

**VS SERIES
NH3 STEAM VAPORIZERS**

OPERATION MANUAL

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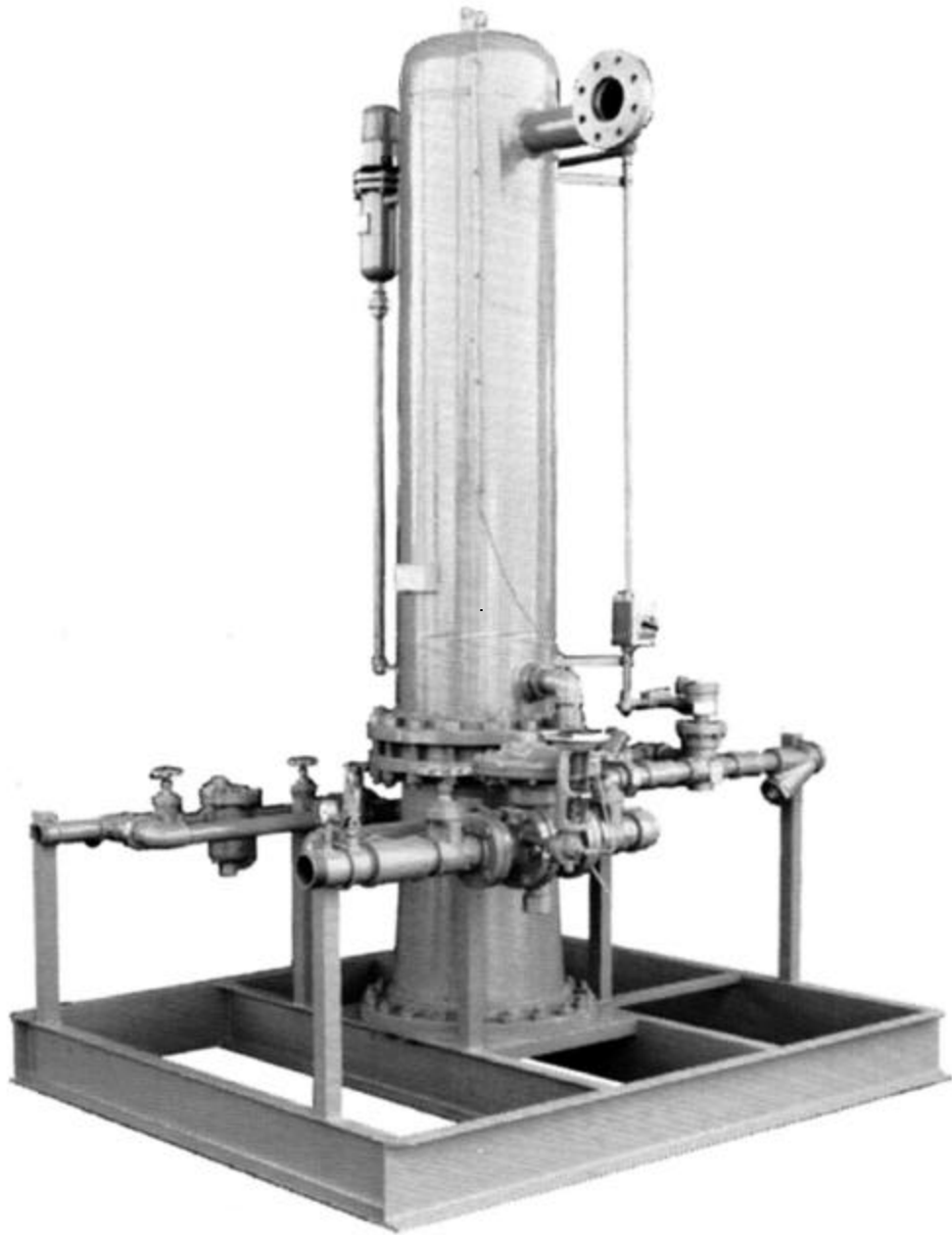


Figure 1-1 - VS Series Vaporizer

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 NH₃ Vaporizers.

1.02 Ransome VS Series Vaporizers provide an economical, dependable source of NH₃ gas vapor for a wide range of applications up to 18,000 pounds 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 NH₃ 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 NH₃ is stored as a liquid and used as a vapor. To change it to vapor, heat must be added at the following amount:

Latent Heat of Vaporization (1 atm.) NH₃ : 589.3 BTU/LB
Specific Volume of NH₃ at 60 F and 1 atm. : 22.33 CF/LB.

1.04 Ransome VS Series Steam Vaporizers utilize steam to provide the heat required for vaporization of the NH₃ liquid. Operating on temperature control, steam flow is controlled into the heat exchanger to vaporize NH₃ according to load.

1.05 Features of the VS Series Vaporizers include the following:

- (a) Reliable float switch signals at low liquid level.
- (b) 265 PSIG Design Working Pressure in NH₃ 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 85 Lbs./hr to 18,000 Lbs./hr NH₃ 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 NH₃ 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 LB/HR. Be **SURE** this is correct. If in doubt, contact the manufacturer's of the equipment.

(a) Determine the total amount of NH₃ vaporized in pounds per hour.

(b) Select a vaporizer from table 4-1 with at least as much capacity. as determined in 1.06.

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

Associated Table 2-1 provides a cross reference for each callout, identifying the respective element as to function and/or description.

4. SPECIFICATION

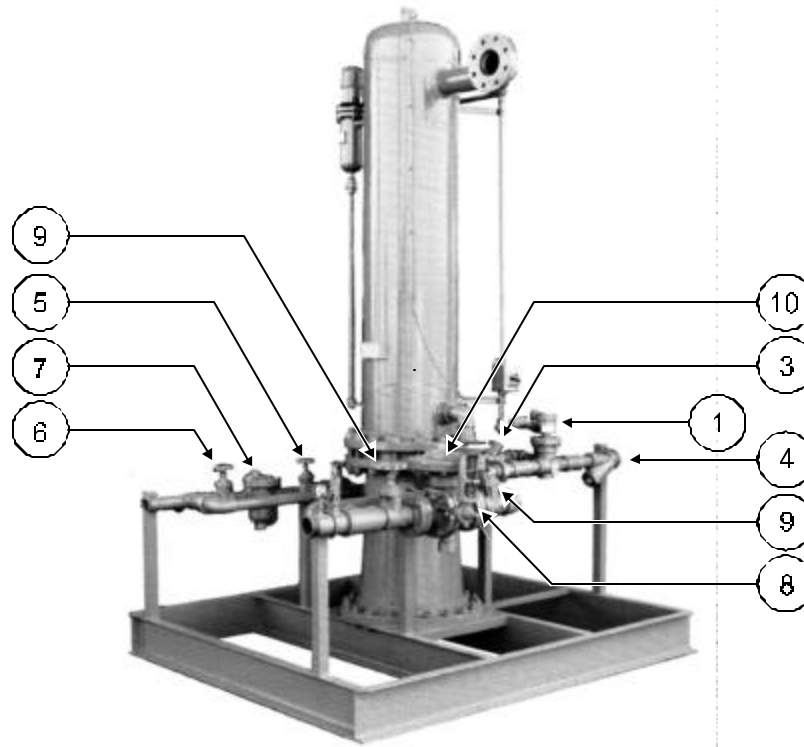


Figure 2-1 - Typical VS Series Vaporizer System

| Key | Element | Function |
|-----|---|---|
| 1. | Liquid Inlet Valve | Blocks incoming liquid in the event of high liquid level. |
| 2. | N/A | N/A |
| 3. | Check Valve | Allows liquid back flow when inlet valve is closed. |
| 4. | "Y" Type Strainer | Prevents debris from entering vaporizer system at the liquid inlet. |
| 5. | Condensate By-Pass Valve | Allows manual by-pass of steam trap. (normally closed) |
| 6. | Steam Trap Isolation Valves (qty. 2) | Allows isolation of steam trap for inspection or repair. (normally open) |
| 7. | Steam Trap | Vents accumulated condensate. |
| 8. | Steam Control Valve | Regulates steam flow to maintain desired vapor temperature. |
| 9. | Steam Control Valve Isolation Valves (qty. 2) | Allows isolation of steam control valve for inspection or repair. (normally open) |
| 10. | Steam By-Pass Valve | Allows manual by-pass of steam control valve. (normally closed) |

Table 2-1 - 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 NH₃ 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 NH₃ storage tank enters the vaporizer, the heat required for vaporization is supplied by incoming steam. Incoming volume of steam is regulated by a thermally actuated steam control valve. This valve is controlled by a sensing bulb filled with a volatile fluid, which is connected to the valve actuator by a capillary tube. As temperature of NH₃ 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 NH₃ 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 265 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 Inlet solenoid 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 ANSI K61.1 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 (NH ₃) |
|-----------------|--|
| 110 | 232 |
| 100 | 197 |
| 90 | 166 |
| 80 | 138.3 |
| 70 | 114 |
| 60 | 92.9 |
| 50 | 74.5 |
| 40 | 58.6 |
| 30 | 45 |
| 20 | 33.5 |
| 10 | 23.8 |
| 0 | 15.7 |
| -10 | 9 |
| -20 | |

VS Series Steam

-  VAPOR
-  LIQUID
-  STEAM
-  CONDENSATE

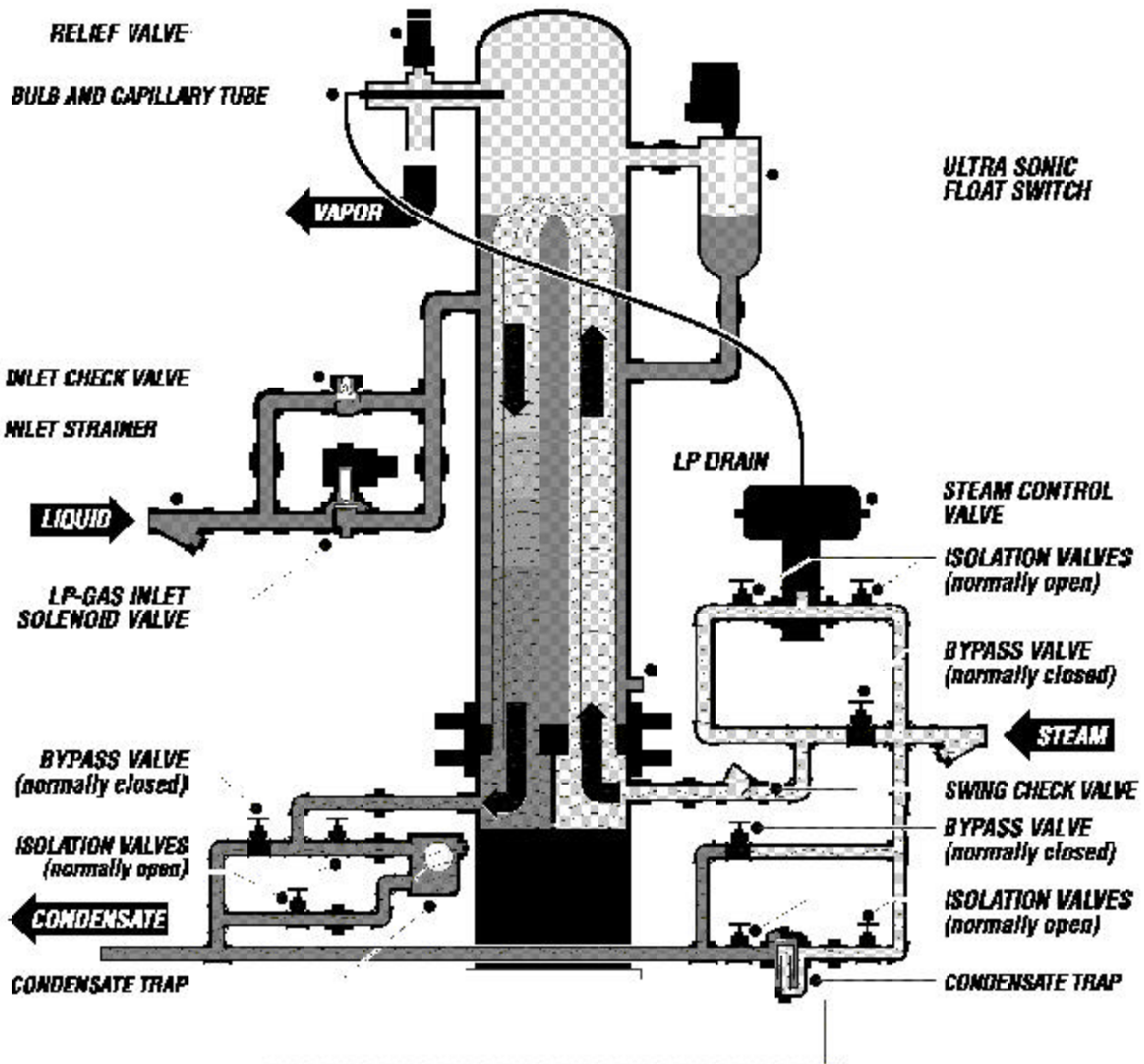


Figure 3-1 - General Schematic for VS Series Vaporizers

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

| LB/HR | CF/HR | Approximate Shipping Weight | | Ransome Model |
|-------|-------|-----------------------------|--------|----------------|
| | | LB. | KG. | |
| 86 | 32 | 890 | 404.5 | VS 55 |
| 158 | 58 | 1000 | 454.5 | VS 100 |
| 520 | 193 | 1125 | 511.4 | VS 330 |
| 1040 | 387 | 1250 | 568.2 | VS 660 |
| 1576 | 586 | 1500 | 681.8 | VS 1000 |
| 2364 | 880 | 1805 | 820.5 | VS 1500 |
| 3782 | 1406 | 2360 | 1072.7 | VS 2400 |

Table 4-1 VS Series Functional Description

5. OPERATION

5.01 The intent of Part 5 is to give the 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, the user will make a plan for the NH3 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.

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

Start Up and Operating Procedure

5.04 All VS Series Vaporizers are factory tested. 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 K61.1 Standards, state, provincial or local regulations, codes and laws. The procedure assumes use of clean, contamination-free NH₃. 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. Flip "OFF/ON" switch to the "ON" position.

Step 4. Slowly open manual shut off valves upstream of the NH₃ inlet control valve. NH₃ will flow into vaporizer until pressure in vaporizer is approximately equal to tank pressure.

Step 5. Open shutoff valves upstream and downstream of condensate trap. Make sure condensate bypass valve is closed, and that condensate drain is clear.

Step 6. 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 7. 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.

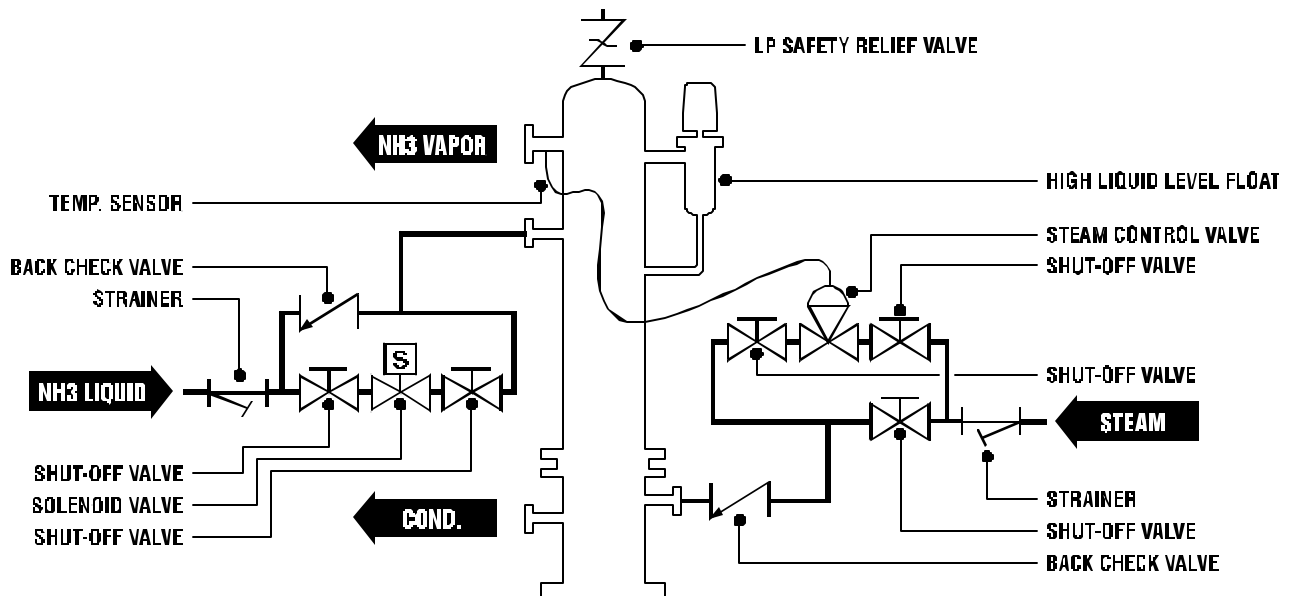
Step 8. The vaporizer is now in operation and will modulate steam flow as required to maintain pressure.

To shut down system, proceed as follows:

- Step 1.** Flip 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 NH₃ 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 Make sure the system components contain no parts or materials containing brass, copper or bronze, etc.

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

Safety Precautions

6.03 A supply of NH₃ liquid must be available at all times. The liquid supply valve and excess flow valve in the storage tank must remain open.

6.04 The RE Series Vaporizers contain 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 accident or injury may occur. Any odor, gas or dark oily stains on joints or fitting indicate a possible gas leak.

6.05 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

6.06 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 NH₃ 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

6.07 NH₃ INLET VALVE(S) to Vaporizer should be disassembled and 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.

6.08 OPERATING SWITCHES AND 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.

6.09 SAFETY RELIEF VALVES should be replaced at 5 year intervals or 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.

6.10 VAPORIZER TUBES should be inspected for corrosion at regular intervals. 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.

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

Purging Gas From The System

6.12 If service requires removal of gas from the system, DO NOT merely vent gas to atmosphere. This could result in the possibility of injury or damage. Follow accepted practices using NH₃ drain valve to remove NH₃ from the system. Make sure all vapor is actually removed from the equipment before any connections are loosened.

6.13 If NH₃ 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. **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 NH₃ 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.

6.14 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

6.15 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 all applicable state, provincial or local regulations, codes and laws.

Warranty Service

6.16 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:

RANSOME MANUFACTURING
3495 South Maple Avenue
Fresno, California 93725
U.S.A.

Phone (559) 485-0979 / Fax (559) 485-8869

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.