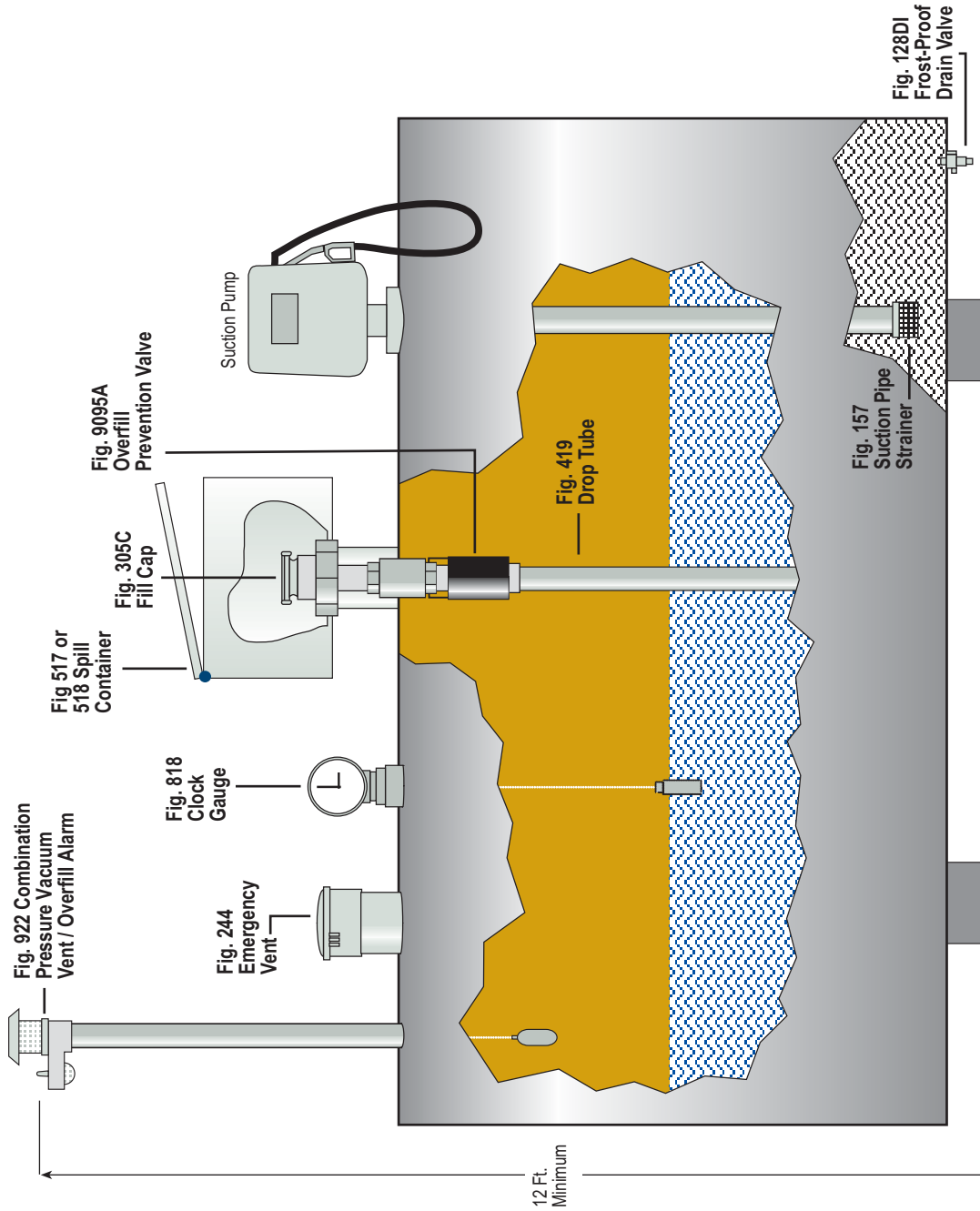
Aboveground Fuel Storage - Pressure System

Rectangular double-wall tank with remote fill and side mounted dispenser



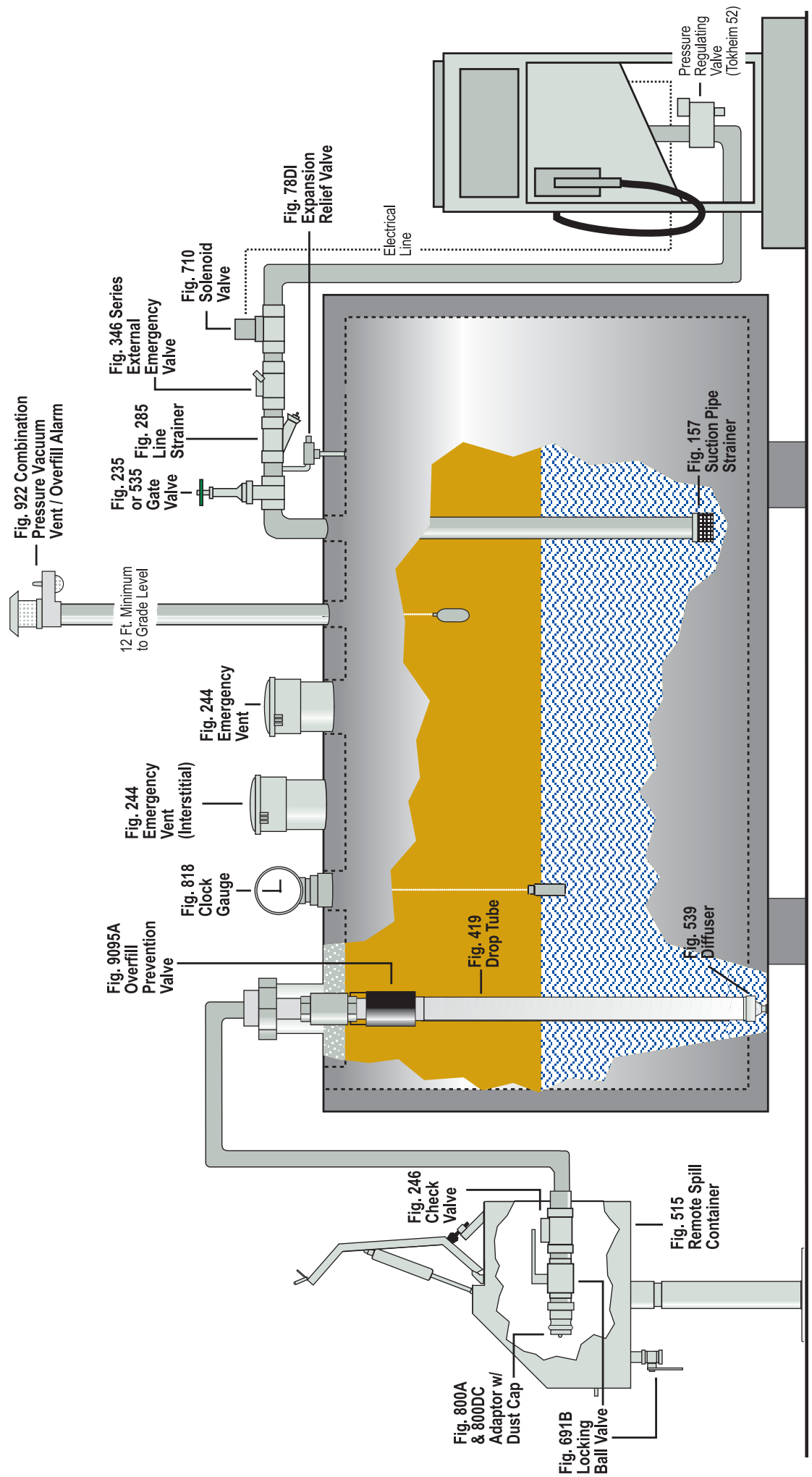
Aboveground Fuel Storage - Suction System

Horizontal cylindrical tank with top fill and top mounted pump



Aboveground Fuel Storage - Suction System

Rectangular Double-Wall Tank With Remote Fill and Remote Pump



AST Bulk Storage

Emergency Vent (Threaded or Flanged)



Allows tank to exhaust excessive pressure if exposed to pool fire. Size to be determined by tank size and type.

Internal Emergency Valve



Automatic shut-off of product flow in event of fire and/or impact. Poppet is located inside tank.

Gate Valve with Expansion Relief



Expansion Relief feature allows excess pressure due to temperature gain to bleed back to tank.

Frost Proof Drain Valve

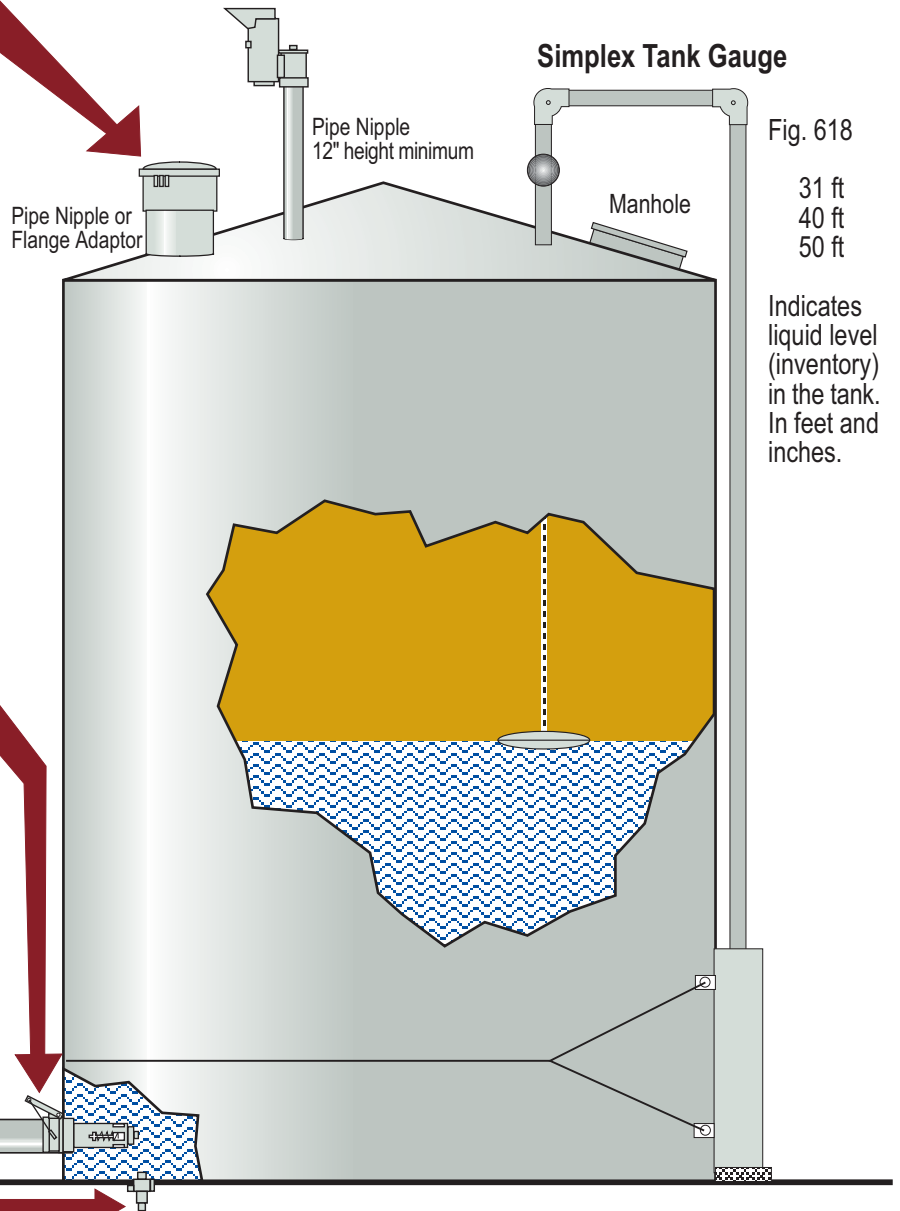


Allows water on bottom of tank to be drained off. Seat is located up inside the tank shell.

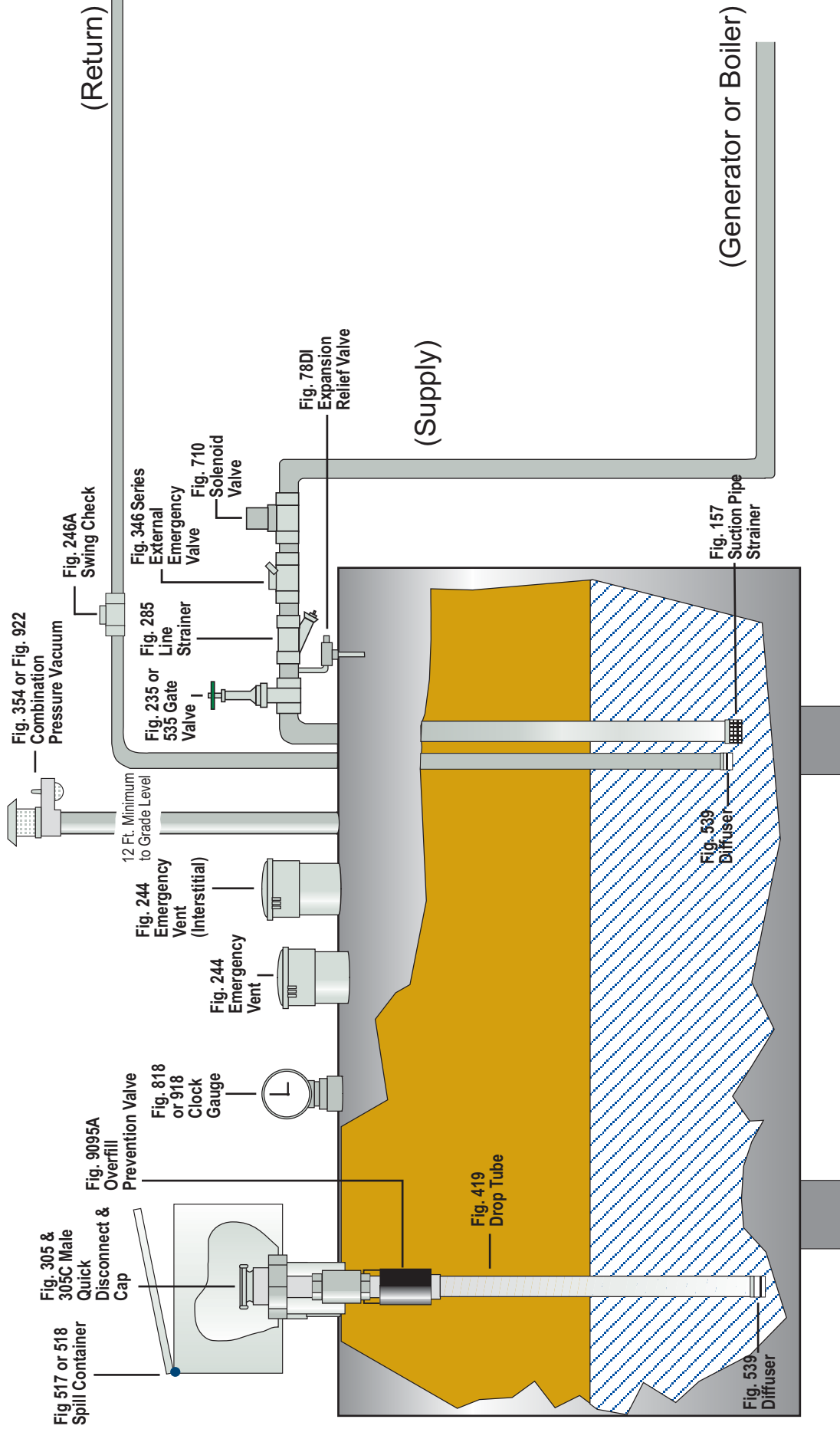
Normal (P/V) Vent - and with Flame Arrestor



Allows tank to breathe during normal filling and withdrawing operations. Match vent size to fill and withdrawal piping.



Emergency Generator or Fuel Oil Suction System





325 East 24th Street
Dubuque, Iowa 52001
800-553-4840 • 563-583-5701
563-583-5028 (Fax)

custserv@morbros.com • www.morbros.com

800.289.7371 Acterra Group, Inc.