1. Description

1.1 Thermax Inc. Ambient Air Vaporizers are fin tube heat exchangers, which use the energy contained in ambient air to heat or cool the process fluid via natural convection. Units ship fully assembled. Multiple units shall be installed and piped in parallel patterns. Contact Thermax Inc. Engineering for recommended layout.

1.2 These instructions apply to the following Thermax Inc. Ambient Vaporizer product lines: **Supergap™, Thermafin™, Megafin™, Hybrid Supergap™, Capricorn™, Hybrid Varigap™**

2. Installation

2.1 Installation shall conform to all local and national codes and regulations.

2.2 Inspect for obvious shipping damage such as bent piping. NOTE: Warped or bent fins will not affect performance unless grossly out of position.

2.3 Compare data plate with job site requirements. See applicable Thermax drawing(s).

2.4 Set on level base pad or pier allowing clear area around module for air circulation and frost buildup. NOTE: Site around vaporizer and/or pad shall allow for drainage of water during defrost cycles of the vaporizer.

2.5 Bolt into position using foot pad bolt holes and anchor bolts, shim to level and plumb as necessary.

2.6 Verify that unit is square, level and plumb.

2.7 Remove protection from vaporizer inlet and outlet connections. Connect liquid feed to vaporizer inlet connection. Connect gas outlet pipe to outlet connection. If connections are threaded use suitable cryogenic thread lubricant or Teflon Tape. If connections are flanged use suitable LOX compatible organic gasket material

2.8 Pressure test system per applicable piping design code.

2.9 Purge the vaporizer and associated piping system with dry gas.

CAUTION! Allow for contraction of field pipe connected to vaporizer. Do not transfer piping loads to vaporizer nozzles.

CAUTION! Handling cryogenic fluids and equipment shall be done only by experienced personnel. Refer to appropriate NFPA, CGA, FDA or other manual for required safety procedures.

CAUTION! Ambient Vaporizers may cause atmospheric fog during operation under certain conditions resulting in significantly reduced visibility in the vicinity. Site selection shall take this potential hazard into consideration.

CAUTION! Natural defrost is recommended, since physically removing ice may cause avalanche from falling ice/snow.

CAUTION! Partial defrost and re-freezing repeatedly may cause hi-density ice to replace relatively compactible frost. “Ice Lensing” may then occur causing structural deformation similar to roadway frost heaves. Full periodic defrost will help minimize this phenomenon.

CAUTION! Do not locate vaporizer installation over underground piping. Low temperatures due to the cold air and frost produced by the ambient vaporizer may penetrate several feet into the ground below the units.

CAUTION! Installations to provide oxygen for medical use require positive verification that oxygen gas produced is without contaminates ***BEFORE*** putting into service.

CAUTION! Equipment foundation, base and footing design and engineering shall be done by a qualified structural engineer and is outside Thermax Inc’s scope of work and supply.

CAUTION! Thermax Inc. units supplied without in/out valving are furnished without pressure relief ports or relief devices. The owner/installer shall provide a suitable device or combination of such devices within an overall assembly per applicable code to protect against equipment pressure limits.

CAUTION! Ambient vaporizers located downwind (in respect to the prevailing wind direction) of large sources of airborne water vapor, such as cooling towers, can result in abnormally high build-up of frost and ice and should be avoided.

CAUTION! Surfaces of the ambient vaporizers can reach cryogenic temperatures and therefore should not be touched by bare skin while in service. Access to ambient vaporizers should be restricted by fences or other means if non-monitored operation is planned.

CAUTION! If downstream components, materials or processes are incompatible with low temperatures (example carbon steel piping) a Failsafe, Low Temperature Protection System, (LTPS) shall be installed to automatically throttle and/or stop flow of the process fluid before fluid temperature below the acceptable range is reached. It is the responsibility of the vaporizer owner, user and operator to insure that a Failsafe, Low Temperature Protection System, (LTPS) is properly installed, tested and maintained, reference CGA P-56

3. Operation and Maintenance

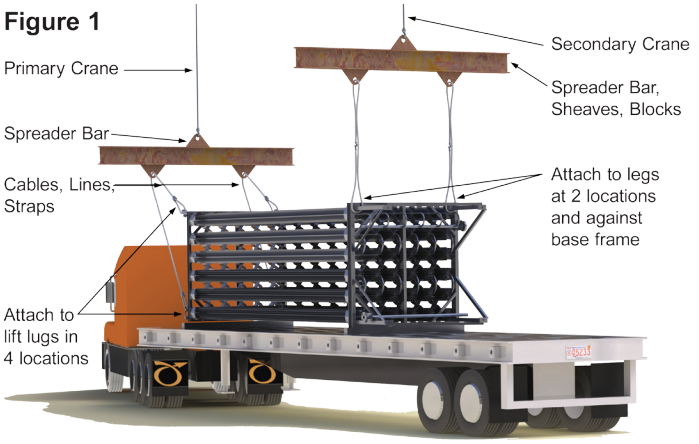
3.1 Ambient Vaporizers are simple, natural convection heat exchangers with no moving parts. Start-up is straightforward. After verification of proper pressure safety relief device installation, pressure tightness of all joints and cleanliness of inlet and outlet piping, cryogenic liquid may be introduced to the unit. Once flow is initiated, verify that outlet pressure, temperature and purity are suitable for your downstream process. Once system has cooled down to operating temperature, re-check for leaks.

3.2 Some frost buildup during operation is normal. During continuous operation, excessive frost buildup will decrease performance. Full rating should be restored by defrosting, which is best accomplished by interrupting flow when ambient temperature is over 32°F. Contact Thermax for additional rating data or refer to Thermax Datasheet "3" Series. Vaporizer units must be periodically defrosted to avoid ice loading beyond design levels and severely reducing performance which may result in low outlet gas temperatures/liquid break-through or structural failure.

3.3 Multiple module arrays require careful design of header system to reduce the potential for flow maldistribution, which causes some loss of total capacity and uneven frost buildup on the modules. Siting criteria such as sun direction and prevailing wind direction may also cause uneven frost buildup leading to flow maldistribution and a corresponding reduction in capacity.

3.4 Unit should be completely defrosted and inspected for ice or other damage once or twice per year.

Figure 1



4. Truck Off-loading & Erection of Large Ambient Vaporizers

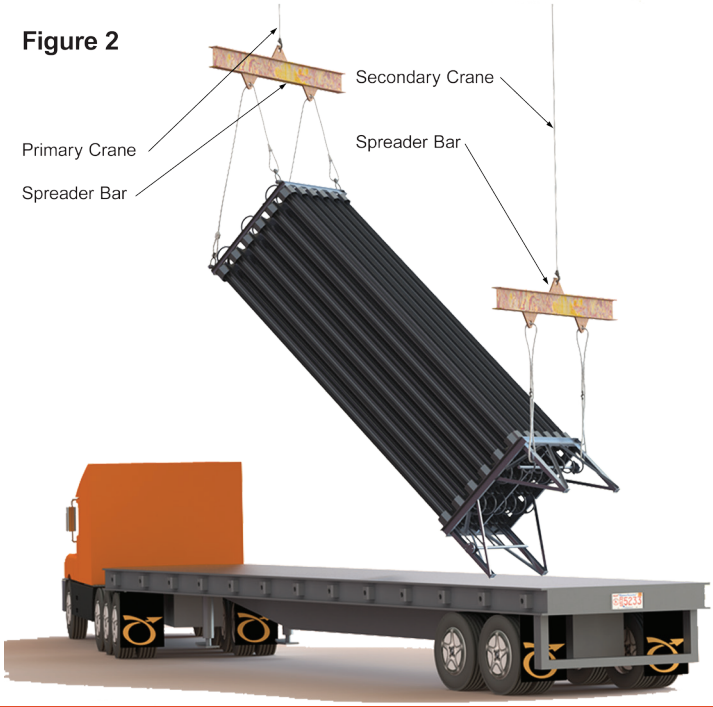
4.1 Thermax accepts no responsibility for damage occurring during vaporizer handling at customer site. Please consult your materials handling consultant/professional/crane provider for planning all of the necessary steps needed to safely carry out all materials handling.

4.2 Verify that crane and all rigging materials are adequate for the dry weight of the unit as shown on the general arrangement drawing with sufficient safety factor to account for wind, eccentric loading, wear, etc.

4.3 Remove shipping straps.

4.4 Two cranes should be used. The primary crane should be rigged to the four lifting lugs at the top of the unit using cables, lines or straps and a spreader beam with sheaves, blocks or other rigging as required. The secondary crane should be rigged to the upper most legs at the leg to base frame joint. See Figure 1. Straps should be attached to the lift lugs with shackles. Shackles must be able to rotate freely and not exert undue bending stress on the lift lugs.

Figure 2



4.5 Lift the unit off the truck bed and away from the truck. Raise the top of the unit and/or lower the base of the unit until the unit is vertical. No part of the unit should touch the ground during this operation. See Figure 2

4.6 Place the vaporizer in the vertical position on a suitable level foundation with adequate drainage. See Figure 3

4.7 Anchor the unit to the foundation using adequate anchor bolts.

5. *Container Unloading Of Large Ambient Vaporizers*

5.1 Thermax accepts no responsibility for damage occurring during vaporizer handling at customer site. Please consult your materials handling consultant/professional/crane provider for planning all of the necessary steps needed to safely carry out all materials handling.

5.2 Verify that forklift, crane and all rigging materials are adequate for the dry weight of the unit as shown on the general arrangement drawing with sufficient safety factor to account for wind, eccentric loading, wear, etc.

5.3 Before proceeding to unload vaporizer(s) from container, ensure that the container is level and secure.

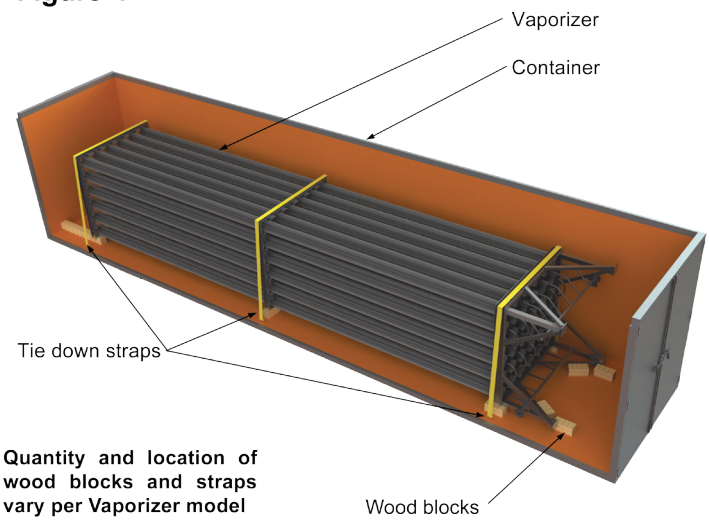
5.4 When lifting with a crane, the crane should be rigged to the four lifting lugs at the top of the unit using nylon straps and a spreader beam or the two upper most legs at the "leg to base frame joint" using a spreader beam. Straps should be attached to the lift lugs with shackles. Shackles must be able to rotate freely and not exert undue bending stress on lift lugs. When lifting with a forklift, strap/sling the vaporizer to the forklift.

5.5 Special attention must be paid to the inside of the container when moving the vaporizer(s) out to prevent parts of the vaporizer from catching on the inside of the container walls/ structure or door.

5.6 Ambient Vaporizers shipped in ocean containers are blocked and strapped directly to the container (quantity and location of wood blocks and straps vary per model). Vaporizers are slid into container(s) at Thermax shop(s) and are secured into place. To facilitate sliding, vaporizers have wood and/or aluminum blocks/skids attached to their frames at floor contact points. (See Detail) This procedure is reversed to remove the vaporizer(s) from the container(s) (Refer to Fig. 4)

Figure 3

Figure 4



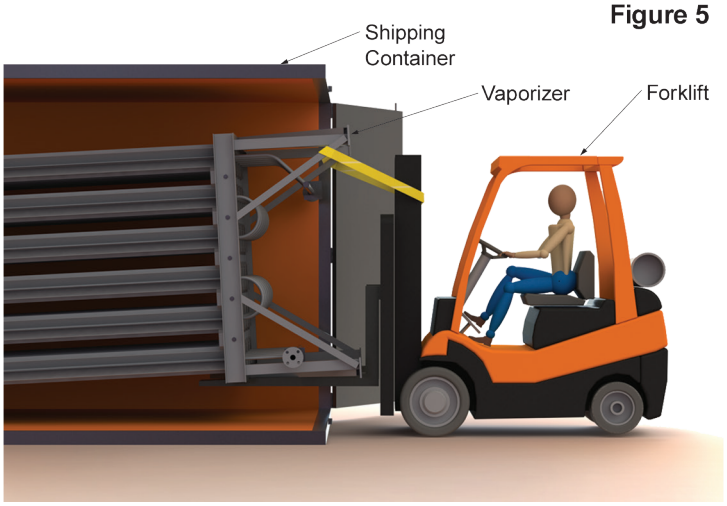
Quantity and location of wood blocks and straps vary per Vaporizer model

5.7 Open container door. Examine inside of container for location of all wood blocks and tie-down straps. Remove all wood blocks and tie down straps, which are blocking or holding the vaporizer in place.

5.8 Using a forklift and slings, lift the end of the vaporizer enough to allow room to fit the forklift forks underneath the vaporizer frame. (Use special care when lifting vaporizers that fit snugly in the container). Place blocks under the vaporizer frame, leaving room for the forks (Refer to Fig. 5)

5.9 Slide the forklift under the vaporizer frame. Sling/strap the vaporizer to the forklift. Lift the vaporizer up off the blocks/container floor. Let the opposite end of the vaporizer continue to rest on the container floor. **!Caution!** When lifting the end of the vaporizer, make sure that the vaporizer clears the top of the container door.

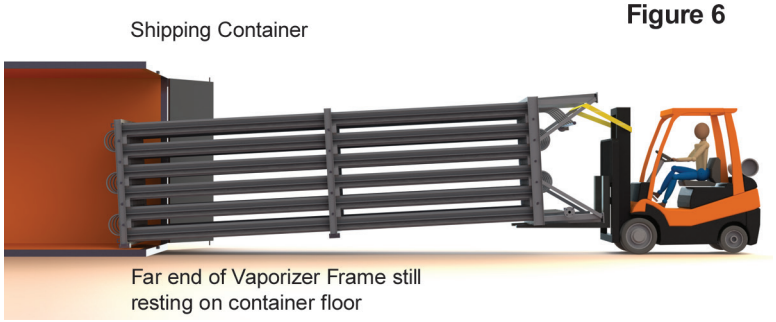
Figure 5



5.10 With the forklift lifting the (near) end of the vaporizer off the container floor, the opposite (far) end of the vaporizer on the floor and the vaporizer securely strapped to the forklift, pull the vaporizer slowly out of the container.

5.11 ***"STOP"*** pulling when the far end of the vaporizer is near the end of the container, but the far end frame is still securely resting on the container floor. (Refer to Fig. 6)

Figure 6



5.12 To complete removal from container, use additional forklift, crane & forklift combination or two cranes (two cranes as shown in Figure 7). When rigging to cranes, refer to Thermax I/O 11 (this document), page 2, Section 4, note 4.4.

5.13 Refer to Thermax I/O 11 (this document), Section 4 for erecting vaporizer(s)

Figure 7