Shipping Container Ventilation for Moisture Control

FAQ's:

Do the stock rectangular vents help ventilate the container? No. The design is to insure sea water doesn't not enter during ocean crossings, each vent has a total air passage way of 3/8 sq. in, the size of a dime. Due to a container being practically air tight, the stock venting is more of a pressure equalization system. In addition, these vents do not exhaust, nor do they move air in either direction, so there is no interior ventilation.

Can a container be properly vented without power. If there is some air movement on location, interior air exchanges are possible. More wind, better the ventilation. Two choices; our "360 Wall Vent" or the roof mounted metal turbines (see below).

What's wrong with the aftermarket louvered vents, or the hooded vent? Passive vents seldom drive air movement. At times they might exhaust, sometimes allow blow in, often they do nothing. If the vent does not manage the various wind directions including turbulence it cannot drive air exchanges. Some passive vent manufactures actually state that a fan will be required for airflow. These passive vents are ok for air intake. Louvers can allow mist inside from rain splashing off the louvers, hooded vents are preferred.

Does the air intake vent have to have the same port size as the exhaust vent? We have had success with a 4/1 ratio of exhaust versus intake. But to allow for all the variables (temperature, winds, outside humidity and the physical location), we suggest 2/1 or better. Sometimes experimentation is required.

What's the use of drawing in humid outside air? If the air is not circulating and being replaced the temperature will soar inside, allowing more moisture content. By replacing the interior air, the days heat is lowered and come evening those large temperature differences are vastly reduced. The big temperature swings from day-to-night and night-to-day is the leading cause of ceiling condensation. Air circulation is key, every article on the topic points to thorough ventilation.

How many vents do I need and where to mount them? Again, there is no one exact calculation due to many variables; local winds, temperatures and humidity. We have been providing a suggested range for vent requirement; please see "Container Vent Design". Vent location is important to capitalize on the available winds, in addition to the different pressure differences in shade vs sun; see "Ventilation Design"

What should the RH be? In the home 30 -50% is generally comfortable. Over two weeks In the PNW we dropped a 20' containers interior RH from 90 -99% down to 80% and the condensation disappeared. Important to note, cooler air cannot hold as much moisture as warm air. So 80% RH at 60 degrees, isn't as bad as it would be at 90 degrees. Ideally if you are 70% or less, you should be good.

Besides ventilation, what else can be done to reduce moisture? Many variables cause are the cause of condensation. Without the use of power, it is important that all possible issues are looked at. Please see our "8 Steps to a Dry Container" for the simple things that can be done to minimize the interior moisture.

Other Suggestions and Container Info

Dehumidifier / Heater In our testing and experimenting we found the humidifiers were not the best bang for the buck in the cooler regions, heaters were a more efficient. But in hot humid climates dehumidifiers are definitely more effective.

The roof mounted metal turbine is a good high volume exhaust system that also inhibits high pressure blow-in. They range from a 6" port to 14", works well in light and strong winds. Installation is complex on a shipping container due to the corrugated roof profile (difficult to seal). The mechanical component is a potential failure point but this is the only other option available as a true exhaust vent.

"Dry-Z-Air" absorbent crystals: We have experimented with boats in storage and smaller shipping containers, both in the PNW. To date we have not had the best results. Possibly due to there is always water sitting in the open collection bowl, and when the interior warms during the day it evaporates back into the air, so regular emptying is a must. As far as we can see this is not a sole remedy.

Moisture and Condensation Facts

Warm air holds more moisture than cold air. As interior warm air rises and comes in contact with a cold metal surface (ceiling) condensation forms. This also happens to contents with hard, dense surfaces such as glass, metal, porcelain, etc. Outside RH is usually higher in the early morning then dries a little throughout the daylight hours. The larger the exterior temperature fluctuation in relation to the inside the more difficult it is to stop the condensation. The heat of the day warms the interior air and when the sun goes down the roof cools off, condensation then forms on the cold ceiling. This is why an insulated ceiling is beneficial. The condensation in a container must be prevented, or the interior RH will always be maxed at 99%.

As the inside cools in the evening (or on the colder days) the RH reading might increase. That's not indicating there is now more moisture inside. The cooler air is denser than the warm air, so the moisture percentage reads higher. Colder air will have less water content. At 5°F there is no moisture in the air, so cooler climates can be easier to manage.

Powered by Wind:

Without power we are completely dependent on nature to keep the enclosure dry. It won't happen in a day or two, this is over time. The data sheets for our vents are not calculated in CFM, cubic feet/minute, but CFD, cubic feet/day. It's important the ventilation is active as much as possible, that's why the exhaust vent must be installed on the windiest side of a container. In our PNW test area we recorded very little wind, we were surprised to see the interior RH drop so significantly after only a week after installation. Our gauges essentially recorded no wind, so we brought in fog machines to monitor the area's air movement. We were surprised to see air moving almost walking speed along the fronts of the lined up containers. In addition, thermals from the heat of the paved driveway and container fronts were pulling the fog up the walls of the containers when the horizontal breeze eased. Due to the vents functioning low wind threshold, they were exhausting the containers almost continually.

Points to Remember

- High Relative Humidity (RH) is the enemy, as is extremely high interior tempatures
- Large and fast temperature changes (day - night differences) promotes condensation
- Wind, sun/shade; can either make the problem worse or better, depending on vent location.