



STI Workshop: Overview of System Components For Shop Fab Tanks

**Jerry Schollmeyer, National Sales Manager
Morrison Bros. Co**

February 27-28, 2024



**26th California Unified Program
Annual Training Conference
February 26 – 29, 2024**

HISTORY | MORRISON BROS. CO.

- Founded in Dubuque, Iowa in 1855
- Leader in AST products
- Produce more than 1,200 different products
- Include equipment for ASTs, USTs, service stations, environmental applications and tank trucks.
- Employ approximately 130 people in Dubuque & Maquoketa, Iowa locations.



*Morrison Bros. Co.
Corporate Headquarters*

TANKS | SHOP-FABRICATED TANKS

Shop-fabricated tanks are small enough to be produced in a tank shop and delivered to the site.



- Atmospheric Pressure Tanks—0-1 PSI operating pressure.
- Vertical Tank: The shell height shall not be more than 50 feet and shall not exceed 60,000 gallons.
- Horizontal Tank: The length of the shall not be greater than 6 times its diameter. Tank diameters exceeding 144 inches shall not exceed 72 feet in length.

NFPA 30 Flammable and Combustible Liquid Classifications

Class IB Motor and Aviation Gasolines

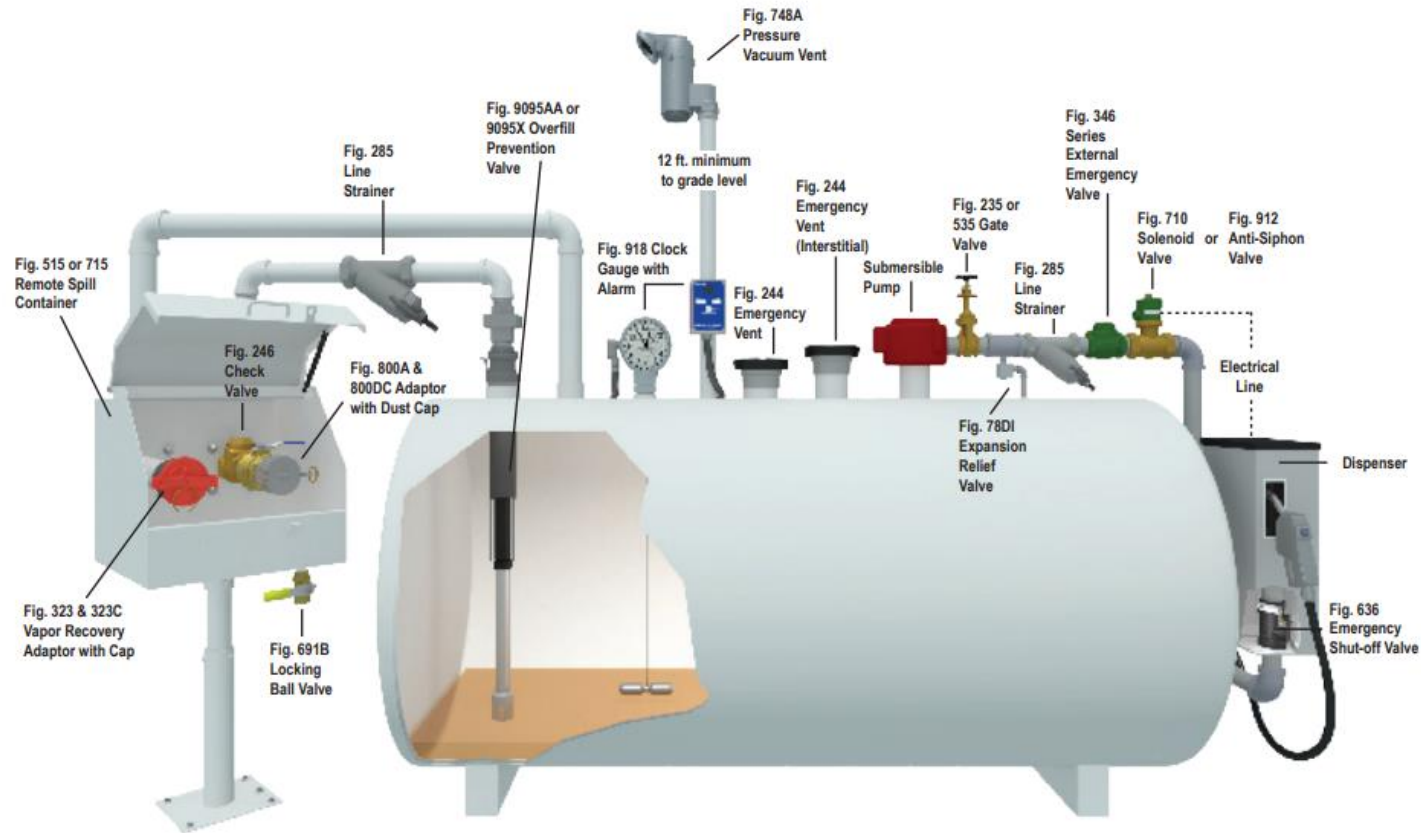
Class II Diesel Fuels

Class IIIB Lubricating Oils, Motor Oils

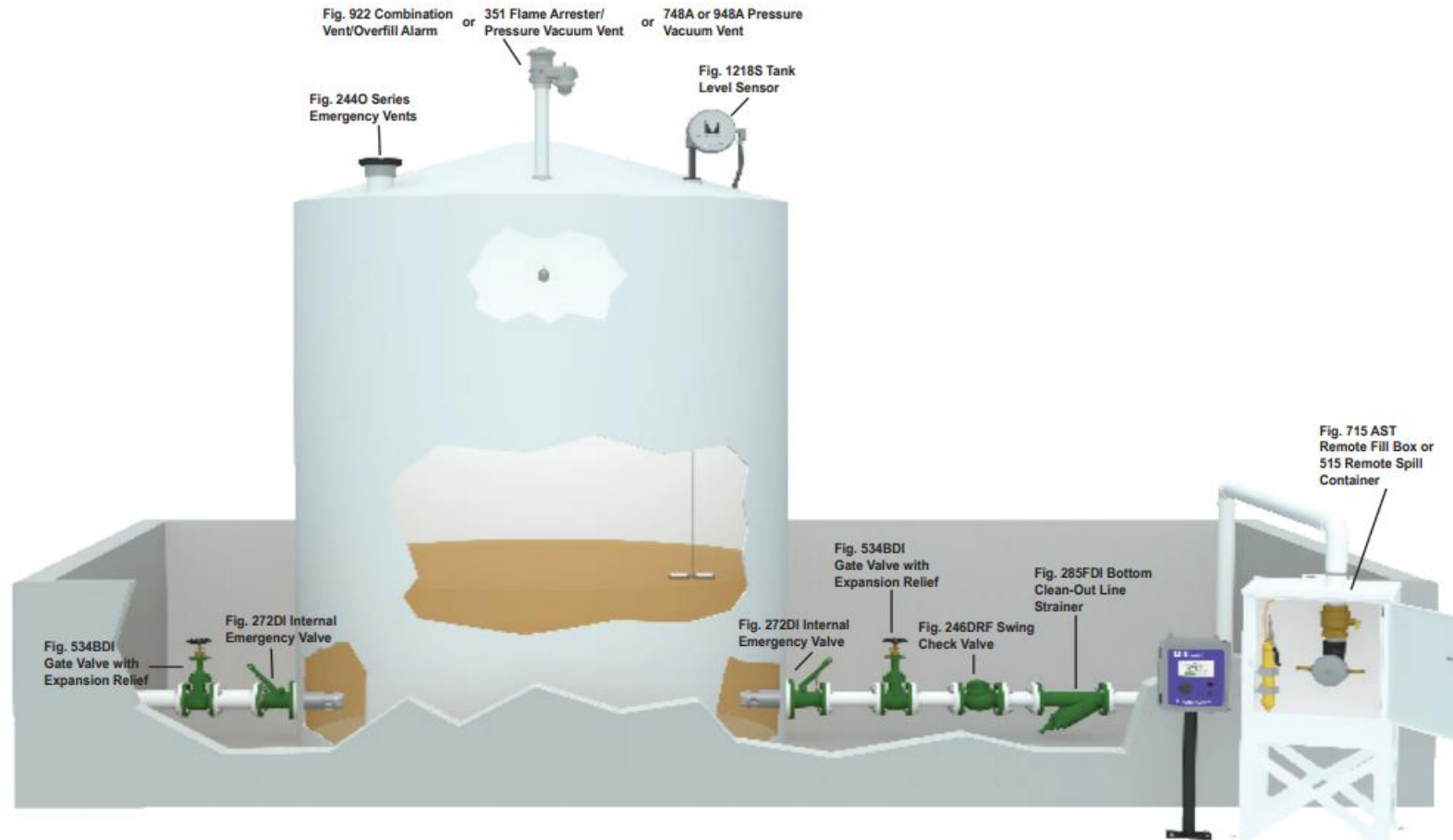
TANKS | HORIZONTAL TANK

Aboveground Fuel Storage - Pressure System

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



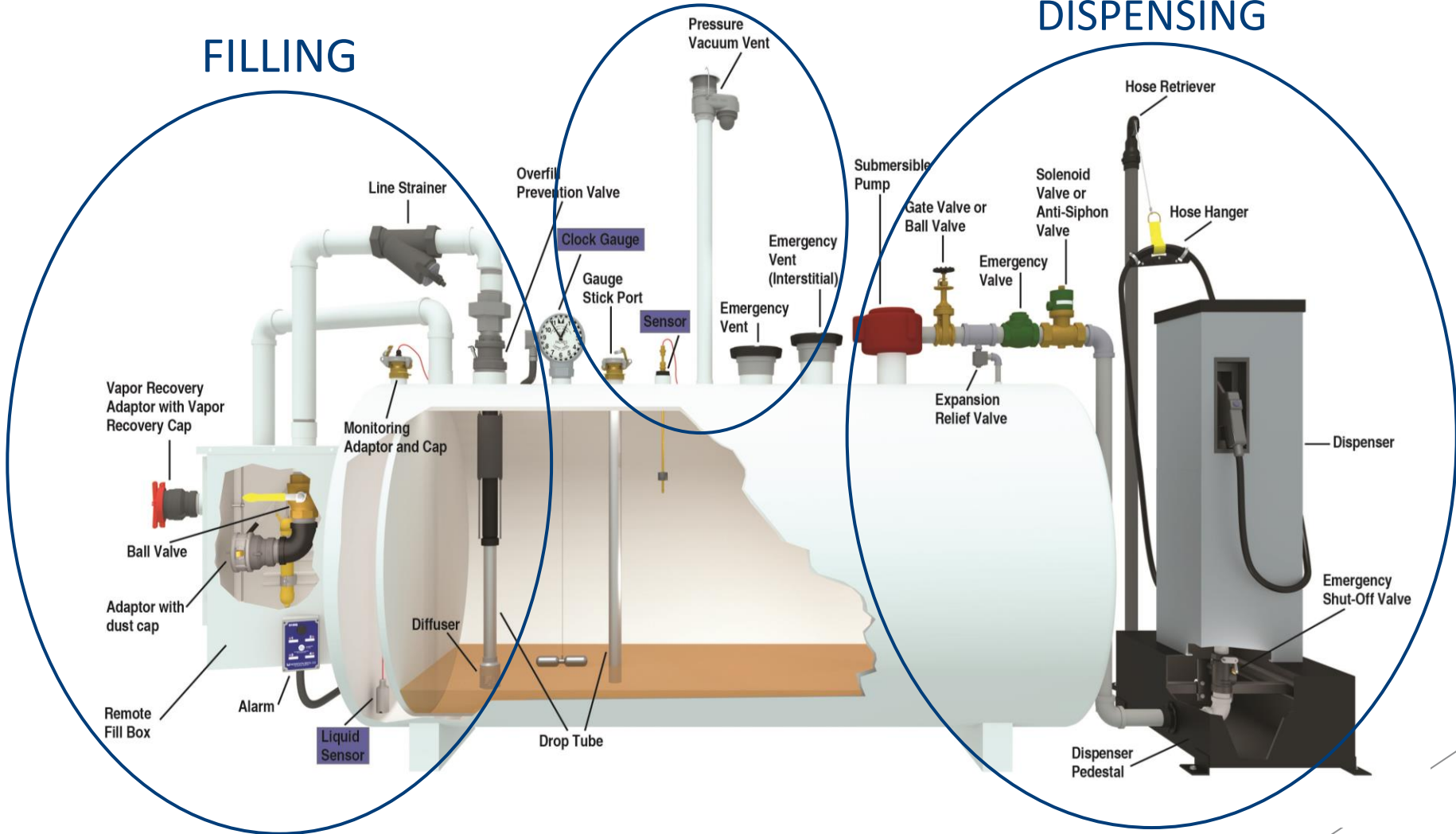
TANKS | VERTICAL TANK



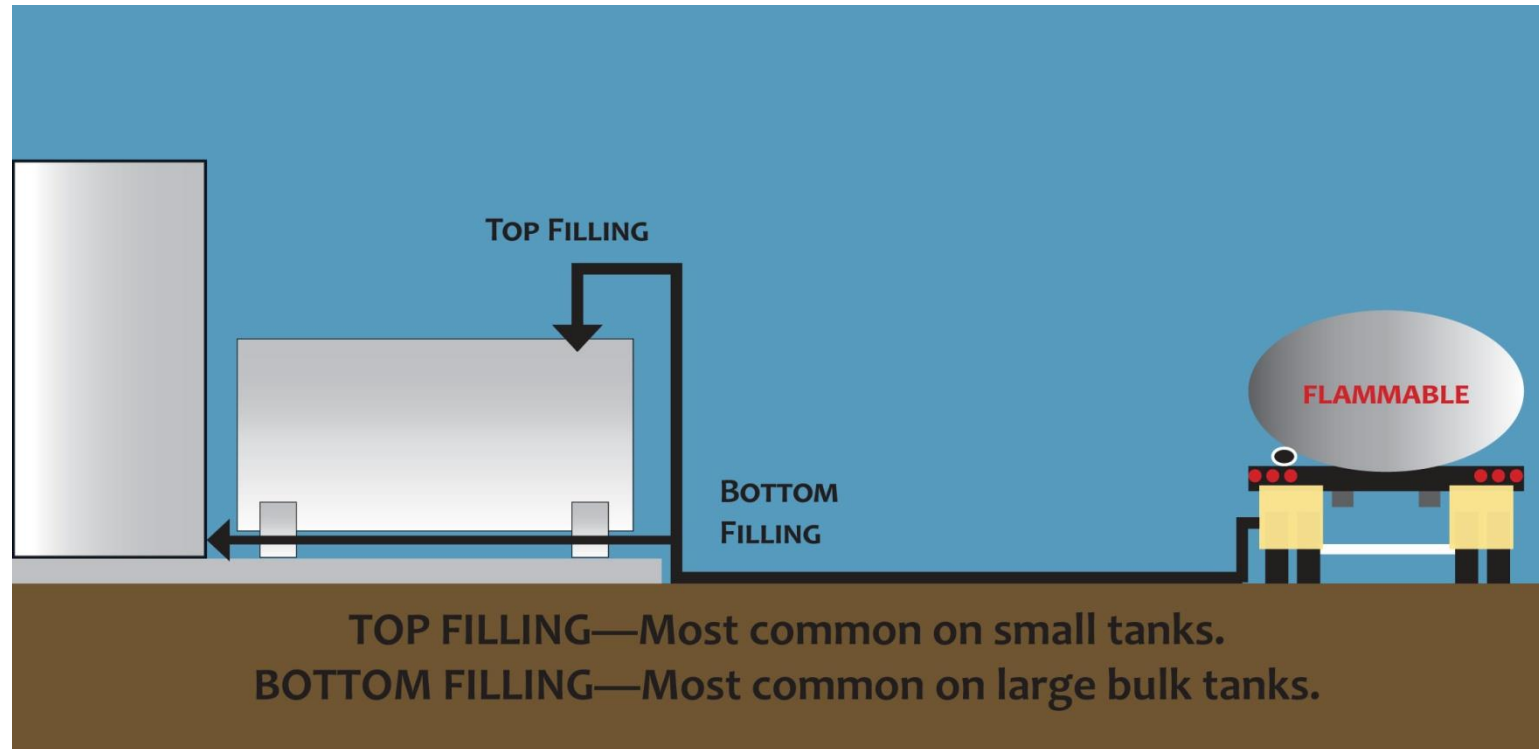
VENTING & GAUGING

DISPENSING

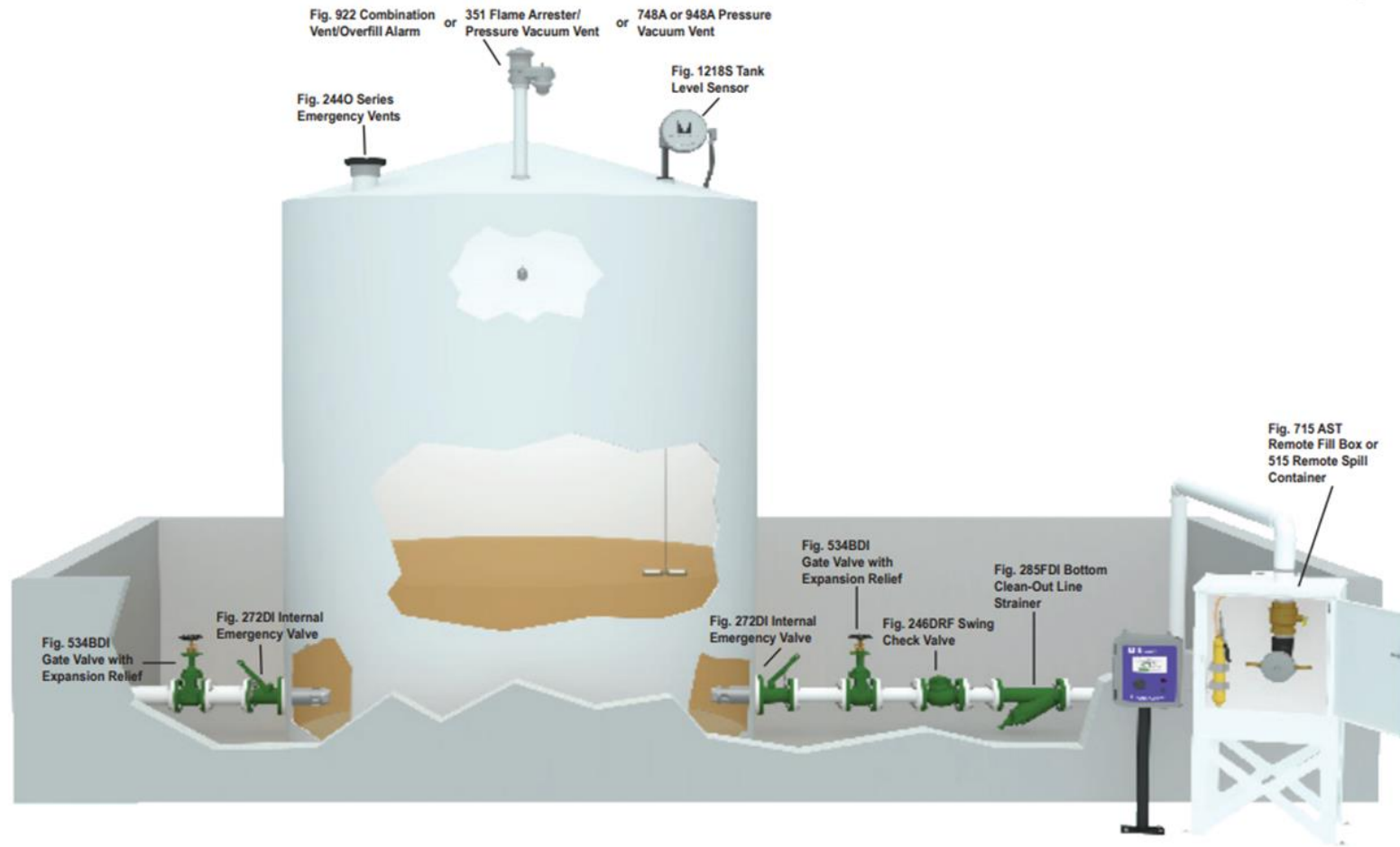
FILLING



TANK FILLING | TOP VS. BOTTOM



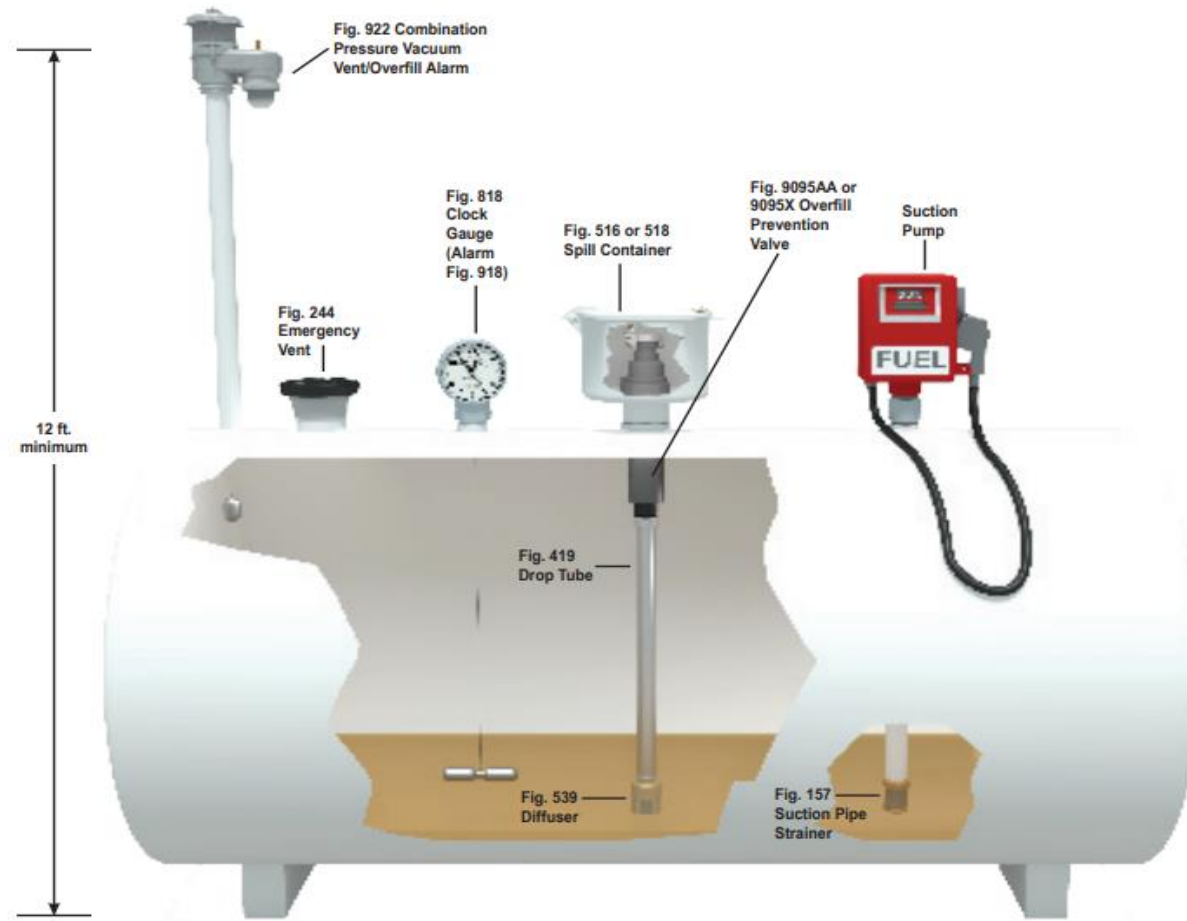
TANK FILLING | VERTICAL TANK – BOTTOM FILL



TANK FILLING | HORIZONTAL TANK – TOP FILL

Aboveground Fuel Storage - Suction System

Horizontal cylindrical tank with top fill and top mounted pump



TANK FILLING | SPILL CONTAINERS/FILL BOXES

AST Spill Containment

516 Spill Container



- 5-gallon capacity hinged cover lockable with a padlock
- 2" or 4" NPT connection
- Centered or offset connection
- ULC listed

517 Spill Container



- 3.5-gallon capacity
- 2", 2.5" or 4" NPT connection
- Hinged cover lockable with a padlock
- Centered connection
- ULC listed

518 Spill Container



- 7.5 gallon capacity
- 2" or 4" NPT connection
- Hinged cover lockable with a padlock
- Centered or offset connection
- ULC listed

515 Remote Spill Containers



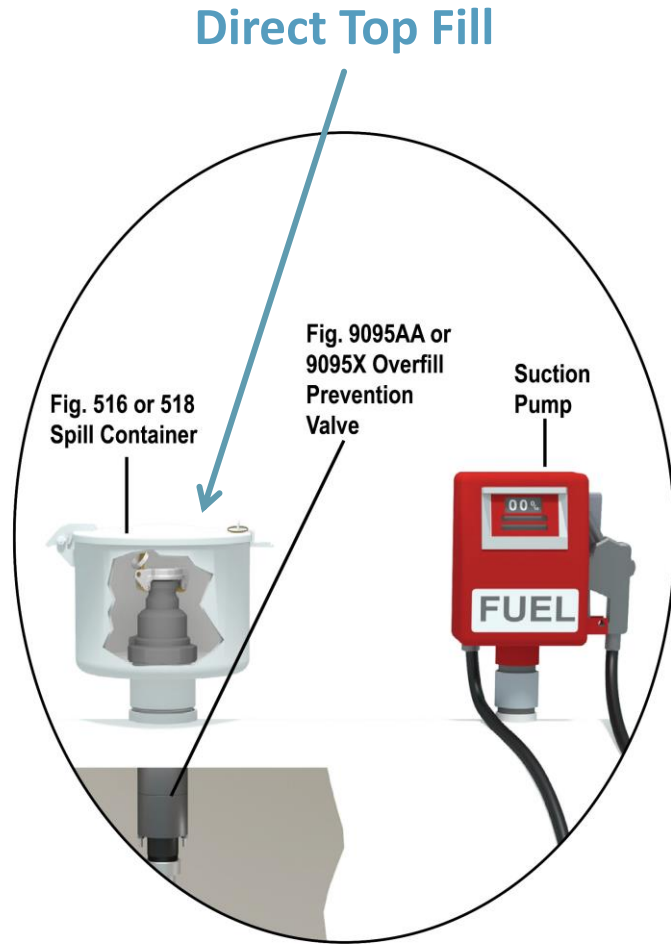
- 15 gallon capacity
- 2", 3", or 4" NPT threaded back connection
- Hinged lid opens upward, lockable with a padlock
- 12-gauge stainless steel, or 12-gauge steel powder coated white
- Four-leg stand or pedestal mount
- ULC listed

715 Remote Spill Containers



- 10 gallon capacity
- 2", 3", or 4" NPT and flange connections (located on top, bottom, or back of box)
- 14-gauge 304 stainless steel, or 14-gauge steel powder coated white
- Pedestal or 4-leg stand also available
- ULC listed

TANK FILLING | SPILL CONTAINERS/FILL BOXES



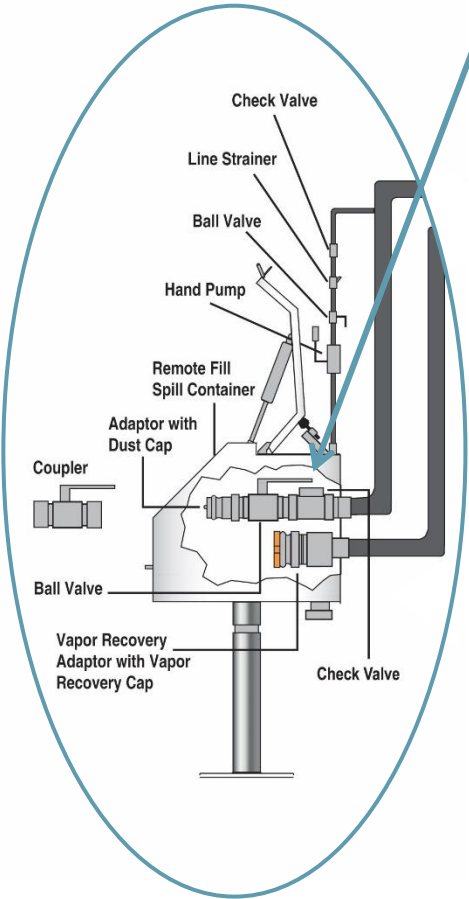
517



516 or 518

TANK FILLING | SPILL CONTAINERS/FILL BOXES

Remote Top Fill



515



715

TANK FILLING | CONNECTIONS



Dry Disconnect



**Quick
Disconnect**

**Quick Disconnect
with Check Valves**



TANK FILLING | CONNECTIONS



TANK FILLING | CHECK VALVES

Inline Check



Wafer Check



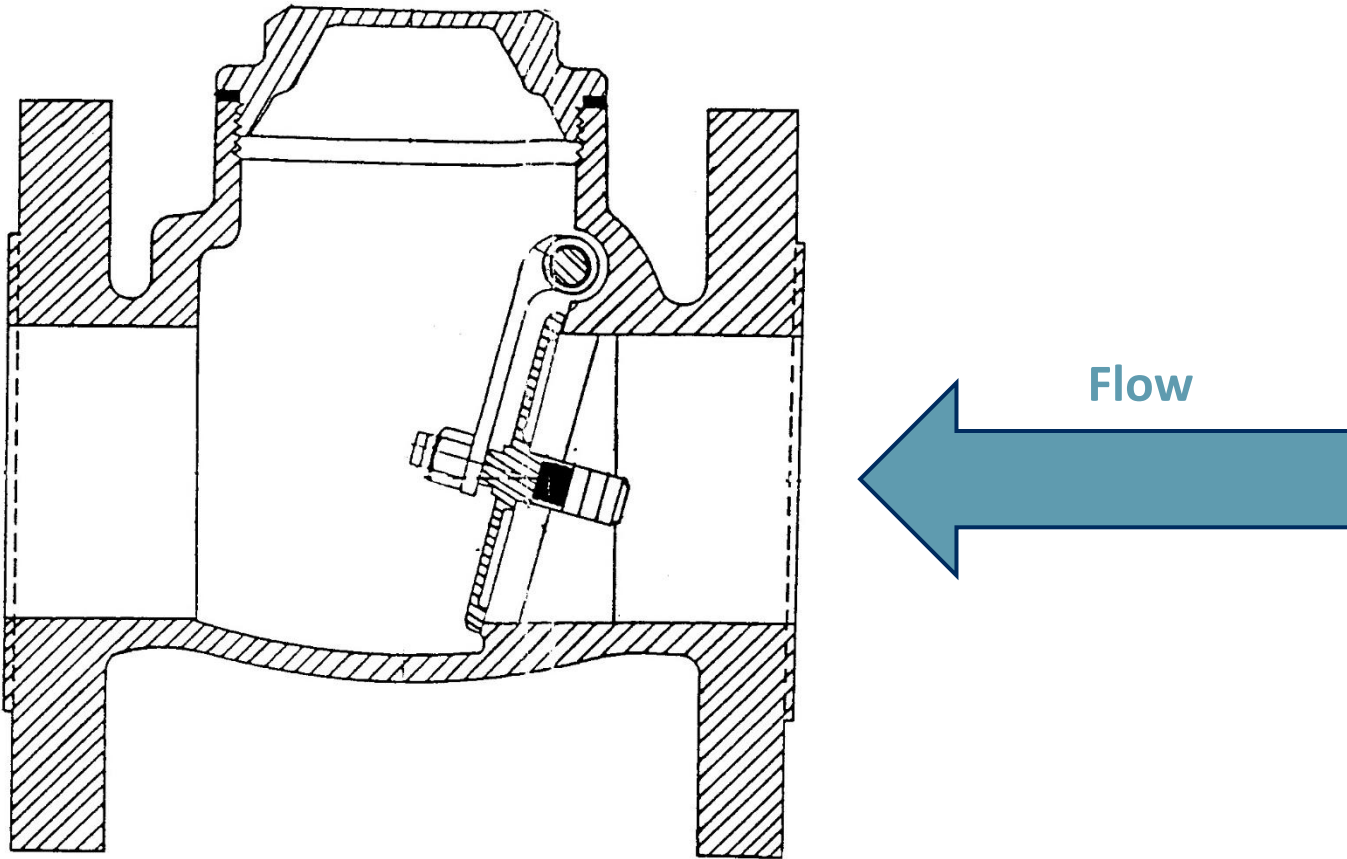
Swing Check



Quick Disconnect with Check Valves



TANK FILLING | CHECK VALVES



TANK FILLING | BLOCK VALVES

Ball Valves



691

Gate Valves



235 & 535

TANK FILLING | LINE STRAINERS

Top Clean-out



286

Bottom Clean-out

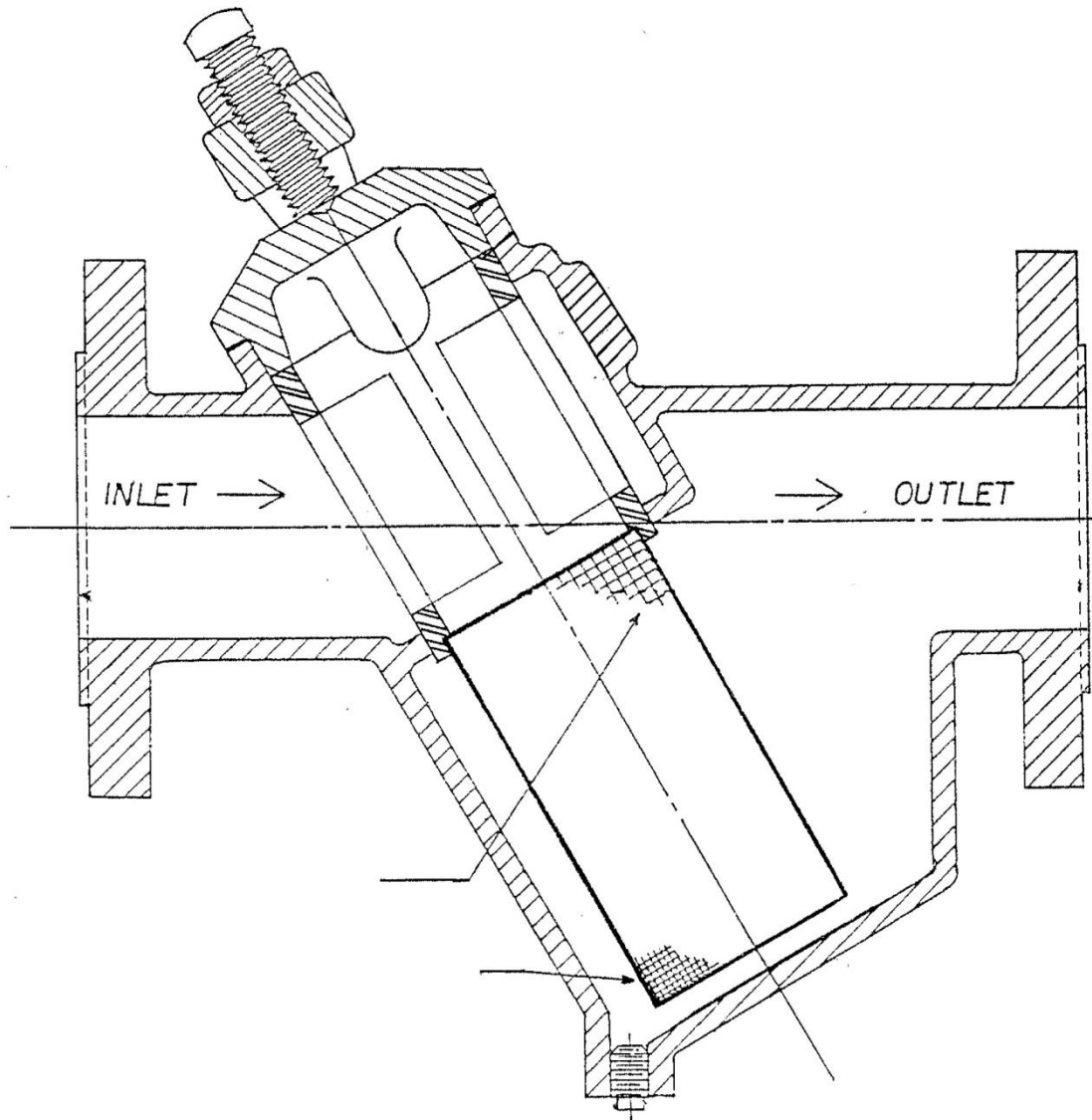


285

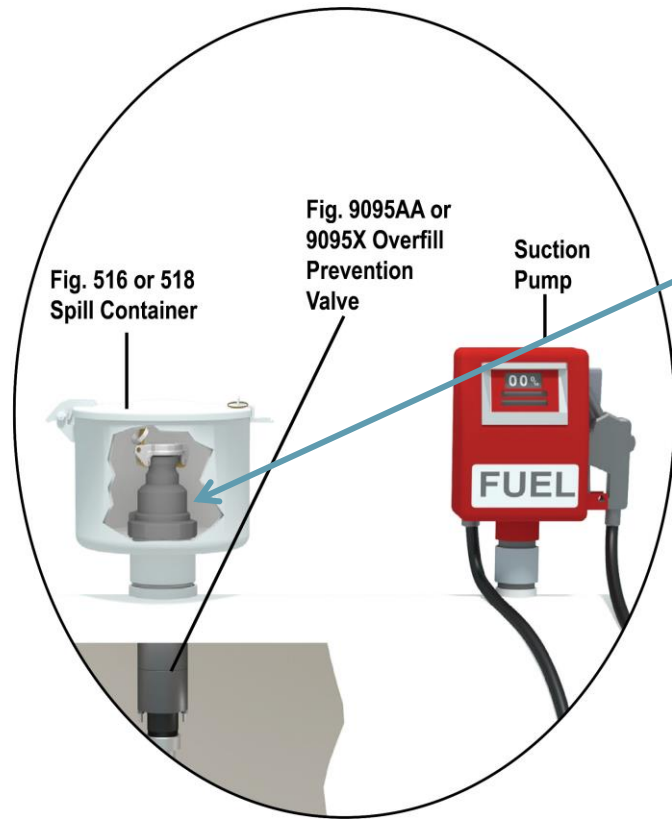


284S

TANK FILLING | LINE STRAINERS

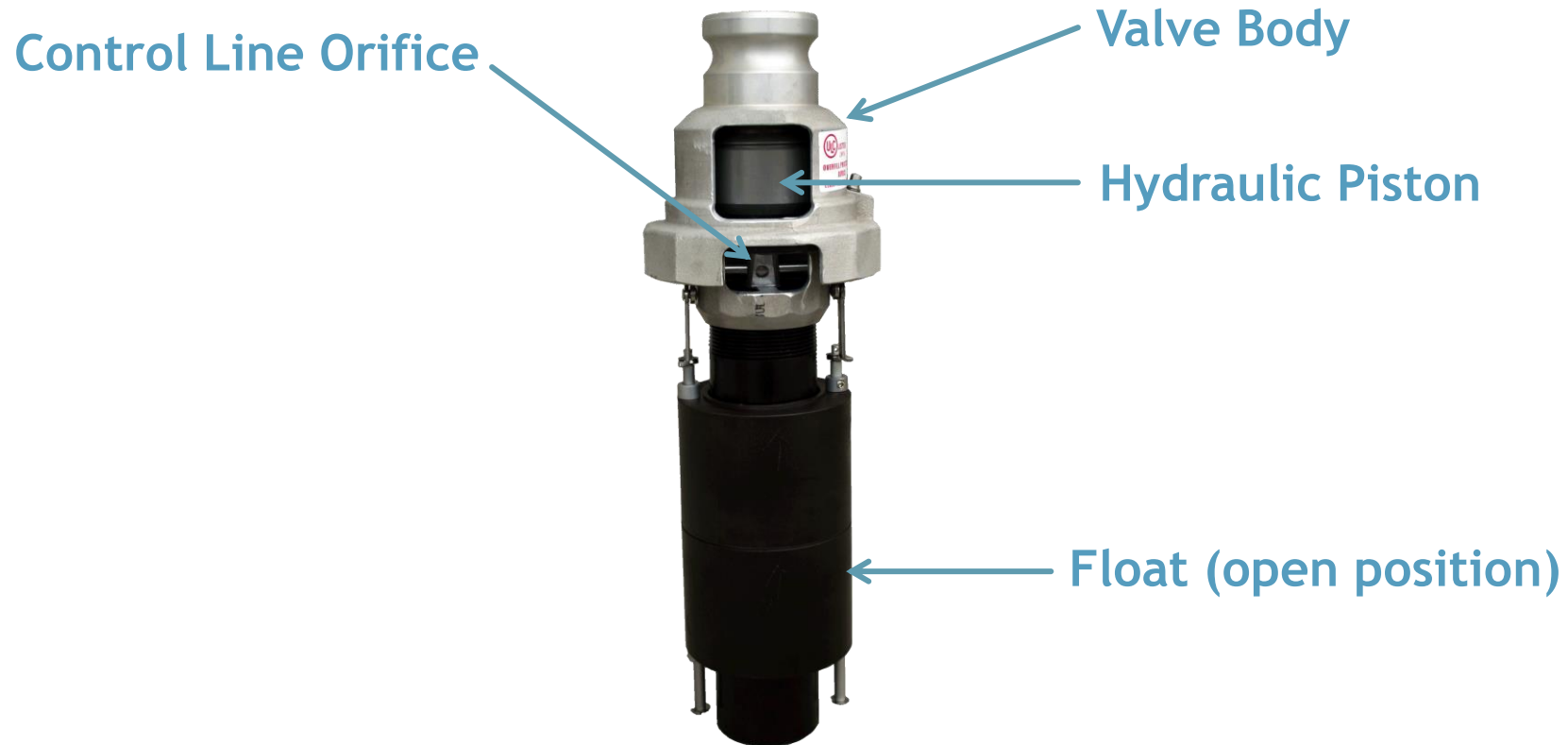


TANK FILLING | OVERFILL PREVENTION VALVES



9095AA

TANK FILLING | OVERFILL PREVENTION VALVES



TANK FILLING | OVERFILL PREVENTION VALVES



TANK FILLING | DROP TUBE AND DIFFUSER

Drop Tube



419

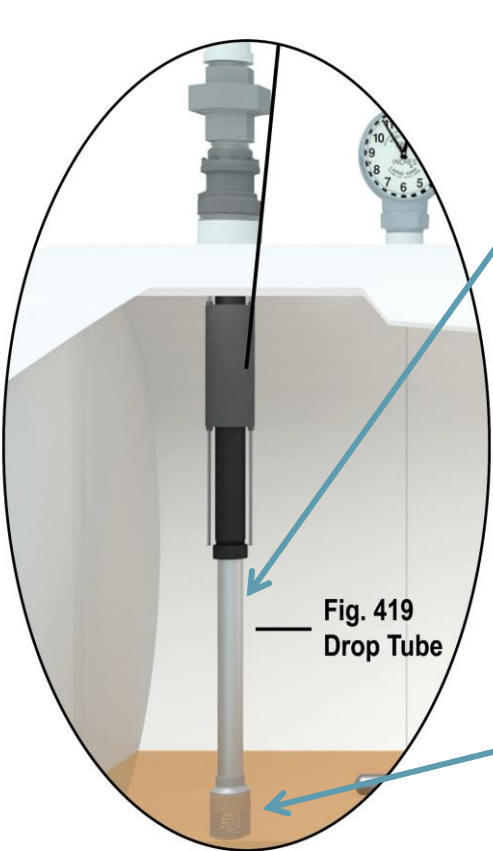


419E

Diffuser



539



TANK FILLING | VAPOR RECOVERY EQUIPMENT



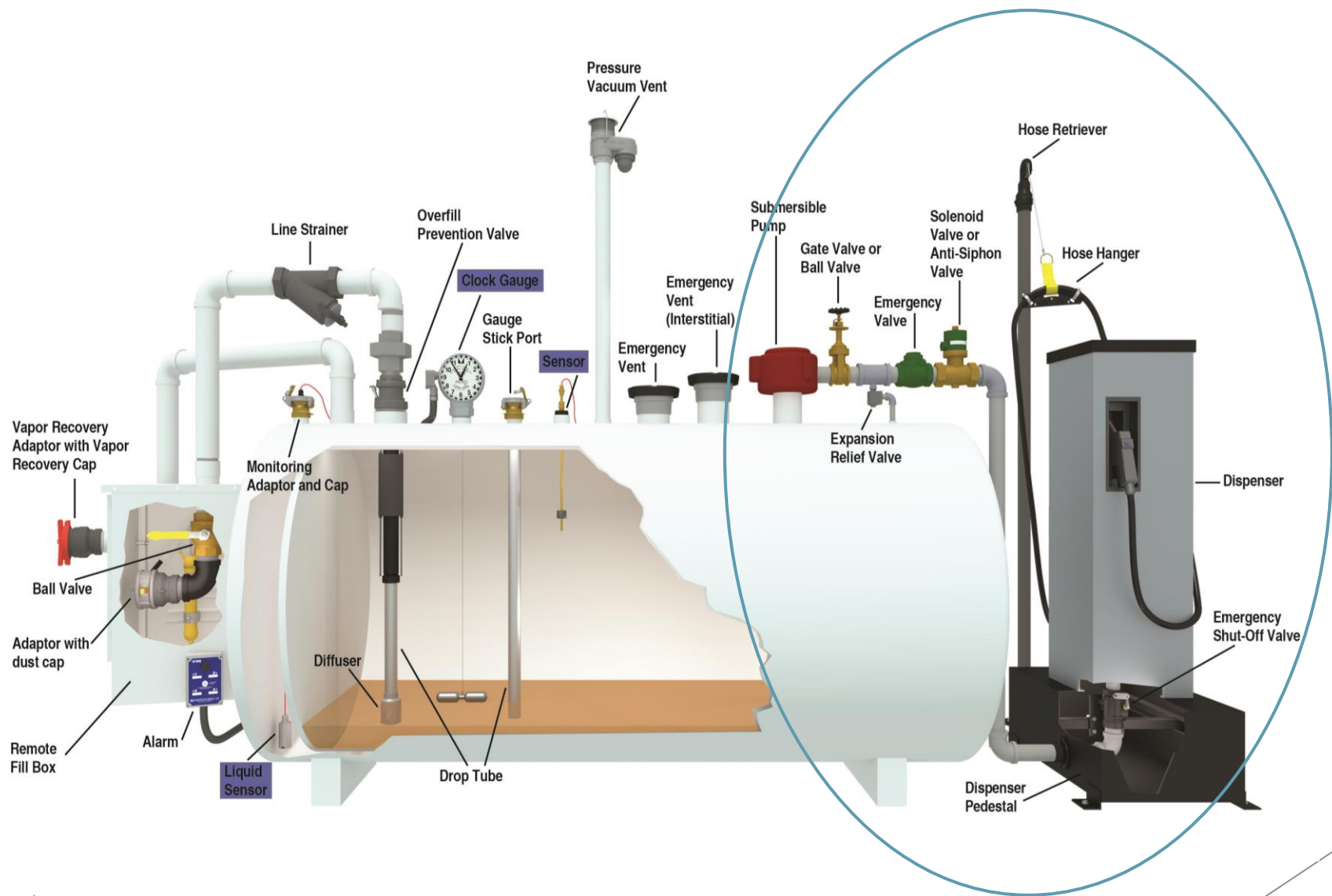
323 & 323C

TANK FILLING | VAPOR RECOVERY EQUIPMENT



TANK EQUIPMENT

DISPENSING



TANK DISPENSING | TYPES OF DISPENSING SYSTEMS

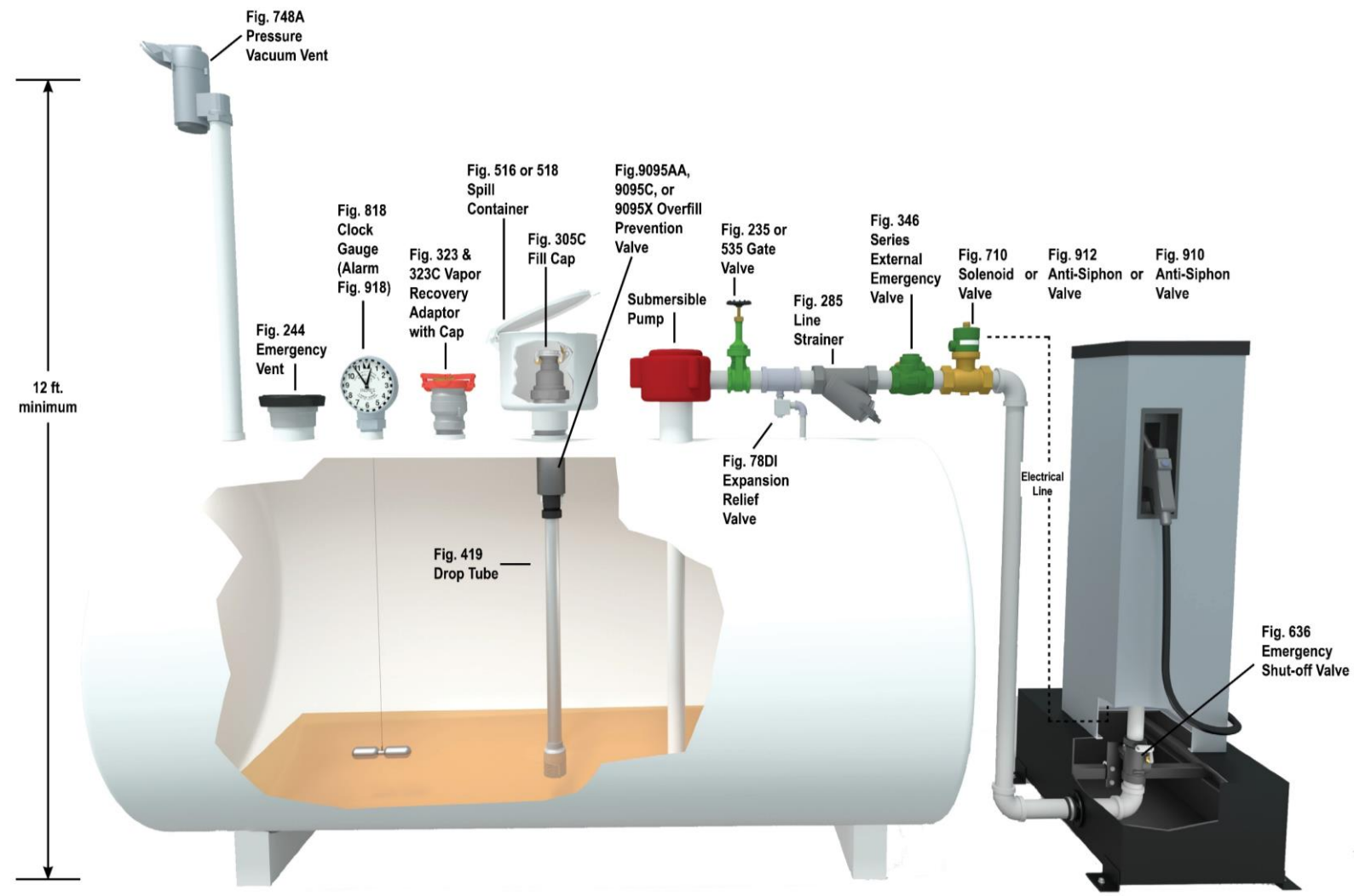
Pressurized



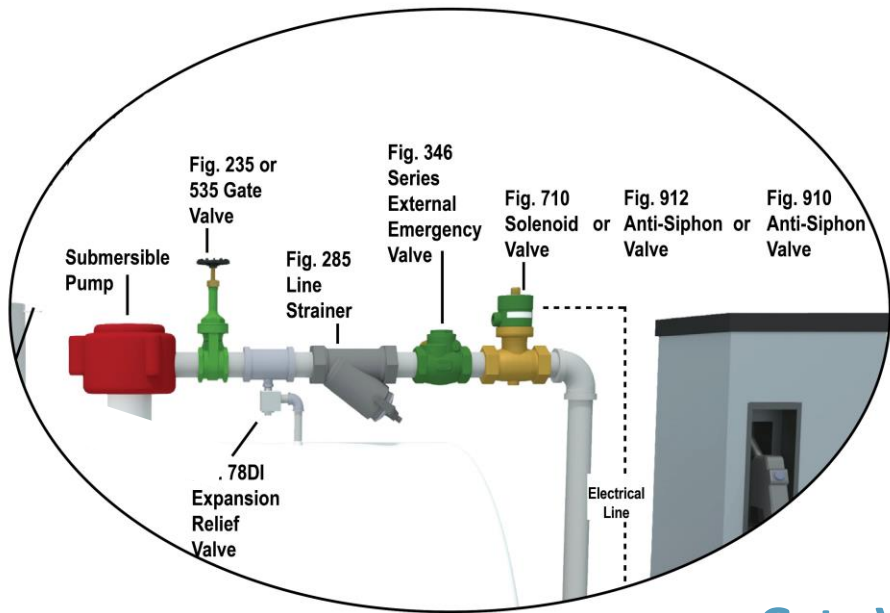
Suction



TANK DISPENSING | PRESSURIZED SYSTEM



TANK DISPENSING | BLOCK VALVES



Ball Valves

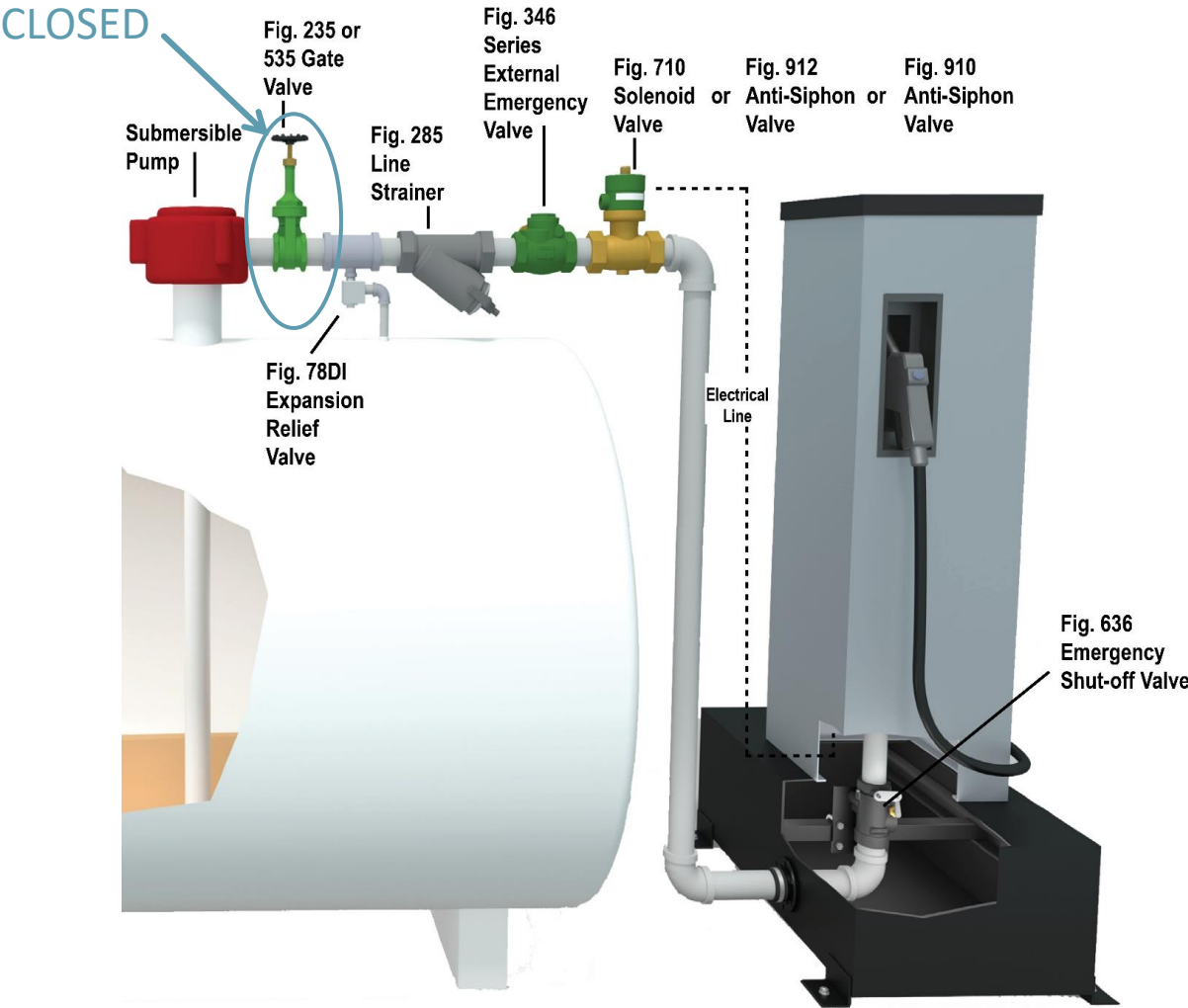


691

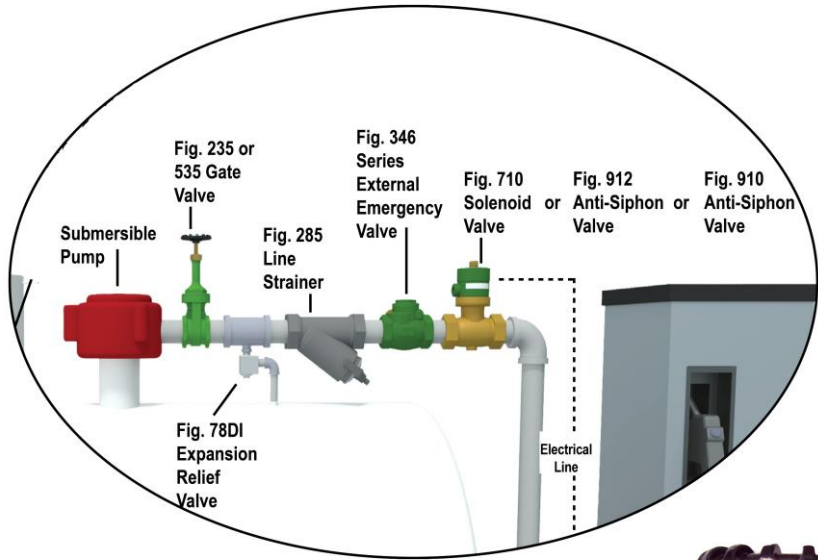
Gate Valves



TANK DISPENSING | THERMAL EXPANSION



TANK DISPENSING | THERMAL EXPANSION



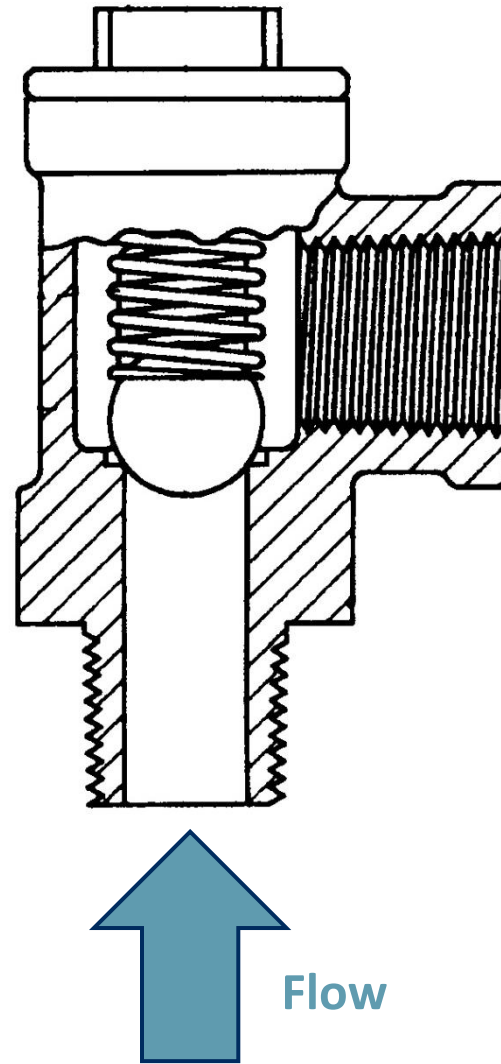
76DI



78DI



TANK DISPENSING | THERMAL EXPANSION



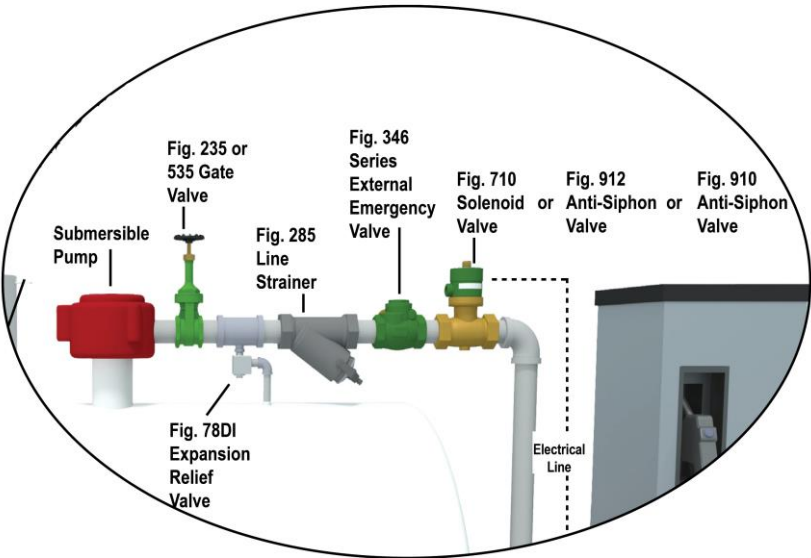
TANK DISPENSING | EMERGENCY VALVES



346DI

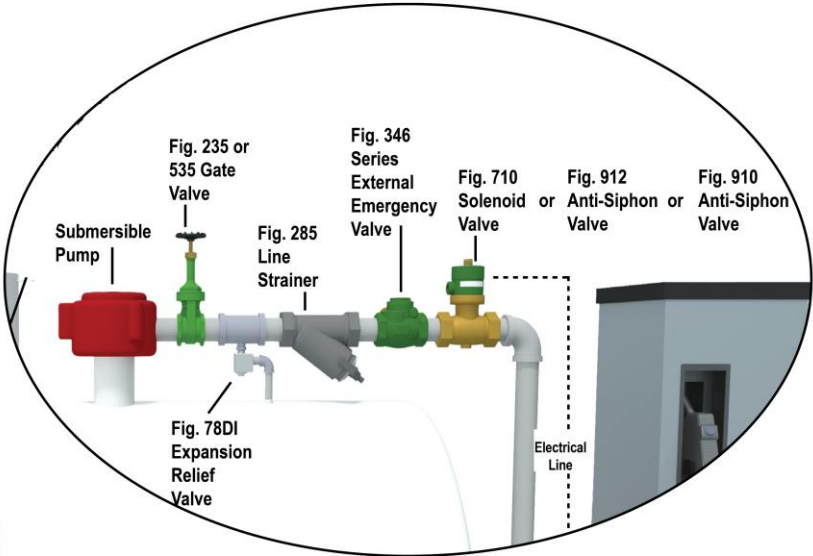


446



346FDI

TANK DISPENSING | ANTI-SIPHON: ELECTRIC SOLENOID VALVES



710



711

TANK DISPENSING | ANTI-SIPHON: ELECTRIC SOLENOID VALVES



TANK DISPENSING | ANTI-SIPHON: ELECTRIC SOLENOID VALVES

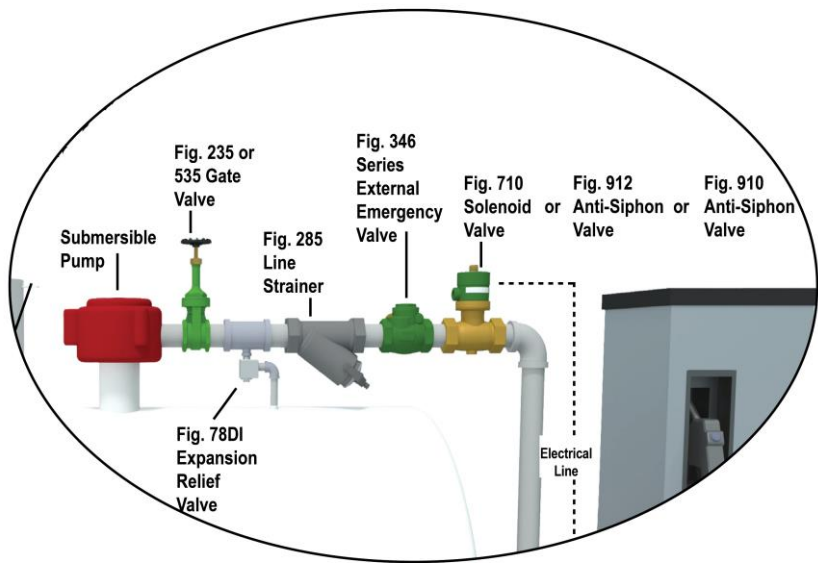


Anti-Siphon Valves installed upside down

TANK DISPENSING | ANTI-SIPHON: MECHANICAL VALVES

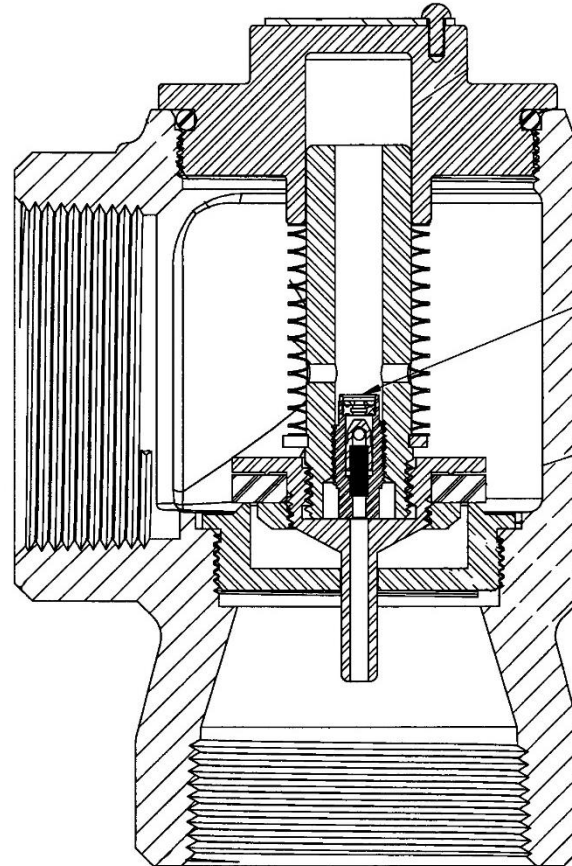
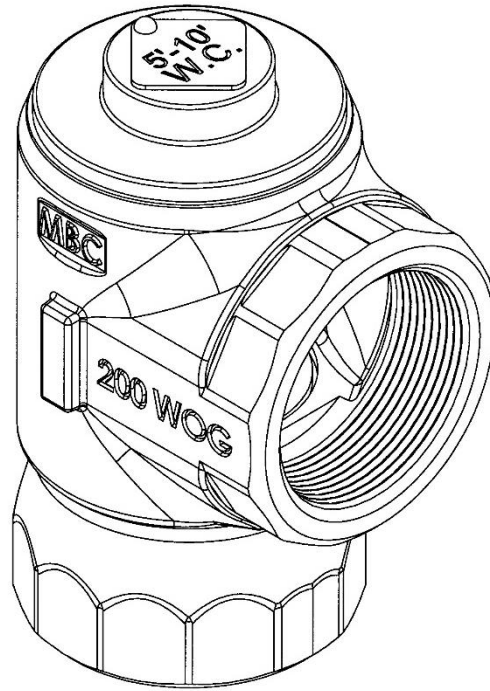


912



910

TANK DISPENSING | ANTI-SIPHON: MECHANICAL VALVES



Expansion
Relief

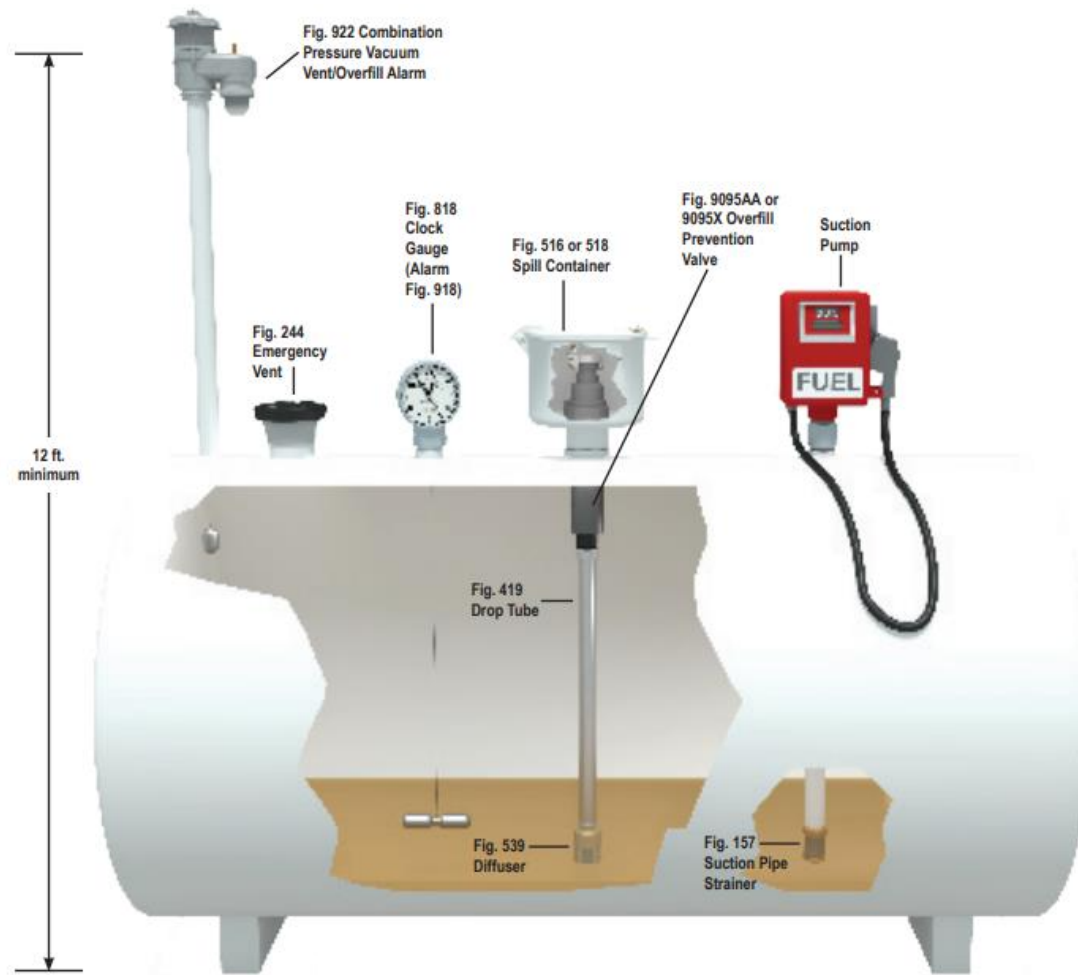


Flow

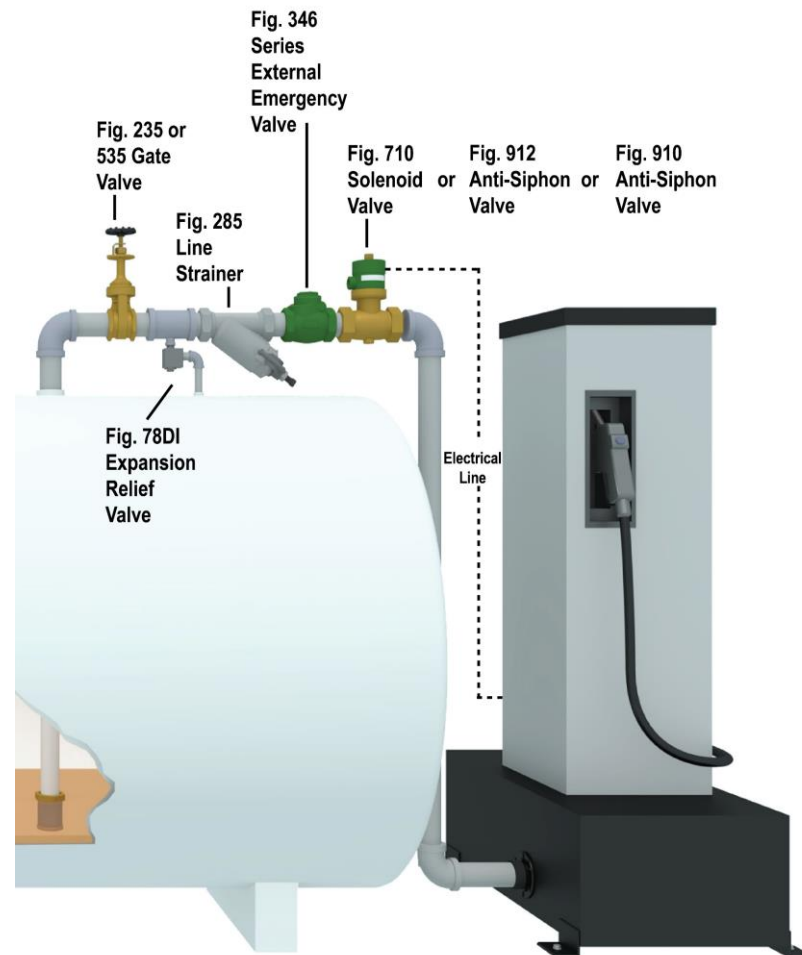
TANK DISPENSING | SUCTION SYSTEM

Aboveground Fuel Storage - Suction System

Horizontal cylindrical tank with top fill and top mounted pump



TANK DISPENSING | SUCTION SYSTEM



Dispensing through a Suction System

TANK DISPENSING | SUCTION SYSTEM

Dispenser pedestals serve as a raised platform for piping and installing dispensers/pumps in aboveground fueling systems



Dispenser Pedestal

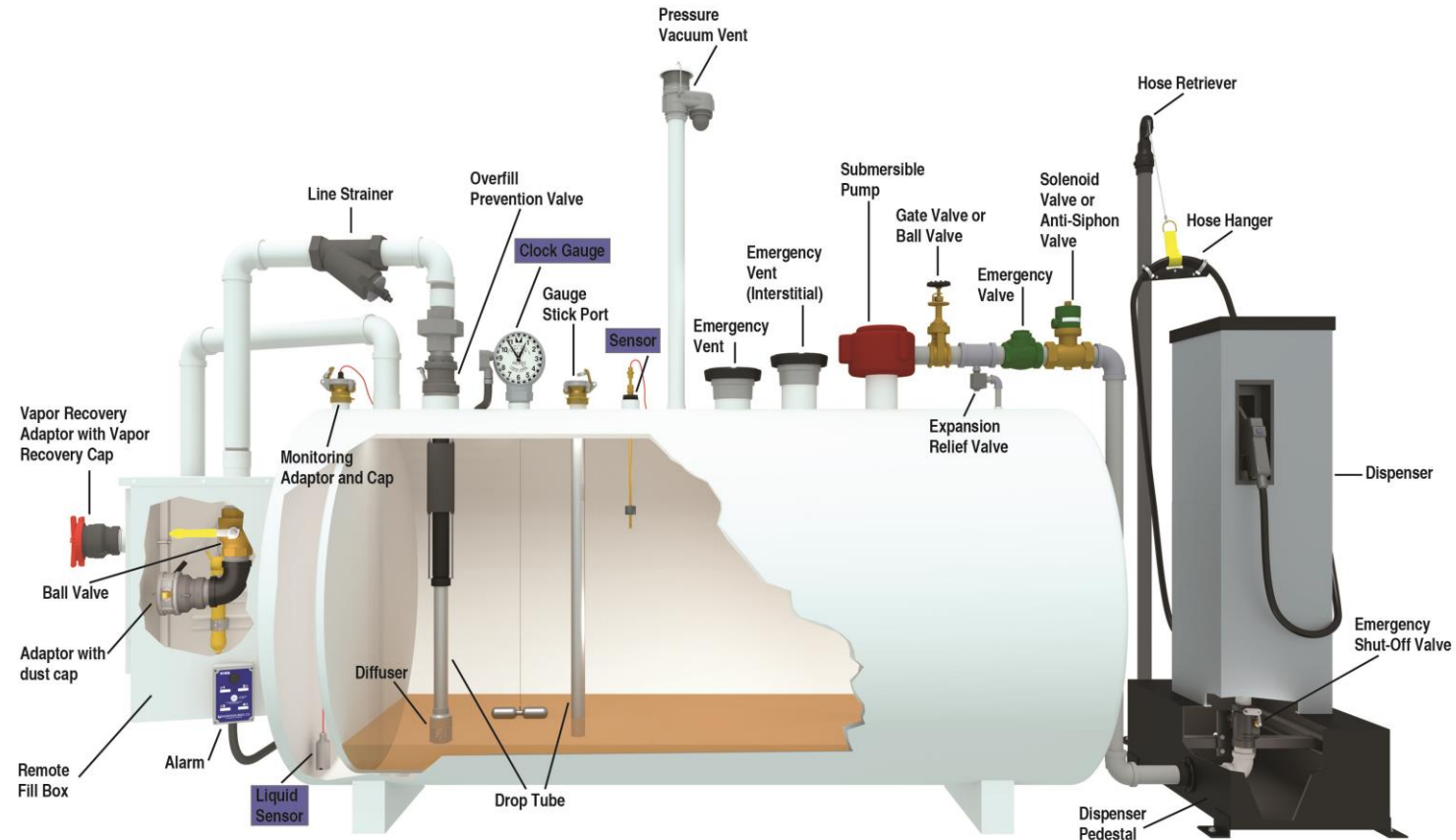
TANK DISPENSING | SUCTION SYSTEM

- Stabilizer bars provide secure brackets for installation of shear valves.
- Cabinet provides secure anchoring of the dispenser
- Spill containment for small spills



Dispenser Pedestal

TANK EQUIPMENT

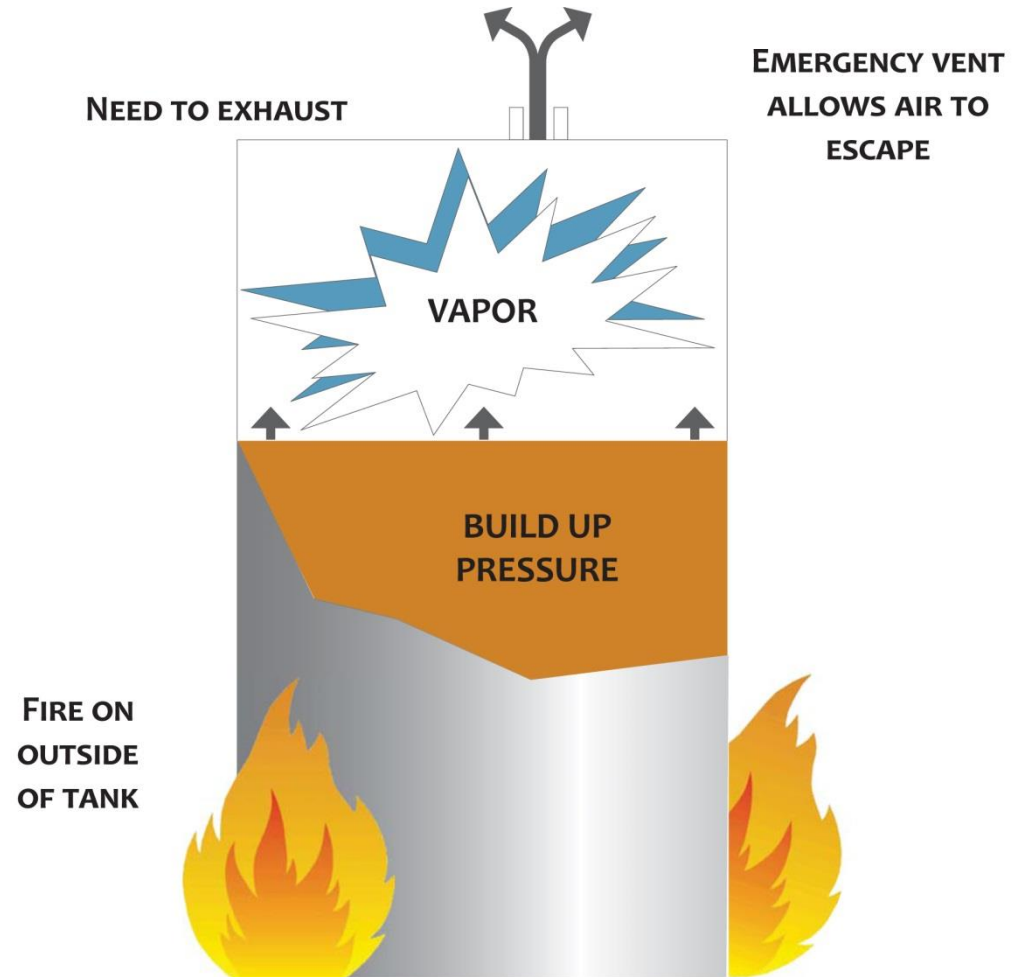


Emergency Venting & Normal Venting

Emergency Venting-

Venting Sufficient to relieve excessive internal pressure in storage tanks caused by fire exposure.

VENTING AND GAUGING | EMERGENCY VENTING



VENTING AND GAUGING | EMERGENCY VENTING

When Is Emergency Venting Required?

8.1 Each tank shall have normal and emergency openings for venting.

8.2 Each primary containment tank including each compartment of a compartment tank shall have provisions for both normal and emergency venting.

8.3 The interstitial space of a secondary containment tank shall have provisions for emergency venting.

VENTING AND GAUGING | EMERGENCY VENTING



244



245F

VENTING AND GAUGING | EMERGENCY VENTING

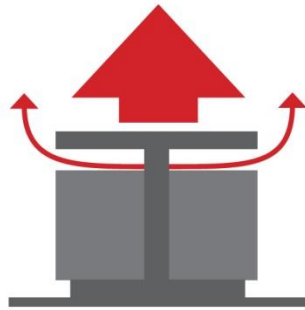
Emergency Vent

- Types of emergency vents
- Sizes of emergency vents
- Connection types
- Venting capacities
- Opening pressures

Types of Emergency Vents

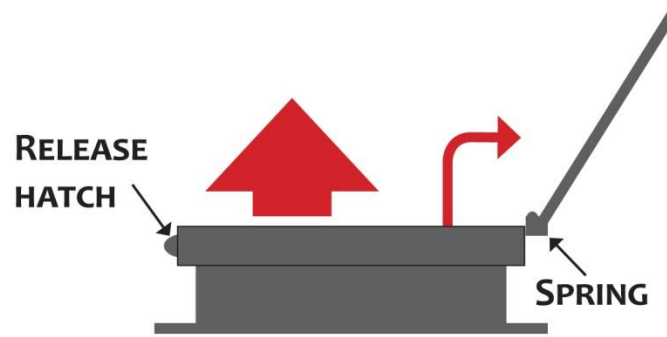
- Pop-Up Style
- Flip-Up Style
- Long-Bolt Manhole

VENTING AND GAUGING | EMERGENCY VENTING



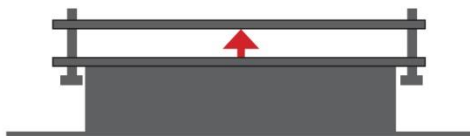
POP-UP STYLE

WEIGHT OF LID DETERMINES PRESSURE SETTING.
(8 OZ., 12 OZ., 16 OZ.)
METAL-TO-METAL SEAT OR O-RING SEAT.



FLIP-UP STYLE

LATCH RELEASES AT SET PRESSURE, SPRING
LOADED HINGE FLIPS LID OPEN.



LONG BOLT MANHOLE

LID IS ABLE TO LIFT UNDER EXCESS PRESSURE.
VAPORS EXIT OUT OPENING.



ROOF-TO-SHELL TANK

SPECIAL JOINT DESIGNED TO LET GO UNDER
EXCESSIVE PRESSURE.

VENTING AND GAUGING | EMERGENCY VENTING

What Size Emergency Vent is Required?

VENTING AND GAUGING | EMERGENCY VENTING

Table F: Emergency Venting Capacity

Wetted surface, square feet*	Venting capacity, standard cubic feet per hour*	Minimum 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	742,000	10
3200	776,000	12
3600 and over	806,000	12

Table F
NFPA30-2015
Table 22.7.3.2
Emergency
Venting Capacity

UL 142
Table 8.1

VENTING AND GAUGING | EMERGENCY VENTING

Sizes of Emergency Vents (generalized application)

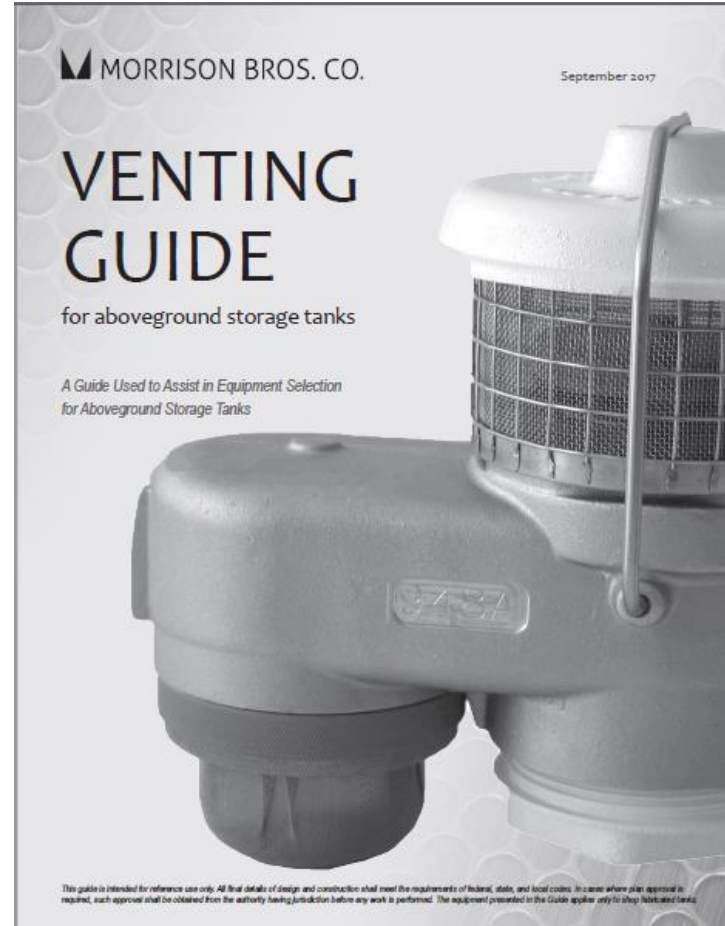
- 2 inch (< 200 gallons)
- 3 inch (< 500 gallons)
- 4 inch (<1000 gallons)
- 5 inch (<1500 gallons)
- 6 inch (< 5,000 gallons)
- 8 inch(< 20,000 gallons)
- 10 inch(< 70,000 gallons)

VENTING AND GAUGING | EMERGENCY VENTING

Morrison Venting Guide References

- UL 142
- NFPA 30
- ULC S601-07
- PEI RP 200

Used to assist in the selection of equipment for aboveground shop-fabricated storage tanks.



VENTING AND GAUGING | EMERGENCY VENTING

Small tanks generally have male or female threaded openings requiring emergency vents with male or female threaded connections.

Large tanks frequently have flanged openings requiring vents with flanged connections.

Slight shift to small flanged vents due to the ease of sealing the opening for tank testing.

VENTING AND GAUGING | EMERGENCY VENTING

Tank connection types

- Male Threads
- Female Threads
- Flange Connections



6" vent (244O)



4" vent



10" vent (244OF)

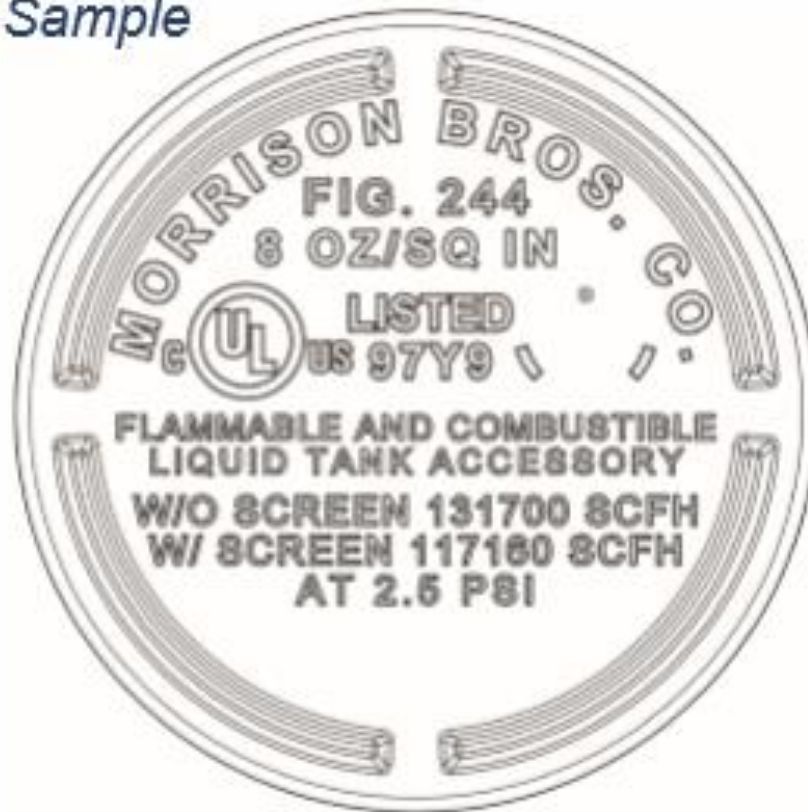
VENTING AND GAUGING | EMERGENCY VENTING

UL 2583 (January of 2015)

- Tested for functionality, relief and flow
- Abuse (drop, assembly, repeat function)
- Exposure & compatibility testing
- Special test (ice, rain, fire, cycling)

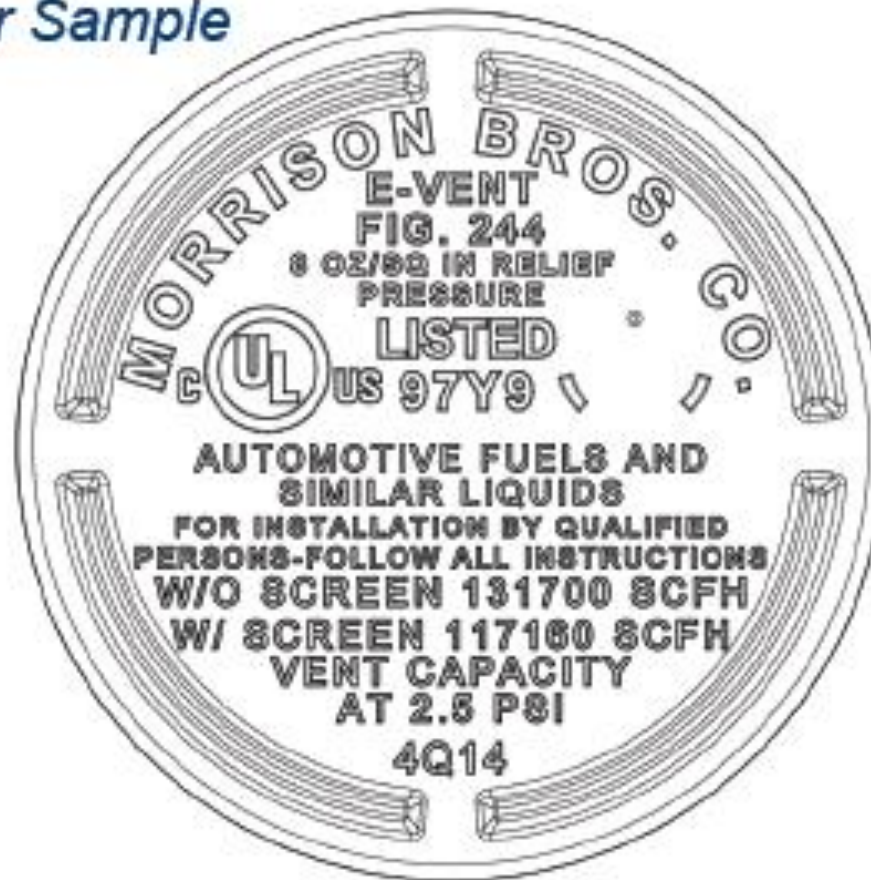
VENTING AND GAUGING | EMERGENCY VENTING

*244 Emergency Vent Cover Sample
Previous UL Listing*



VENTING AND GAUGING | EMERGENCY VENTING

244 Emergency Vent Cover Sample *New UL 2583 Listing*



Normal Vent

An opening, construction method, or device that allows the relief of excessive internal pressure or vacuum during normal storage and operations.

VENTING AND GAUGING | NORMAL VENTING



Normal Venting is very important

VENTING AND GAUGING | NORMAL VENTING

**Normal Venting Includes
Pressure Relief and
Vacuum Intake**

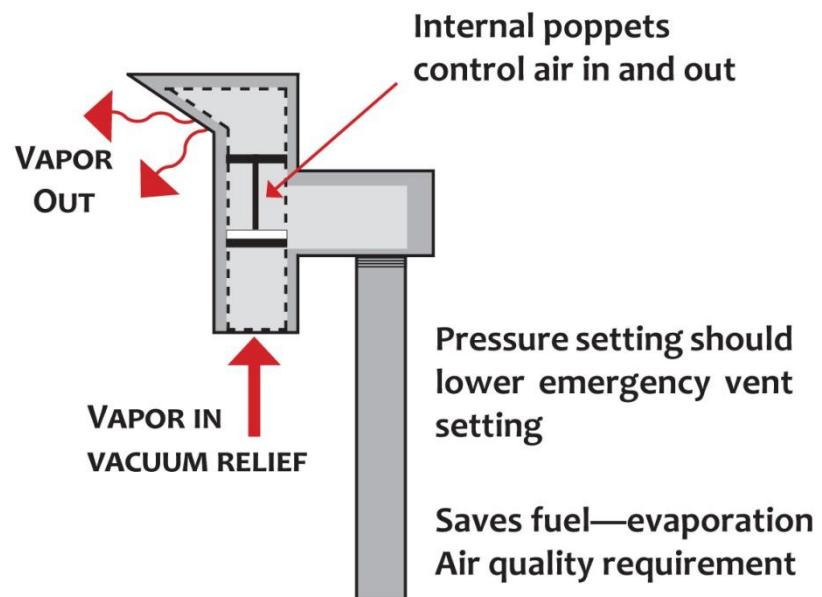


VENTING AND GAUGING | NORMAL VENTING

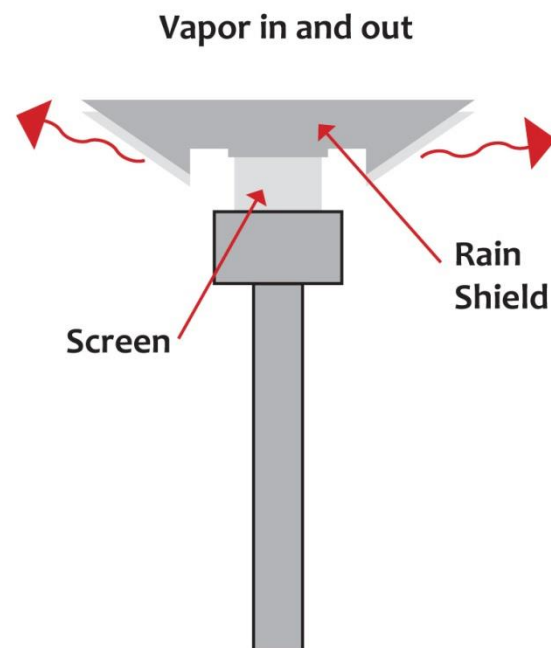
NORMAL VENTING

VENTING UNDER “NORMAL” (NON-EMERGENCY) CONDITIONS

PRESSURE/VACUUM VENT



OPEN VENT



Vent Relief Setting: Morrison Rule of thumb

Select a normal vent with a pressure relief setting greater than the emergency vent relief setting. This allows the normal vent to control the breathing allowing the emergency vent to remain closed.

Example: Normal vent with a 2 ounce per square inch opening pressure setting, choose an emergency vent with an 8 ounce pressure setting.

VENTING AND GAUGING | NORMAL VENTING

Normal Vent—Venting Under “Normal” (Non-Emergency) Conditions.

- Open vent allows free movement of air in and out of tank
 - Rain hood keeps water out directs vapors outward and upward in accordance with NFPA 30
 - Vent height determined by authority having jurisdiction. (generally 12 feet above grade)
 - Screen keeps bugs and debris out of tank.



354

VENTING AND GAUGING | NORMAL VENTING

Normal Vent, 749 Pressure Vacuum Vent Features and Details

- Screen protects the tank from debris & insects
- Integrated internal drain port channels water away from the tank
- Vent vapors up and outward per NFPA 30
- Conserves fuel
- Certified SCFH ratings



749

VENTING AND GAUGING | NORMAL VENTING

Item Number	A	B	C	D	E	SCFH
749---0100 AV	2N	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.
749---0200 AV	2N	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.
749---1100 AV	3N	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.
749---1200 AV	3N	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.
749S--0100 AV	2S	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.
749S--0200 AV	2S	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.
749S--1100 AV	3S	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.
749S--1200 AV	3S	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.
749CRB0500 AV	2N	8.0 oz	0.50 oz	V	Y	6200 @ 20oz./in.sq.
749CRB0600 AV	2N	3" W.C.	8" W.C.	V	Y	3800 @ 8.2" H2O
749CRB1500 AV	3N	8.0 oz	0.50 oz	V	N	6200 @ 20oz./in.sq.
749CRB1600 AV	3N	3" W.C.	8" W.C.	V	N	3800 @ 8.2" H2O
749CRBS600 AV	2S	3" W.C.	8" W.C.	V	N	3800 @ 8.2" H2O
749CRBS1600 AV	3S	3" W.C.	8" W.C.	V	N	3800 @ 8.2" H2O
749BSP0100 AV	2B	8.0 oz	0.50 oz	M	N	6200 @ 20oz./in.sq.
749BSP0200 AV	2B	12.0 oz	0.50 oz	M	N	7500 @ 25oz./in.sq.
749T--0200 AV	2S	8.0 oz	0.50 oz	V	N	7500 @ 25oz./in.sq.



749

Pressure Vacuum Vent, 748A Features and Details

- Vents outward and upward in compliance with NFPA 30
- Tri-polar mounting screws for mounting exhaust hood in any of three positions
- Optional dryer connections accommodate the installation of desiccant dryers on vacuum connection



VENTING AND GAUGING | NORMAL VENTING

- **Flame Arrestor**—Prevents the transmission of heat and/or an ignition source into the tank.



Pressure Vacuum Vent
Arrester
(351S)



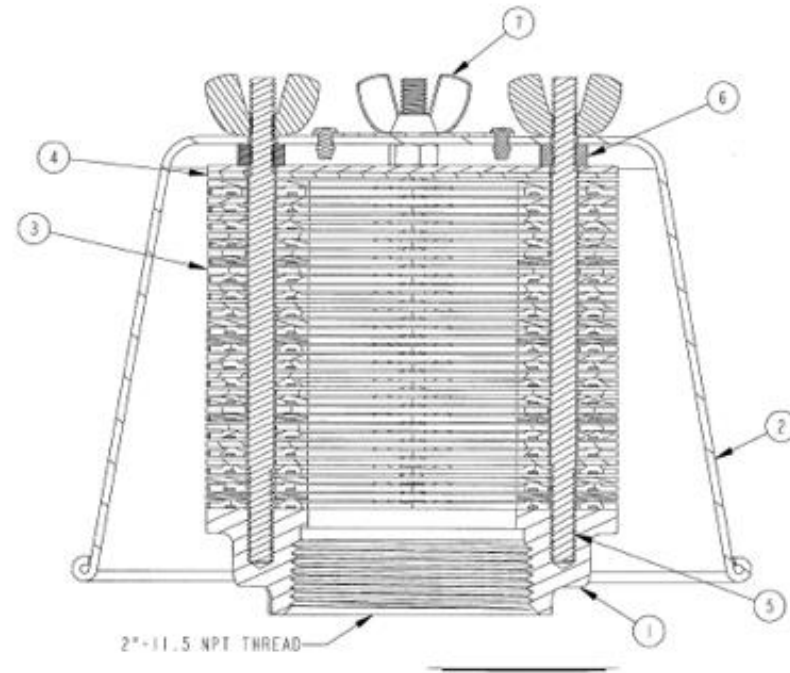
352 (2")



352 (3")

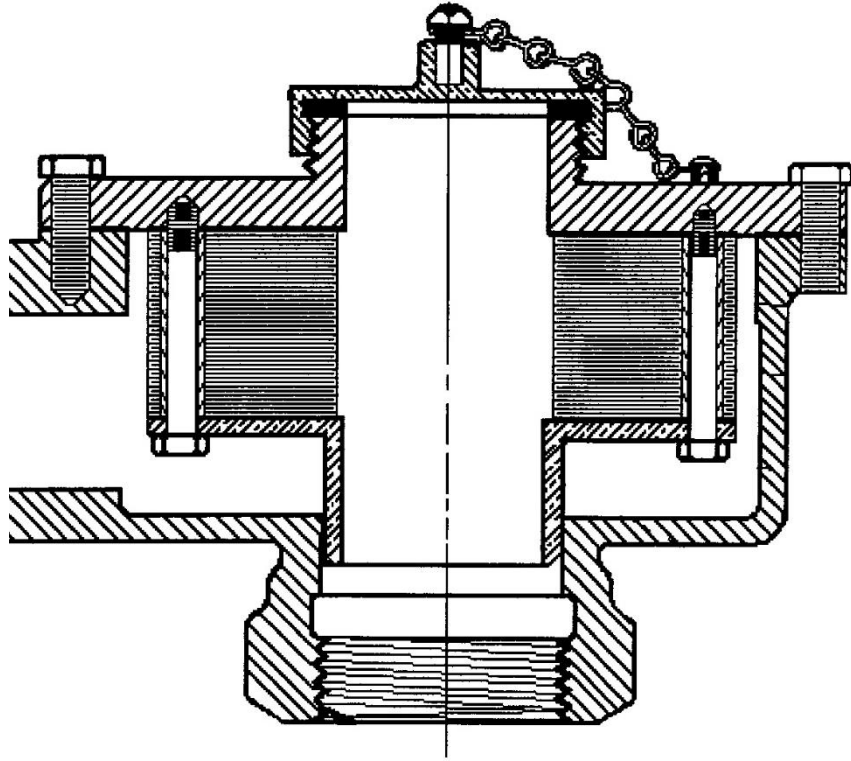
➤ 352 End-of-line, Open Air Deflagration Flame Arrester

The flame arrester provides a protection barrier that deters a flame generated from a source outside of the tank from flashing through the vent into the vapor space of the tank.



2 Inch has 38 Grid Plates; 3 Inch has 58 plates

VENTING AND GAUGING | NORMAL VENTING



2 Inch 351S Has 21 Grid Plates

VENTING AND GAUGING | LEVEL GAUGES



VENTING AND GAUGING | LEVEL GAUGES

- Liquid Level Gauges



(inches)

Model 718



(gallons)

VENTING AND GAUGING | LEVEL GAUGES

- Liquid Level Gauge
 - Reads in feet and inches



818 With
Standard Float

- Liquid Level Gauge
 - Reads in meters and centimeters



VENTING AND GAUGING | LEVEL GAUGES

- Liquid Level Gauge
 - Reads in gallons
 - Tank-specific design
 - Eliminates tank chart requirement



818G With
Drop Tube
Float

- Liquid Level Gauge
 - Reads in liters
 - Tank-specific design
 - Eliminates tank chart requirement



VENTING AND GAUGING | LEVEL GAUGES

- Clock Gauge & Alarm Combination



918

VENTING AND GAUGING | LEVEL GAUGES



VENTING AND GAUGING | LEVEL GAUGES & ALARMS

- 918 Alarm Boxes (battery powered)



918S Single Input
918D Dual Input
918Q Quad Input

VENTING AND GAUGING | LEVEL GAUGES & ALARMS

- 918 Alarm Boxes With 360 Degree Beacon Light
(battery powered)



918SB



918DB



918QB

918SB Single Input

918DB Dual Input

918QB Quad Input

VENTING AND GAUGING | LEVEL GAUGES & ALARMS

- 918 System Interface Alarm Boxes (AC powered)



**UL/cUL913 Listing for ordinary location with Hazardous Location intrinsically safe input circuits for Class I, Div 1 Group D, Florida DEP EQ-834.*

918AC
1 to 4 Input Relays
0 to 4 Output Relays

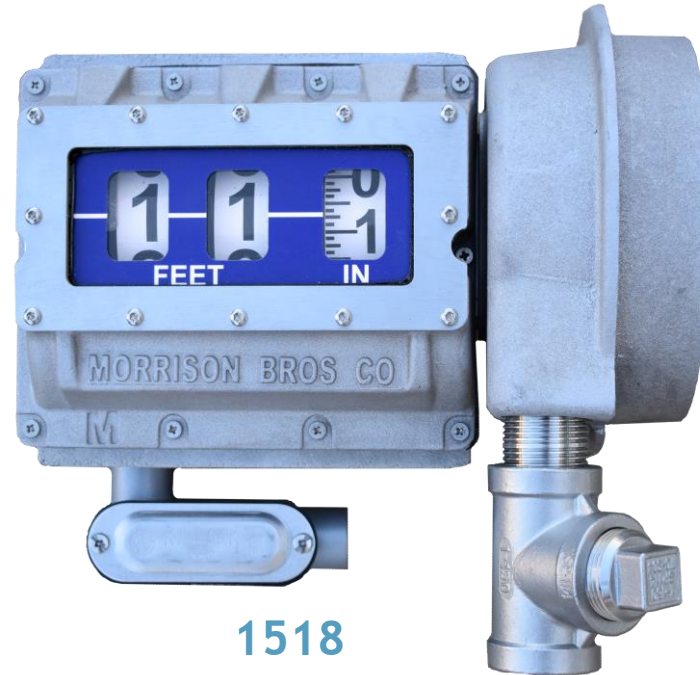
VENTING AND GAUGING | LEVEL GAUGES & ALARMS

- Mechanical Tank Gauges



1519
(with Power Module)

The level alarm relay output wiring from the gauge has to be connected to an external alarm box (sold separately).



1518

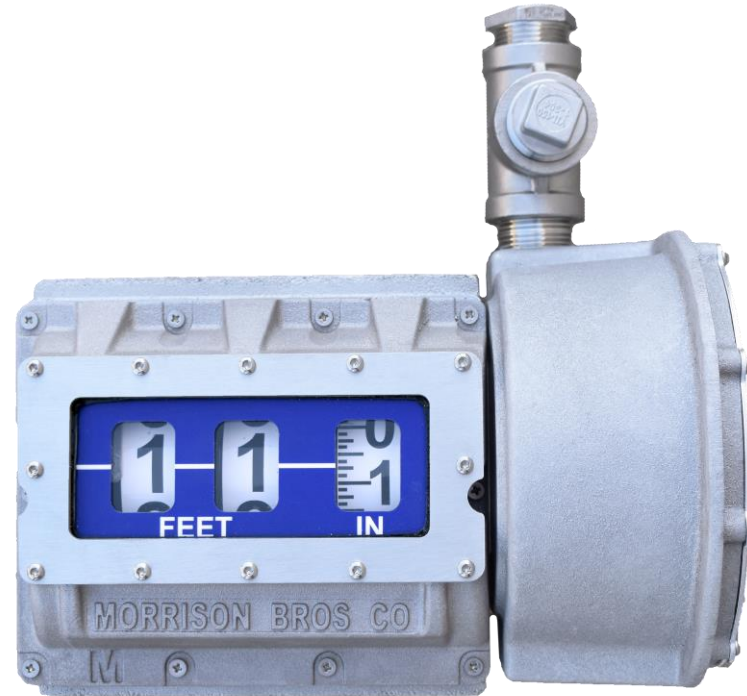
- Mechanical Vertical Tank Gauges for vertical tanks.



1619

(with Power Module)

The level alarm relay output wiring from the gauge has to be connected to an external alarm box (sold separately).



1618

VENTING AND GAUGING | LEVEL GAUGES & ALARMS

Level Sensors



** Third party EPA evaluated with both 918AC and 918S/D/Q.*

† Intrinsically safe for Class 1, Div 1 Group D Hazardous Locations when installed with a 918S, 918D, or 918Q Tank Alarms or 918AC System Interface.

VENTING AND GAUGING | LEVEL GAUGES & ALARMS

- Electronic Gauges
 - Digital Electronic Gauge



1218C Console
1218S Sensor

VENTING AND GAUGING | LEVEL GAUGES & ALARMS

Mechanical Leak Indicator



724 Leak Indicator
(in alarm state)



724 Leak Indicator
(in normal state)



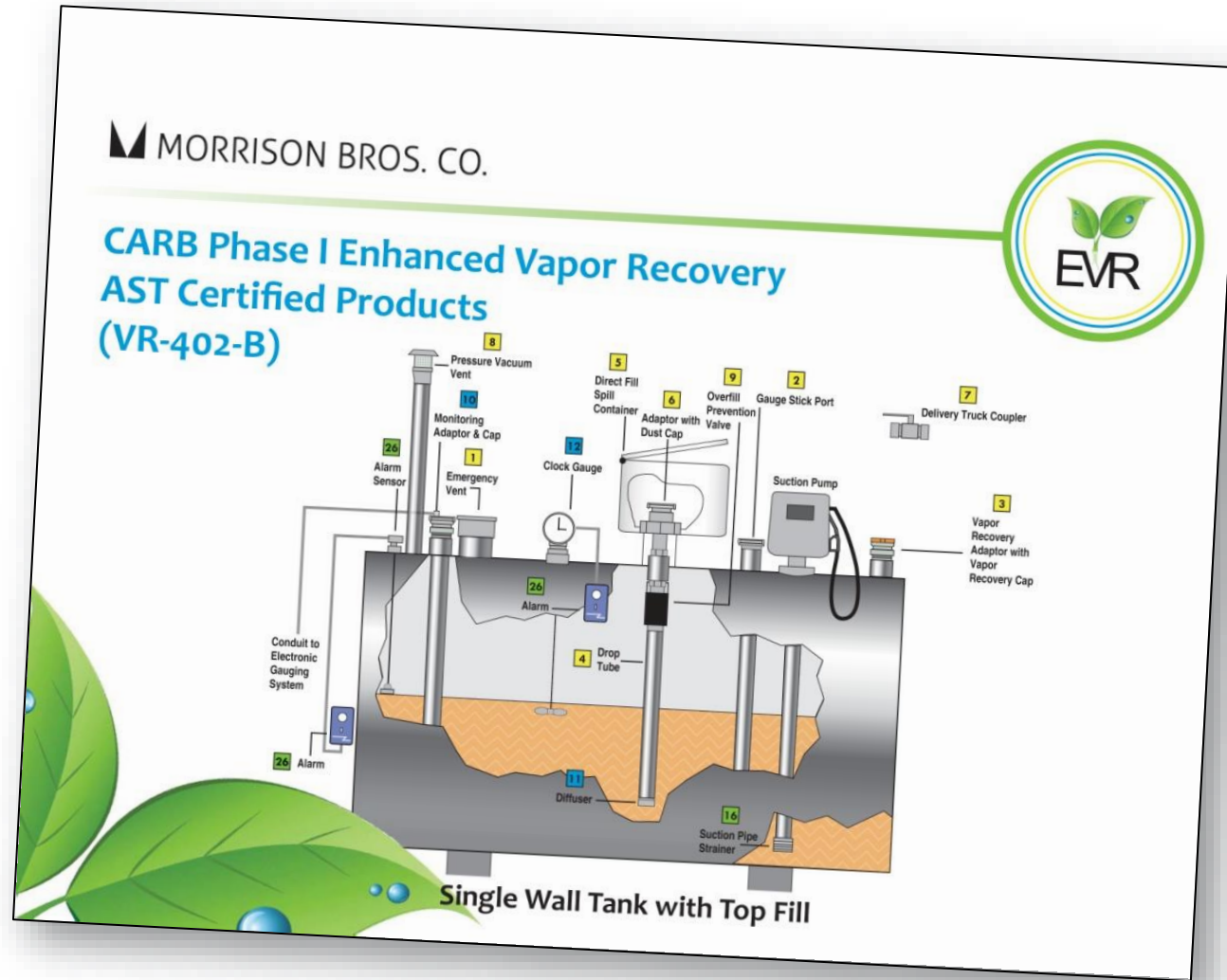
724 Leak Indicator
(with guard)



724 Overfill Indicator

724 & 724 With Guard

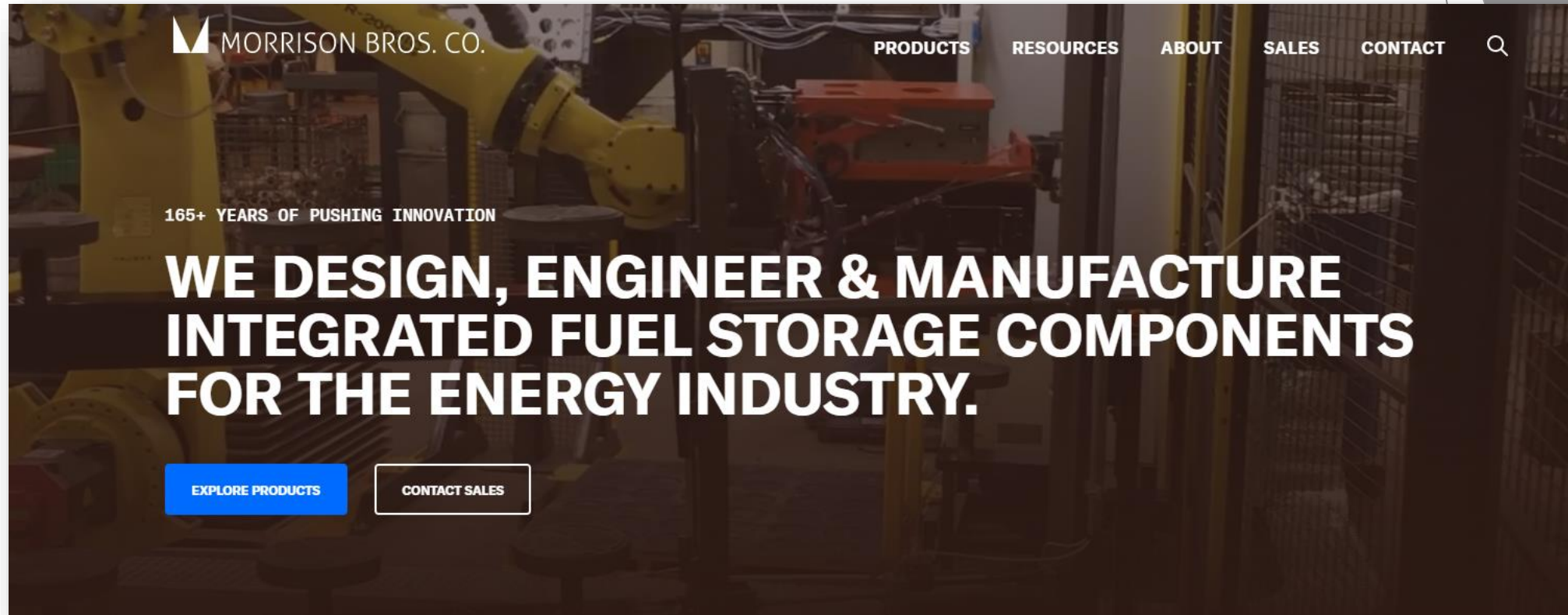
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