

OPERATION MANUAL

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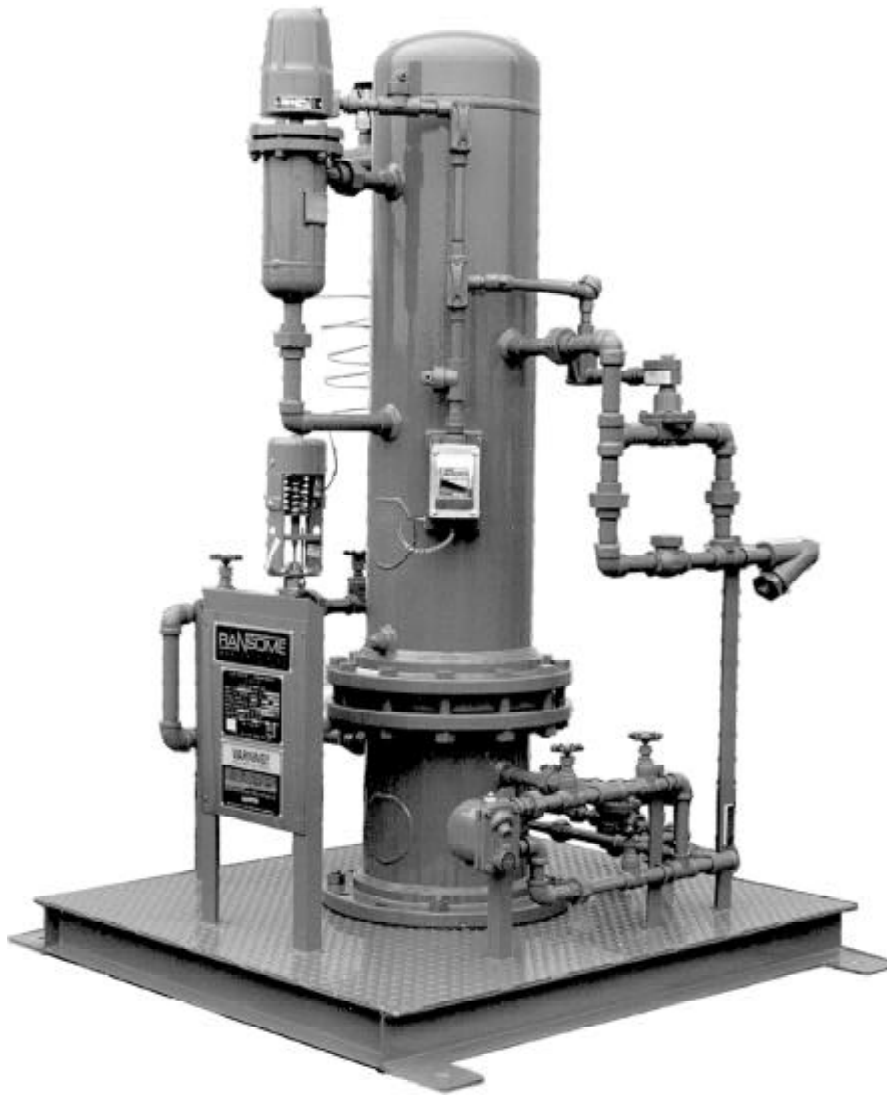


Figure 1-1 - VS Series Vaporizer

1. GENERAL

1.01 This manual provides a physical and functional description and operating theory necessary for effective use of the Ransome VS Series Steam heated LP-Gas Vaporizers.

1.02 Ransome VS Series Vaporizers provide an economical, dependable source of Liquefied Petroleum (LP) gas vapor for a wide range of applications up to 11,800 gallons per hour. Standard units are completely self-contained, requiring electric power for liquid level and temperature control. They are individually factory-tested and shipped ready for use. The LP-Gas Inlet and Vapor Outlet are connected to the user's system. Steam supply and condensate outlet are connected and the VS Series Vaporizer goes to work, quietly and automatically.

1.03 LP-Gas is stored as a liquid and used as a vapor. To change it into a vapor, heat must be added at the rate of:

(a) From 785 BTU for each gallon of Propane at -44 F to 441 BTU @ 132 F.

(b) From 808 BTU for each gallon of Butane at -32 F to 634 BTU @ 130 F.

The liquid will then boil, changing to vapor at the rate of:

(c) 36.4 ft. for each gallon of Propane.

(d) 31.3 ft. for each gallon of Butane.

1.04 Ransome VS Series Steam Vaporizers utilize steam to provide the heat required for vaporization of LP-Gas; about one pound of steam per gallon of propane vaporized. Operating on temperature control, steam flow is controlled into the heat exchanger to vaporize gas according to load.

1.05 Features of the VS Series Vaporizers include the following:

(a) Reliable float switch signals at low liquid level.

(b) 250 PSIG Design Working Pressure in LP-Gas space and 100 PSIG in Steam space. All vaporizers are designed and inspected in accordance with the ASME code.

(c) Modular design provides maximum capacity in a compact, rectangular unit.

(d) Models are available in a complete range of sizes from 55 gph to 11,800 gph Propane capacity, allowing the user to specify precisely the vaporization needed.

(e) All sizes are capable of infinite turndown and will maintain a ready supply of vapor from zero load to full capacity. At no load, only enough steam will be utilized to maintain pressure. This provides a continuous heat source, which eliminates starting lag when accommodating widely fluctuating loads.

(f) Bottom steam feed protects against freezeup. The condensate is constantly warmed by incoming hot steam. Even if the vaporizing temperature in the shell falls below freezing temperature, there is no risk of the condensate freezing with a consequent bursting of the tube.

(g) The tube bundle is removable and can be replaced in the field. It is not necessary to remove the whole unit in the event the tubes begin to corrode out. A replacement can be installed in the field with a minimum of down time.

How To Select A Steam Vaporizer

1.06 Determine the total amount of LP-Gas Vapor required. Add up the maximum inputs of all the gas-using equipment in the system from manufacturer's data plate or literature, usually expressed in BTU/hr. Be SURE this is correct. If in doubt, contact the manufacturer of the equipment.

(a) Calculate required capacity as follows:

$$Q = \frac{Ht \times Fd}{91,690}$$

Where:

Q = Required Capacity in Gallons/Hour Propane.

H = Total Input Required, BTU/Hour.

Fd = Load Variation Factor:

1.0 for Gradual Load Changes

1.1 for Rapidly Fluctuating Load Changes

1.2 for Temperatures Below Minus 30 F.

1.07 Determine if required amount of steam is available; about one pound of saturated steam per gallon of propane vaporized.

2. PHYSICAL DESCRIPTION

2.01 The Ransome VS Series Vaporizers are all similar in design and construction. They are designed for mounting on a concrete slab, outdoors, in varied weather conditions. The heat exchanger is mounted on a structural channel base designed to take up the minimum of floor space.

2.02 The principle difference between models is the capacity, ranging from 55 to 11,800 gph. The VS Series uses an external

float Switch to signal at high liquid level. Most of the system components are the same or similar between models. Capacity is increased by the vaporizer tube size.

2.03 Figure 2-1 callouts are for the liquid inlet, vapor outlet, steam inlet and condensate outlet. Associated Table 2-1 provides a cross reference for each callout, identifying each as to dimension.

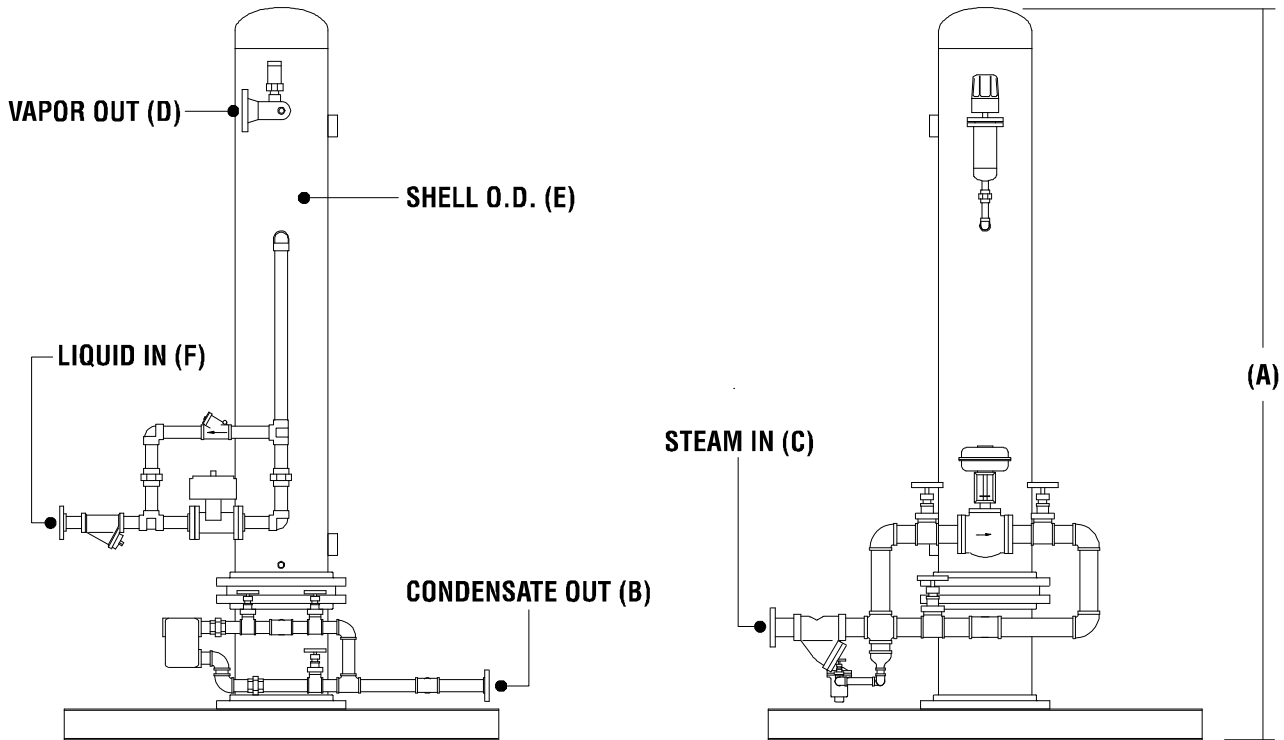


Figure 2-1 - VS Series Physical Specifications

Dimensions						Ransome Model
(A) Height Overall	(B) Condensate Outlet	(C) Steam Inlet	(D) LP Vapor Outlet	(E) Shell O.D.	(F) LP Liquid Inlet	
73-1/2"	1/2" NPT	1/2" NPT	1-1/2" NPT	3-1/2"	1" NPT	VS 55
78"	1/2" NPT	3/4" NPT	1-1/2" NPT	4-1/2"	1" NPT	VS 100
84"	3/4" NPT	1-1/4" NPT	2" NPT	6-5/8"	1" NPT	VS 330
84"	3/4" NPT	1-1/4" NPT	2" NPT	8-5/8"	1" NPT	VS 660
84"	1" NPT	2" NPT	3" 300 # F.	10-3/4"	1" NPT	VS 1000
84"	1-1/4" NPT	2-1/2" NPT	3" 300 # F.	12-3/4"	1-1/4" NPT	VS 1500
84"	1-1/2" NPT	2-1/2" NPT	4" 300 # F.	16"	1-1/2" NPT	VS 2400
92"	2" NPT	3" 150 # F.	4" 300 # F.	20"	2" NPT	VS 3780
92"	3" 150 # F.	4" 150 # F.	4" 300 # F.	24"	3" 300 # F.	VS 5460
116"	3" 150 # F.	6" 150 # F.	6" 300 # F.	30"	3" 300 # F.	VS 7700
126"	4" 150 # F.	8" 150 # F.	8" 300 # F.	36"	3" 300 # F.	VS 11800

Table 2-1 - VS Series Physical Specifications Cross-Reference

2.04 Figure 2-2 illustrates a typical VS Series Vaporizer system and is provided with key number callouts for the liquid level float assy., safety relief valve and the heat exchange shell. Associated

Table 2-2 provides a cross reference for each callout, identifying the respective element as to function and/or description.

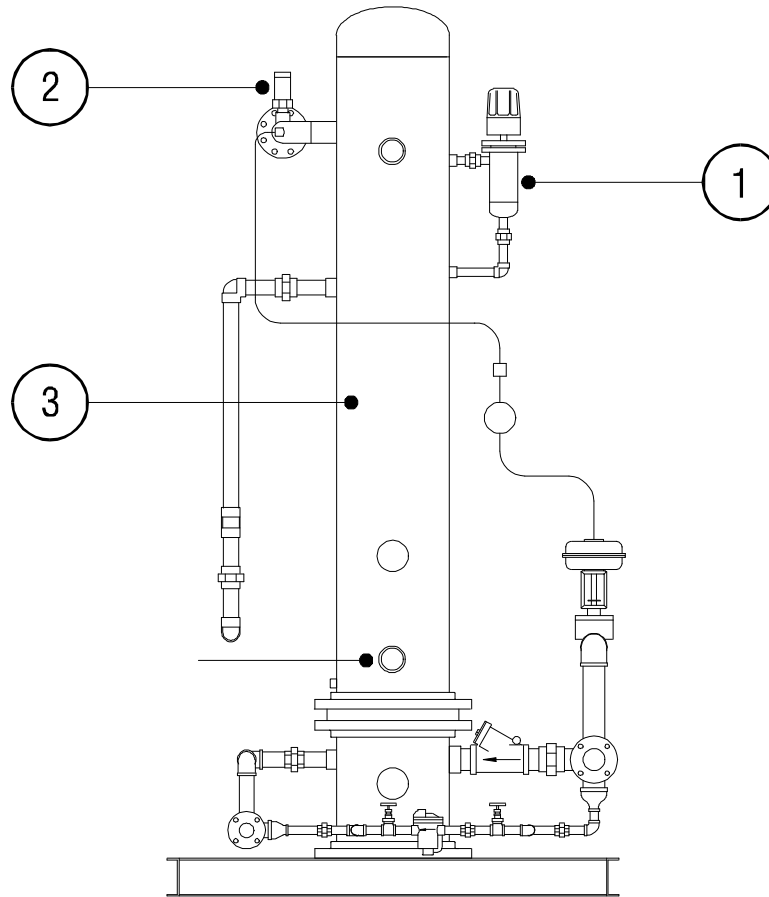


Figure 2-2 - Typical VS Series Vaporizer System

Key	Element	Function
1.	Liquid Level Float Assy.	Monitors liquid level and actuates liquid inlet valve to prevent liquid spillover.
2.	Safety Relief Valve	Vents to atmosphere if vessel pressure exceeds 250 psig.
3.	Heat Exchange Shell	Contains heat exchanger.

Table 2-2 - Typical VS Series Vaporizer System Cross-Reference

2. PHYSICAL DESCRIPTION (continued)

2.05 Figure 2-3 illustrates a typical VS Series Vaporizer system and is provided with key number callouts for all the major system elements and controls.

Associated Table 2-3 provides a cross reference for each callout, identifying the respective element as to function and/or description.

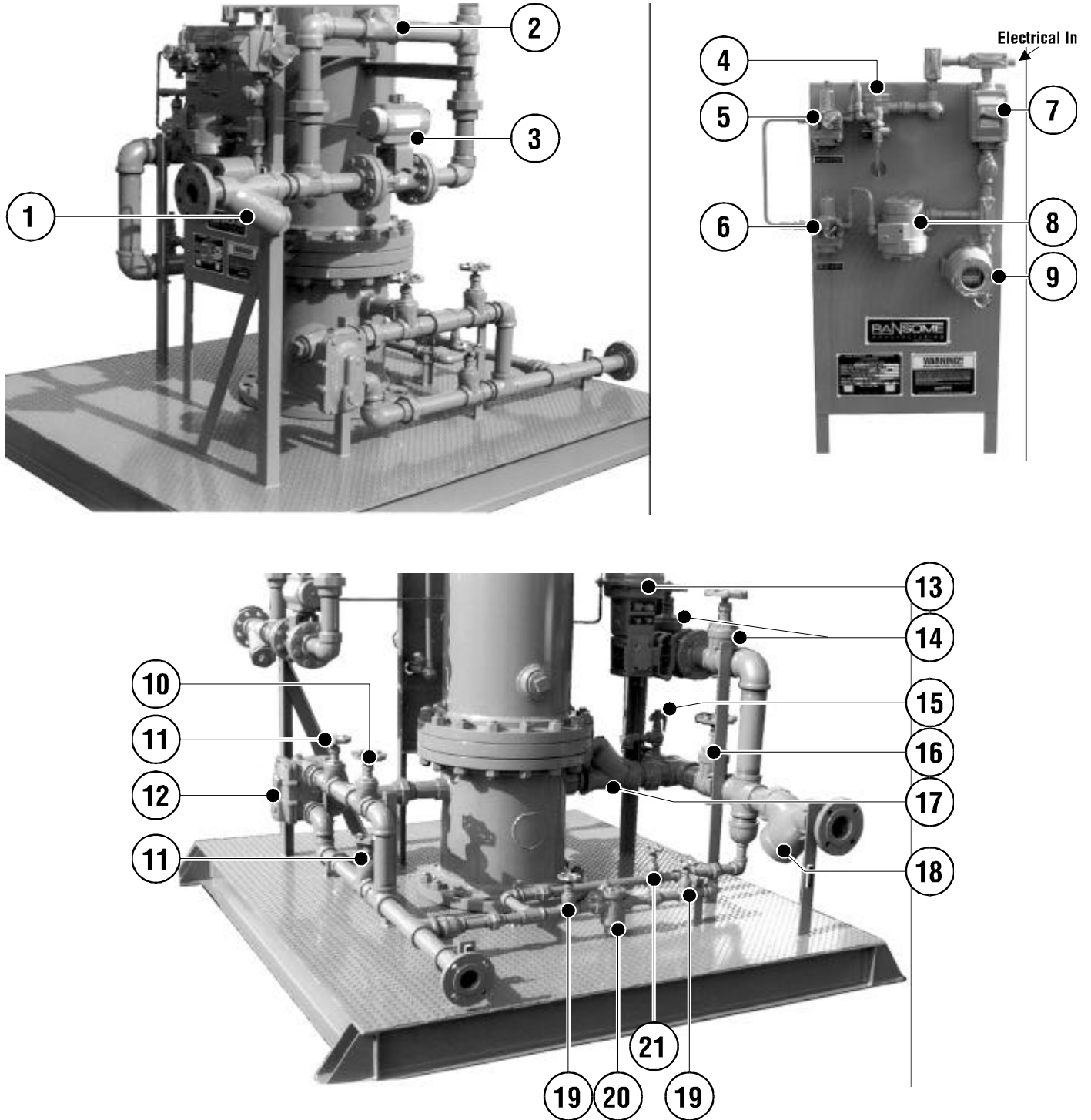


Figure 2-3 - Typical VS Series Vaporizer System

Key	Element	Function
1.	"Y" Type Strainer	Prevents debris from entering vaporizer system at the liquid inlet.
2.	Check Valve	Allows liquid back flow when inlet valve is closed.
3.	Liquid Inlet Valve	Blocks incoming liquid in the event of high liquid level.
4.	Inlet Control Solenoid	Supplies air to actuator on liquid inlet valve to open and close valve.
5.	Air Regulator	Provides regulated air to liquid inlet valve actuator via control solenoid.
6.	Air Regulator	Provides regulated air to pressure transducer to operate steam control valve.
7.	ON/OFF Electrical Switch	Activates incoming electrical power to unit.
8.	Pressure Transducer	Converts 4-20ma signal from temperature controller to 3-15psig pneumatic signal to modulate steam control valve.
9.	Temperature Controller	Monitors vapor outlet temperature and maintains set point by controlling steam control valve.
10.	Condensate By-Pass Valve	Allows manual by-pass of steam trap. (normally closed)
11.	Steam Trap Isolation Valves (qty. 2)	Allows isolation of steam trap for inspection or repair. (normally open)
12.	Steam Trap	Vents accumulated condensate.
13.	Steam Control Valve	Regulates steam flow to maintain desired vapor temperature.
14.	Steam Control Valve Isolation Valves (qty. 2)	Allows isolation of steam control valve for inspection or repair. (normally open)
15.	Steam Trap	Vents accumulated condensate.
16.	Steam By-Pass Valve	Allows manual by-pass of steam control valve. (normally closed)
17.	Swing Check	Prevents introduction of LPG into steam system in event of tube failure.
18.	"Y" Type Strainer	Prevents debris from entering vaporizer at the steam inlet.
19.	Steam Trap Isolation Valves (qty. 2)	Allows isolation of the steam trap for inspection or repair.
20.	Steam Trap	Vents condensate at steam inlet to maintain dry steam to the heat exchanger.
21.	Steam Trap By-Pass Valve	Allows manual by-pass of steam trap. (normally closed)

Table 2-3 - Typical VS Series Vaporizer System Cross-Reference

3. FUNCTIONAL DESCRIPTION

3.01 Figure 3-1 illustrates the general schematic for VS Vaporizers and is functionally equivalent for all VS Series Vaporizers.

3.02 LP-Gas is supplied to the vaporizer inlet from the user's Storage Tank(s) System at a pressure dependent on temperature. (Refer to Table 3-1.)

Controls

3.03 As liquid from the LP-Gas storage tank enters the vaporizer, the heat required for vaporization is supplied by incoming steam. Incoming volume of steam is regulated by a steam control valve. This valve is controlled by a 3-15 psig pneumatic signal from the electronic temperature controller via a pressure transducer. As temperature of LP-Gas vapor decreases due to load demand, the actuator opens the steam control valve, supplying the needed heat for vaporization. As the load decreases, the temperature of the LP-Gas vapor increases and the flow of steam through the steam control valve is reduced.

3.04 The Vapor Outlet Line pressure is monitored by the Safety Relief Valve which opens when the line pressure exceeds 250 psig. The user should provide a Shut-Off Valve on the Vapor Outlet Line.

Limits and Safety Features

3.05 ASME Code Heat exchange pressure vessels. The shell is constructed of rugged carbon steel for high strength and good heat exchange characteristics.

3.06 The removable, field replaceable tube bundle is constructed entirely of stainless steel to ensure long life and corrosion resistance.

3.07 Ransome's unique liquid level float configuration. The liquid level float closes the liquid inlet valve in the event of a high liquid level, preventing spillover.

3.08 Liquid inlet valve with bypass back check valve. The solenoid valve, closes the inlet preventing the liquid from entering the vaporizer if a high liquid level condition exists.

3.09 Bottom steam feed protects against freeze up. The condensate is constantly warmed by incoming hot steam. Even if the vaporizing temperature in the shell falls below freezing, there is no risk of the condensate freezing with the resultant bursting of the tube.

3.10 ASME stamped safety relief valve. Each vaporizer unit is adequately protected in accordance with NFPA 58 and California Title 8 codes.

3.11 All sizes are capable of infinite turndown and will maintain a ready supply of vapor from zero load to full capacity.

3.12 Standard electrical configuration Class I, Division II.

3.13 Vertical design provides maximum capacity in compact, rectangular unit.

Table 3-1 - Storage Tank Pressure vs. Ambient Temperature Chart

Temperature (F)	Approximate Pressure PSIG	
	Propane	Butane
100	220.0	46.0
100	190.0	37.0
90	165.0	29.0
80	140.0	22.0
70	120.0	16.5
60	102.0	11.5
50	86.0	6.9
40	72.0	3.0
30	58.0	
20	47.0	
10	37.0	
0	28.0	
-10	20.0	
-20	13.5	
-30	8.0	
-40	3.6	

VS Series Steam

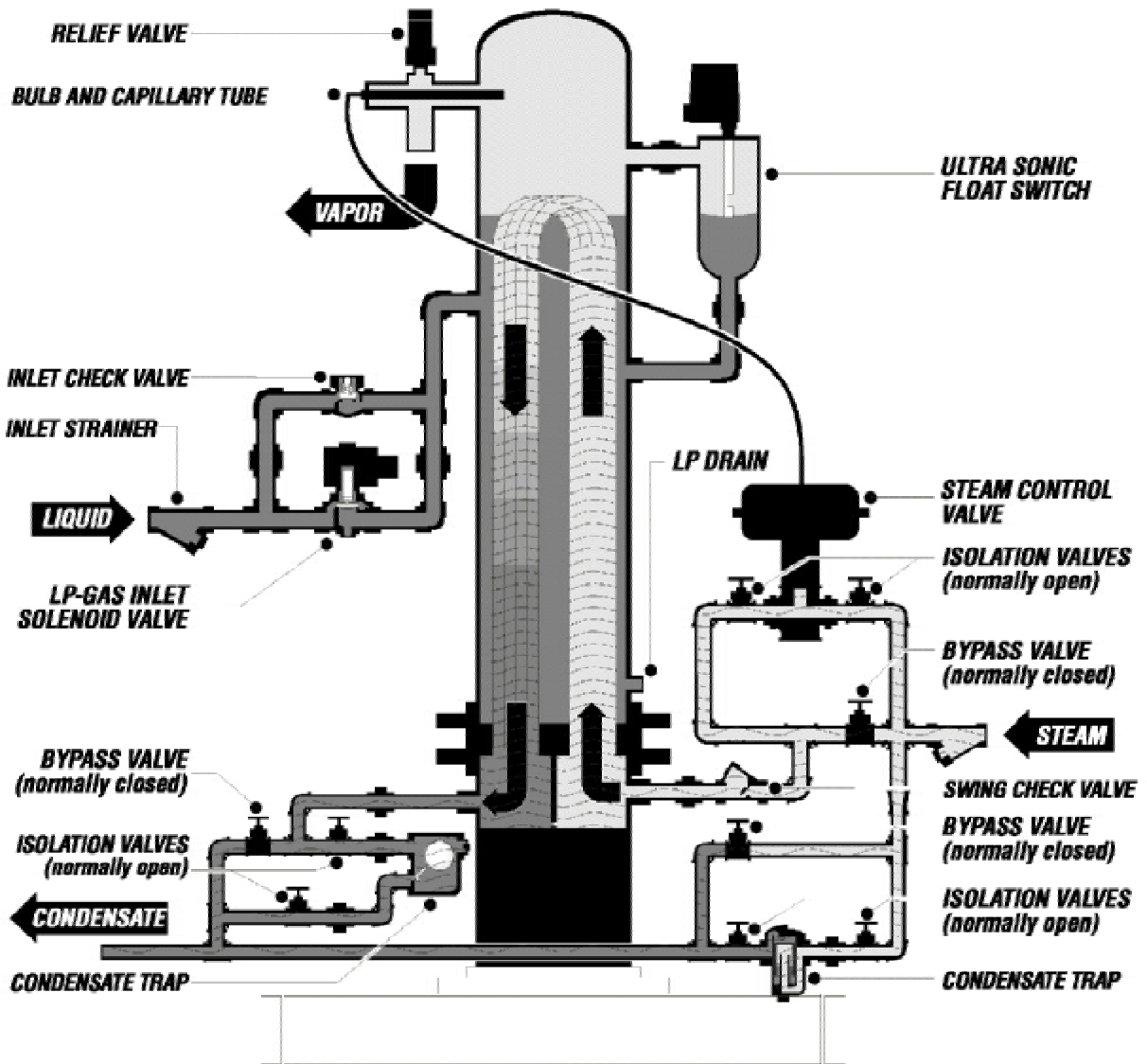
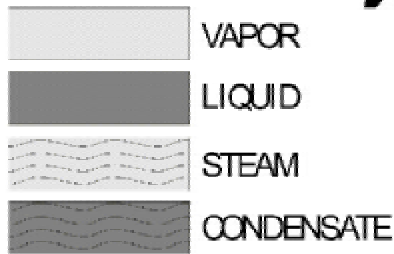


Figure 3-1 - General Schematic for VS Series Vaporizers

4. SPECIFICATION

4.01 Table 4-1 will provide the user with tabulated performance specifications for VS Series Vaporizers. Figure 4-1 illustrates the physical specifications of each VS Vaporizer. The user will find this useful when planning new installations.

Selection Chart

Propane Capacity			Approx. Steam Required LB/HR	Standard Steam Pressure PSI	Steam Pressure PSIG	Approximate Shipping Weight		Ransome Model
Millions of BTU/HR	CF/HR	GAL/HR				LB	KG	
5.03	2,001	55	55	15	10	890	404.5	VS 55
9.15	3,639	100	100	15	10	1,000	454.5	VS 100
30.2	12,009	330	330	15	10	1,125	511.4	VS 330
60.4	24,017	660	660	15	10	1,250	568.2	VS 660
91.5	36,390	1,000	1,000	15	10	1,500	681.8	VS 1000
137.3	54,585	1,500	1,500	15	10	1,805	820.5	VS 1500
219.6	87,336	2,400	2,400	25	15	2,360	1072.7	VS 2400
345.4	137,554	3,780	3,780	25	25	2,915	1325	VS 3780
499.6	198,689	5,460	5,460	25	25	3,470	1577.3	VS 5460
704.6	280,203	7,700	7,700	50	25	4,025	1829.5	VS 7700
1079.7	429,402	11,800	11,800	50	50	4,580	2081.8	VS 11800

Table 4-1 - VS Series Functional Description

5. OPERATION

5.01 The intent of Part 5 is to give the LP-Gas user general information on installation and turn-on procedure for the Ransome VS Series Vaporizers. Each user's application will differ slightly, but it is hoped the user will gain from these generalized instructions.

5.02 After consulting with the Ransome Sales and Service Engineer or Distributor and reviewing Figure 5-1, the user will make a plan for the LP-Gas storage and Vaporizer location.

5.03 When the Ransome equipment arrives, examine the shipping container for obvious shipping damage. All Claims for shipping damage should be made to the shipper, not to Ransome Manufacturing or the Distributor. Obvious workmanship problems or incomplete shipments should be immediately referred to Ransome Manufacturing (or Distributor) following the warranty service procedures described in Part 6.

<p>CAUTION Only a trained, experienced vaporizer serviceman should inspect, test, start up or service Ransome equipment.</p>

Start Up and Operating Procedure

5.04 All VS Series Vaporizers are factory tested using commercial Propane. Ransome Vaporizers are thoroughly tested at the factory and assured to be free from leaks. However, vibration and jarring during subsequent handling, shipment and installation can cause leaks.

The factory recommends:

(a) Use a good quality liquid leak detecting solution, for leak checking. This is available for subfreezing temperatures as needed. A thorough leak test must be conducted after installation and any leaks must be repaired prior to operation of the Vaporizer.

This start-up procedure assumes a complete, proper installation of the entire gas system including storage tank(s), valve, piping, bypass valves, etc., and including any required electrical power. Supply of clean, saturated steam at constant pressure, free of condensate. Complete installation of liquid and vapor manifolds, plus steam supply and condensate manifolds, etc. with piping arranged to suit actual installation.

All installations must be in accordance with NFPA No. 58 Standards, state, provincial or local regulations, codes and laws. The procedure assumes use of clean, contamination-free LP-Gas. Close ALL VALVES in the system prior to startup. Then proceed as follows:

CAUTION

Do not use matches or other flames to conduct leak tests.

Step 1. Close all valves in system prior to start up. Turn on electrical power and instrument air to vaporizer. Then proceed as follows:

Step 2. Prime system by slowly opening valves in liquid line one at a time, between storage tanks and vaporizer inlet, starting at tank.

Step 3. Activate "OFF/ON" switch to the "ON" position.

Step 4. Slowly open manual shut off valves upstream of the LPG inlet control valve. LPG will flow into vaporizer until pressure in vaporizer is approximately equal to tank pressure.

Step 5. Shut off valve provided on vapor outlet may now be slowly opened to pressurize downstream piping. As soon as pressurizing is completed, system may be placed into operation.

Step 6. Open shutoff valves upstream and downstream of condensate trap. Make sure condensate bypass valve is closed, and that condensate drain is clear.

Step 7. Slowly open shutoff valve in steam system upstream of steam control valve. Slowly open shutoff valve downstream of steam control valve. Steam will flow in vaporizer, and trapped air and condensate will flow out of condensate outlet line until vaporizer is fully charged with steam or until steam control valve closes.

Step 8. The vaporizer is now in operation and will modulate steam flow as required to maintain pressure.

Start Up and Operating Procedure (continued)

To shut down system, proceed as follows:

- Step 1.** Move ON/OFF switch to "OFF" position.
- Step 2.** Close vapor shut off valve at vapor outlet of vaporizer.
- Step 3.** Close shut-off valve on steam line upstream of steam control valve.
- Step 4.** Allow vaporizer to cool for about 10 minutes.
- Step 5.** Close shut-off valves upstream and downstream of steam trap.
- Step 6.** Close LPG shut off valve upstream of liquid inlet control valve.

NOTE

Bypass valves on steam line and condensate line may be used to assist in priming system during startup. However, be absolutely sure that they are closed at any time during normal operation.

6. MAINTENANCE

6.01 Maintenance procedures in Part 6 should be performed in accordance with local regulations and the user's maintenance plan.

Safety Precautions

6.02 The VS Series Vaporizers contain flammable gas under pressure while in normal operation. Any gas leaks within the Vaporizer System or in any part of the installation are potentially dangerous and must be eliminated immediately or a fire may occur. Any odor, gas or dark oily stains on joints or fittings indicate a possible gas leak. If such a leak does exist, pilots or other source of ignition must be immediately extinguished. Electrical power should be disconnected at a location remote from the suspected leak.

6.03 Thorough inspections for leaks should be conducted frequently. Any leaks should be repaired immediately. Since this equipment, as well as any other components in the installation uses threaded joints, gaskets and "O" rings and are subjected to vibration and thermal stresses, the possibility of leaks developing over a period of time is always present.

Emergency Instructions

6.04 If a large leak is discovered, do not attempt to affect repair.

- (a) Evacuate all personnel from the area.
- (b) Call the Fire Department.
- (c) If it can be done with safety, shut off the Main Gas Supply Valve(s) at the LP-Gas Storage Tank(s)

The leak will stop when all gas downstream from the Gas Supply Valve(s) has been exhausted.

- (d) Make certain all gas has safely dispersed before attempting repairs.

Routine Inspection

6.05 LP-GAS INLET VALVE(S) to Vaporizer should be inspected at least ONCE A YEAR and more often if the equipment is in heavy use and also at any time an abnormality is detected. Any parts that are worn or show deterioration should be repaired.

6.06 OPERATING CONTROLS should be checked for correct performance at frequent intervals. Repair or replacement should be accomplished at the first indication of sticking, erratic performance or any abnormal condition.

6.07 SAFETY RELIEF VALVES should be replaced at any time possible damage is suspected. Vent piping connected to Safety Relief Valves must be kept open, free from condensation, ice or other foreign material that might restrict release of excessive pressure in an emergency.

6.08 PRESSURE REGULATOR VENTS must be kept clear or erratic operation, stability or loss of control may result.

6.09 VAPORIZER TUBES should be inspected for corrosion. If signs of corrosion or other damage are found, the Vaporizer Tube should be reinspected, tested and approved by a Certified A.S.M.E. Code Inspector. Any rejected Vaporizer Tube must be replaced.

6.10 EXTERIOR PAINT - Keep all external surfaces well painted to prevent deterioration and rust.

Purging Gas From The System

6.11 If service requires removal of gas from the system, do not merely vent gas to the atmosphere. This could result in fire with the possibility of injury or damage.

- (a) A Flare Burner should be installed at a safe distance from any gas leakage.
- (b) Dispose of gas by burning.
- (c) Make sure all gas is actually removed from the equipment before any connections are loosened.

6.12 If LP-Gas liquid is present in the Ransome equipment, it will chill as the pressure is relieved, slowing the rate at which it will boil and discharge as vapor through the Flare Burner. BE CERTAIN all liquid is actually vaporized before loosening any connections. The presence of frost on the outside of a component part is an indication of the presence of LP-Gas liquid and no connections should be loosened until it melts. The use of a heat source, such as a forced air heater, may expedite this process in cold weather.

6.13 All servicing must be done in a safe, thorough, step-by-step manner. If in doubt about what to do, the serviceman should:

- (a) Consult the Operation Manual.
- (b) Contact the gas system installer.
- (c) Contact Ransome Manufacturing, following the instructions under Warranty Service in this manual.

Gas System Trouble Shooting

6.14 Before beginning any trouble shooting, make certain the Ransome Vaporizer has been properly installed. All system components including storage tanks, valves, piping, pumps and bypass valves must conform to NFPA No. 58 Standards and all state, provincial or local regulations, codes and laws.

Warranty Service

6.15 Faulty system components should be returned to Ransome Manufacturing following the conditions set out in the Warranty. Defective material or technical questions should be referred to:

When the material is returned to Ransome, the following information will expedite repair or replacement and return if it is included:

- (a) Complete Material Return Authorization (MRA) form. These can be obtained from Ransome Customer Service upon request.
- (b) The name and area code - telephone number of the individual most familiar with the failure.
- (c) A brief statement of the problem with the unit.
- (d) Make(s) of other gas equipment in the user's system.
- (e) The approximate date and Purchase Order Number for the Ransome equipment (if known).
- (f) The Model and Serial Number of the Ransome equipment.

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