

**RE SERIES  
NH3 TANK HEATER**

**OPERATION MANUAL**

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Figure 1-1 - RE Series Tank Heater

## 1. GENERAL

**1.01** This manual provides a physical and functional description and operating theory necessary for effective use of the Ransome RE Series Tank Heater.

**1.02** Ransome RE Series Tank Heaters provide an economical and dependable source of ammonia (NH<sub>3</sub>) gas vapor for a wide range of applications up to 625 pounds per hour. All units require electrical connections, which must only be connected by experienced and qualified personnel. Each unit is individually factory tested on ammonia and shipped ready for use. The NH<sub>3</sub> inlet and vapor outlet are connected to the user's system, heaters are activated, and the Ransome RE series vaporizer goes to work quietly, safely, and automatically.

**1.03** NH<sub>3</sub> 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.) NH<sub>3</sub> : 589.3 BTU/LB  
Specific Volume of NH<sub>3</sub> at 60 F and 1 atm. : 22.33 CF/LB.

**1.04** Ransome RE Series Tank Heaters develop the heat required for vaporization through the use of an electrical immersion heater which functions as needed to create enough vapor to replace that being used.

**1.05** Features of the RE Series Tank Heaters include the following:

(a) Precision high temperature switch, factory set and sealed against tampering, incorporates precious metal contacts for extended service life.

(b) ASME code pressure vessel. Optional fully insulated shell to prevent unwanted heat loss.

(c) Models are available in a complete range of capacities, vaporizing 20 to 625 pounds per hour of NH<sub>3</sub> thus allowing purchase of the precise capacity required.

(d) All sizes are capable of automatic-infinite turn-down and will maintain ready supply of vapor from no-load to full load capacity. At no-load, only enough heat will be generated to maintain pressure in storage tank.

(e) Standard units are furnished with a weather-tight (NEMA 4) control panel. (NEMA 7 available)

(f) Standard electrical configuration is 480 volt, 3 PH, 60 Hz. Electrical wiring may be arranged for most voltages. (see Table 4-2)

## How to Select an Electric Vaporizer

**1.06** How To Select an Electrically Heated Vaporizer.

(a) Determine the total amount of NH<sub>3</sub> vaporized in pounds per hour.

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

## How They Work

**1.07** The RE Series Tank Heater uses pressure actuated ON/OFF control to maintain a desired pressure in the NH<sub>3</sub> storage vessel. An operating pressure switch cycles an immersion heater full ON or OFF. Pressure sensitivity (hysteresis) is designed into the control action between ON and OFF. This sensitivity is designed to prevent the switching of the immersion heater ON and OFF within a pressure span that is too narrow. Pressure is always maintained "about the set point." This is dictated by the switching sensitivity of the ON/OFF control. The control action further dictates that there will be a certain amount of pressure overshoot and undershoot. The degree of overshoot and undershoot will be dependent on the characteristics of the entire thermal system.

## 2. PHYSICAL DESCRIPTION

**2.01** The Ransome RE Series Tank Heaters are all similar in design and construction. Designed for mounting on a concrete slab, outdoors, in varied weather conditions.

**2.02** The principal difference between each model is capacity, ranging from 20 to 625 pounds per hour. Most of the system components are similar between models. Capacity is increased by the vaporizer tube size and heating capacity of immersion heater.

### Features and Benefits

**2.03** ASME Code Pressure Vessel. Each vessel is constructed of high strength carbon steel as per Section VII, Div. I of the ASME Code.

**2.04** Precision operating and safety limit switches. All parts are steel or stainless steel. All wetted parts are of stainless steel construction.

**2.05** Top quality flanged immersion heater. Steel elements are standard. Stainless steel available. Heaters are sized for the exact heat required.

**2.06** ASME stamped relief valve. ASME pressure vessel is adequately protected by an external safety relief valve.

**2.07** All controls (contactors, relays, etc.) are located inside a NEMA 4 control panel for dependable performance even in extreme weather conditions.

**2.08** All sizes are capable of infinite turndown and will maintain heat supply and resultant pressure in NH3 storage vessel from zero load to full capacity. At no load, only enough heat will be generated to maintain set point pressure.

**2.09** Standard electrical configuration Class I, Div. II. (Class I, Div. I also available)

## 3. HEATING SYSTEM

**3.01** The heating process is achieved by using an electrical immersion heater. The Operating NH3 Pressure Switch monitors the vapor pressure and maintains it at approximately 100 psig by cycling on the electric immersion heater when the pressure falls below 100 psig.

Temperature F	Approximate Press. psig NH3
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	

**Table 3-1 - NH3 Vapor Pressure**

#### 4. SPECIFICATIONS

##### Performance

Rated capacity in Pounds per hour @ 60 degrees F  
100 psig.

LB/HR	CF/HR	Model
40	904	RE25
80	1808	RE50
128	2893	RE80
256	5786	RE160
384	8678	RE240
512	11571	RE320
640	14464	RE400

**Table 4-1**

Operating pressure switch setting: 100 psig

High pressure switch setting: 240 psig

High temperature switch setting: 140 F

Relief valve pressure setting: 265 psig

ASME pressure vessel design pressure: 265 psig

Design temperature: 650 F

##### Connections

<b>Inlet:</b>	RE 25 - RE240	2" FNPT
	RE320 - RE400	3" FNPT
<b>Outlet:</b>	RE 25 - RE 80	2" FNPT
	RE160 - RE400	3" MNPT

##### Construction

**Vaporizer Vessel Shell:** SA106 Grade B Carbon Steel.

**Connections:** SA105 Carbon Steel.

#### IMPORTANT INSTALLATION NOTE:

Use the shortest possible HORIZONTAL piping at the vaporizer's outlet. (Not more than 1 foot from the vaporizer cabinet). After this short horizontal run, the piping must be vertical to above storage tank's 86.5% fill line. From there it can piped horizontally. Too long of horizontal piping in the liquid region may cause the tank heater to overheat.

**Table 4-2 - Electrical and Physical Specifications**

KW	Amps/Line 480V - 3 Ph 50/60 Hz	Conduit size Heater Circuit	Number of Lines	Shell O.D.	NH3 Inlet	NH3 Outlet	Approx. Overall Length	Approx. Overall Height	Ransome Model
8	10A	3/4"	3	4-1/2"	2" NPT	2" NPT	56"	24"	RE 25
16	19A	3/4"	3	8-5/8"	2" NPT	2" NPT	36"	30"	RE 50
25	31A	3/4"	3	8-5/8"	2" NPT	2" NPT	45"	30"	RE 80
50	30A	1"	6	10-3/4"	2" NPT	3" 300 CL	64"	32"	RE 160
75	45A	1"	6	10-3/4"	2" NPT	3" 300 CL	82"	32"	RE 240
100	40A	1-1/4"	9	12-3/4"	3" 300 CL	3" 300 CL	74"	36"	RE 320
125	50A	1-1/4"	9	12-3/4"	3" 300 CL	3" 300 CL	92"	36"	RE 400

**NOTE:** All control circuits 120V AC, 50/60 Hz, 10A

## 5. OPERATION

**5.01** The intent of Part 5 is to give the NH<sub>3</sub> user general information on installation and start-up procedures for the Ransome RE Series Tank Heaters. Each user's application will differ slightly, but it is hoped the user will gain from these generalized instructions.

**5.02** After consultation with the Ransome Sales and Service Engineer or distributor and reviewing Figure 5-1, the user will make a plan for the NH<sub>3</sub> storage and vaporizer location.

**5.03** When the Ransome Equipment arrives, examine the shipping container for obvious damage. Carefully unpack the unit and examine the exterior for any obvious shipping damage. All claims of shipping damage should be made to the shipping company, not to Ransome or your distributor. Obvious workmanship problems or incomplete shipments should be immediately referred to Ransome (or distributor) following the warranty service procedures described in Part 6.

### Start Up and Operating Procedure

**5.04** The RE Series Tank Heater is installed as close to and as far below the NH<sub>3</sub> storage tank as practical. This is very important since the tank heater is dependent on gravity for the flow of NH<sub>3</sub> liquid into it. The shortest possible run of adequately sized supply piping minimizes pressure drop and maximizes the value of liquid head pressure to the tank heater. As liquid flows into the tank heater, it is immediately vaporized by the warm immersion heater. The resultant warm vapor is naturally re-circulated back into the NH<sub>3</sub> storage vessel. This addition of heat raises the temperature and consequently raises the pressure in the system. As system pressure varies due to rise and fall of ambient temperature or vapor withdrawal from tank, the tank heater will circulate sufficient NH<sub>3</sub> to maintain desired set point pressure as long as heat losses do not exceed capacity of tank heater input.

**5.05** All RE Series Tank Heaters are factory tested using commercial NH<sub>3</sub>. Ransome vaporizers are thoroughly tested at the factory and are 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 leak detecting solution such as Sherlock, for leak checking. This is available for subfreezing temperatures as needed. A thorough leak test using this solution or

equivalent leak detector must be conducted after installation and any leaks must be repaired prior to operation of the vaporizer.

**5.06** This startup procedure assumes a complete and proper installation of the entire gas system including storage tank(s), valves, piping, fittings, etc. and including any required electrical power. All installations must be in accordance with State, provincial or local regulations, codes, and laws. The procedure assumes use of clean, contamination free NH<sub>3</sub>. Close all valves in the system prior to start-up. Then, proceed as follow:

**Step 1** - Allow a qualified electrician to complete all electrical connections between the control panel of the RE Tank Heater and incoming power. Be sure to conform to all applicable installation codes.

**Step 2** - Prime the system by slowly opening valves in the NH<sub>3</sub> liquid line one at a time between the storage tank and the RE Tank Heater inlet valve, starting at the storage tank.

**Step 3** - Slowly open RE Tank Heater inlet valve, admitting NH<sub>3</sub> liquid to the vaporizer. Be sure that all valves downstream of the RE tank Heater, are closed.

**Step 4** - Open all the valves on the outlet of the Tank Heater, starting at the vaporizer toward the tank.

**Step 5** - With service power connected, push the tank heater "START" button. If the vapor pressure within the tank/heater system is below 100 psig (i.e. ambient temperature below 65 degrees F), the immersion heater will be energized to operate until the system's Operating Pressure Switch interrupts the heater control circuit.

**Step 6** - When the main heaters automatically shut off, the NH<sub>3</sub> vapor in the tank is at the proper pressure for continuous operation. The system is now ready to be put on line.

**Step 7** - For tank heater shutdown, push the "STOP" button on the control panel .

# Tank Heater Series

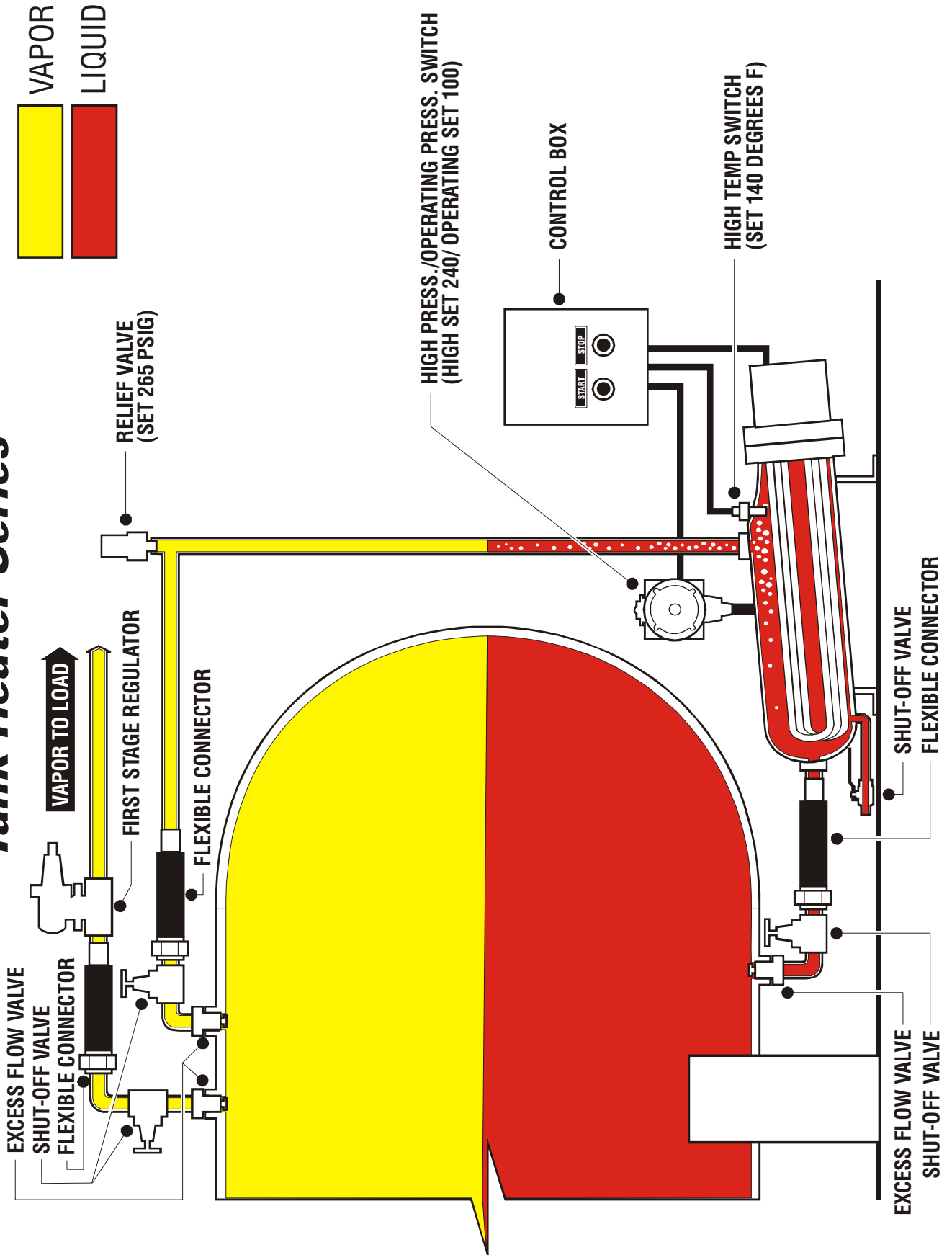


Figure 5-1 - Typical RE Series Tank Heater Installation

## 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 state and local regulations.

### Safety Precautions

**6.03** A supply of NH<sub>3</sub> 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 Tank Heaters contain gas under pressure while in normal operation. Any gas leaks within the heater/tank 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 fittings 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 use threaded joints, gaskets and “O” rings, they 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 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 NH<sub>3</sub> Storage Tank. The leak will stop when all gas downstream of the Gas Supply Valve(s) has been exhausted.
- (d) Make certain all gas has dispersed before attempting repairs.

### Routine Inspection

**6.07** 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.

**6.08** SAFETY RELIEF VALVES should be replaced at any time lack of safety or 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 the release of excessive pressure in an emergency.

**6.09** Electrical connections must be tight and corrosion free. In order for all controls and heaters to work properly, check all electrical fittings and conduit for weather related cracks or leaks. Repair as necessary.

### Purging Gas From The System

**6.10** 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 NH<sub>3</sub> drain valve to remove NH<sub>3</sub> from the system. Make sure all vapor is actually removed from the equipment before any connections are loosened.

**6.11** If NH<sub>3</sub> 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 NH<sub>3</sub> liquid and NO connections should be loosened until frost is no longer present.

**6.12** 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 Operations Manual.
- (b) Contact the Gas System Installer.
- (c) Contact Ransome, following the instructions under Warranty Service in this manual.

### Gas System Trouble Shooting

**6.13** The trouble-shooting procedures described in Table 6-1 are intended to help a serviceman isolate the cause or trouble encountered during routine operation to a replaceable part listed in Table 6-2 and Table 6-3. Only the kinds of trouble most likely to be encountered in service are listed; the list is by no means comprehensive. The Probable Cause column of Table 6-1 lists in order of most likely occurrence. To make best use of these trouble-shooting procedures, the serviceman should be thoroughly familiar in the Physical and Functional Description of the Ransome system, described in Parts 2 and 3 of this manual.



## **Gas System Trouble Shooting** (continued)

**6.14** Before beginning any trouble-shooting, make certain the Ransome vaporizer has been properly installed. All system components including storage tank(s), valves, piping, pumps and fittings must conform to all state, provincial or local regulations, codes and laws.

### **Warranty Service**

**6.15** Faulty system components should be returned to Ransome, 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.

**Table 6-1 - Trouble Shooting**

<b>Symptom</b>	<b>Probable Cause</b>	<b>Remedy</b>
Heaters will not turn off	<ol style="list-style-type: none"> <li>1. System at capacity.</li> <li>2. Faulty contactor.</li> <li>3. Fault in Temperature Control Circuit (Operating Pressure Switch).</li> </ol>	<p>Normal operation.</p> <p>Check and replace if necessary.</p> <p>Check components for any physical damage and replace as needed.</p>
Unit shuts down	<ol style="list-style-type: none"> <li>1. Exceeded High Temperature limit.</li> <li>2. Exceeded High Pressure limit.</li> <li>3. Loss of control circuit power.</li> </ol>	<p>Check unit for proper fuel supply and contactor operation.</p> <p>Operate unit within its rated capacity. Verify all heaters are operating at rated wattage.</p> <p>Check incoming control and heater circuit power. Even a momentary loss of power will cause the unit to shut down.</p>
Unit overheats	<ol style="list-style-type: none"> <li>1. Faulty contactor.</li> <li>2. Fault in Temp. Control Circuit.</li> <li>3. Unit dry due to loss of product.</li> </ol>	<p>Check and replace if necessary.</p> <p>Check component for any physical damage and replace as needed.</p> <p>Verify and assure adequate liquid supply to inlet of vaporizer.</p>
Unit will not maintain Pressure	<ol style="list-style-type: none"> <li>1. System beyond its rated capacity.</li> <li>2. Loss of power to heater control circuit.</li> <li>3. Loss of wattage in one or more heaters.</li> <li>4. Fault in Pressure Control Circuit.</li> </ol>	<p>Reduce demand to rated capacity.</p> <p>Verify electrical power to heaters.</p> <p>Verify heaters are operating at rated wattage.</p> <p>Check components for physical damage and replace as needed.</p>
Insufficient capacity	<ol style="list-style-type: none"> <li>1. Unit over-capacitated.</li> <li>2. Loss of wattage in one or more heaters.</li> <li>3. Liquid supply inadequate.</li> </ol>	<p>Reduce demand to rate capacity of unit.</p> <p>Verify heaters are operating at rated wattage.</p> <p>Verify and assure adequate supply of liquid to inlet of vaporizer.</p>
Safety relief valve Actuates	<ol style="list-style-type: none"> <li>1. Liquid trapped between shutoff valves.</li> </ol>	<p>Open valves where liquid is trapped.</p>