

Container Ventilation Manual

Powered by the Wind and the "360 Wall Vent"

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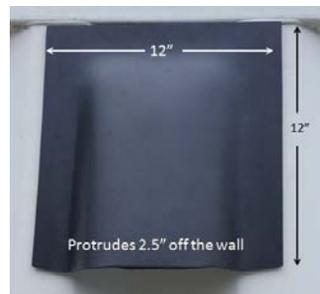
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Eight Steps to A Dry Shipping Container- Without Power

Contributing Variables and Remedies for Eliminating Condensation

The following is prioritized by the biggest bang for the buck. Please note; every location and climate zone will be a little different, but the following 8 steps should resolve most condensation issues.

The following 6 steps are mandatory- the basic starting point:

1. Container must be placed on good draining ground, not in a low wet area
2. Exposure to wind, in a sunny area, but a shaded roof can be very beneficial (sounds a little conflicting).
3. A min. separation of 1ft. from neighbouring buildings or other Conex, for airflow (drying) purposes
4. Never place the container directly on the ground, always on a beam at each end, allowing airflow underneath
5. The roof must be kept clear of leaves, soil, algae, moss, etc. Regular maintenance required in some areas.
6. If rusted or a dark color, paint white (gloss), especially the roof to reflect the heating effects of the sun. Good reports on this silicone roof paint: GacoFlex s2100 <https://gaco.com/product-details/gacoflex-s2100/>
7. **Ventilation is the next step:** Install proper ventilation that will encourage multiple air exchanges per day. Some locations will need more air flow than others. Three choices: A powered fan system, spinning rooftop turbine, or our “360 Wall Mount” exhaust vent. The air must be driven; louvers, hooded vents and other passive products do not create airflow. See “**Ventilation Requirements**”.
8. **If condensation persists, Insulation is the next option:** Closed cell spray insulation is the most effective because it fills all air pockets and also works as a vapor barrier: We have seen extremely low RH in containers with just the ceiling done. In the tough situations the walls might also have to be sprayed. ½” – ¾” appears sufficient. There are companies that will spray it (over \$1000), or there are “Do it Your Self Products” (\$300-\$600).

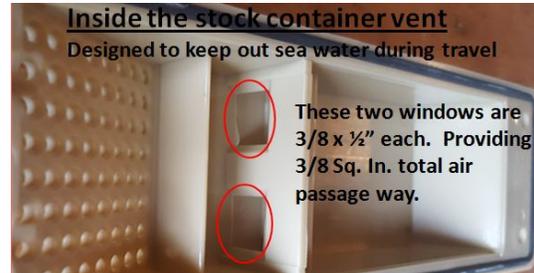
Important Tips

- Avoid bringing wet materials or equipment into the container, same goes with wet shoes when entering. The extra moisture could be sufficient to initiate condensation, only adding to the work load of the above advantages.
- A full container often has fewer problems than an empty one. Displacement reduces the interior air volume, which in turn reduces the interior moisture content.
- The best method of monitoring the interior atmosphere is with a humidity gauge. We have been using the small digital units, located about half way up a wall. You don’t want to go in every day to check (especially with wet shoes), but it is the best way to monitor the RH and to see the results of your moisture control efforts.
- You can’t change your location, so you must maximize the use of the local winds. After you have read our “Vent Location” page, spend time learning the air movement around your container. Vent placement is crucial.

Note: All the points listed here will offer your Conex the best possible chance of being condensation free. Depending on the severity of the containers moisture problem you might require an extra vent

Ventilation Overview

Stock Container Vents: Are usually mounted on the upper side walls, 4 - 8 units per container. They are as passive as you get, worse still they only have an air passage way of 3/8 sq. in, about the size of a dime. Proper ventilation needs a driving force with direction, and to provide sufficient air exchanges for size of the enclosure. Our passive intake vent below has about 60 times the airflow capacity of these stock vents.



Airflow Direction and Drive: The overall goal is to pull air from one end thru to the other where it's exhausted. An open port concept that lets the wind blow in is not ideal. Air borne particles including mist, moisture, pollen, ash etc., will be blown inside. Normally, fans are used to exhaust, pushing out air from one end, which is the same as our "360 Wall Vent". Most places have sufficient winds to drive a good exhaust. See the following site for winds in your area: <https://www.wunderground.com/history/>. The spinning turbines are good exhaust units, but the installations are complex due to having to seal on the corrugated metal roof. They are mechanically dependent and are known for allowing water and insects inside.

Our Exhaust Vent "360 Wall Vent" - Drives the Airflow: An easy install, with no moving parts, a bug screen, water proof and exhausts 3-4 Cu Ft / min with every 1 mph of wind. The patented vent cover manages all winds, any direction, turbulence, gusts and can still exhaust with air movement as low as 1/2 mph. To take best advantage of your local winds, vent location is important. To allow vent installation on any of the four walls we have adapter plates to insure the best location for the exhaust vent is always possible.



Our "Intake Vent" A Passive Container Vent: Fits almost anywhere on a container, preferably installed on the less windy side and shady side. Two styles; one for the side wall profile and another one for the back end.



Determining Vent Quantity: Exhaust and Air Intake

1. Calculate the volume of the enclosure / container
2. Attempt to assess the winds on location. Direction, speed, duration, does it change direction through the day, is it gusty and turbulent? Check the following link for regional winds <https://www.wunderground.com/history/>

Wind Speeds: 1-2 mph: not even noticeable and usually present
 3 mph: a slow walking speed, hardly noticeable
 4-5 mph: a slight breeze
 6-7 mph: a light wind
 8-9 mph: a good breeze
 10 -12 mph: white caps form on the water, its windy.

The following air exchange examples are based on our **360 Wall Vent** average draw rate of 3 cu. ft / min/1 mph of wind. This Exhaust vent is the primary, it powers the ventilation process, it must be subjected to as much wind as possible. These numbers do not reflect the additional gusts, turbulence, rising thermals, or the vent's max draw rate of 4 cu ft.

In average winds a 20' would need 1 Ex, 1 Intake. A 40' 2 Ex and 1 Intake. On the last example below with the 53', a second intake vent is recommended.

Example		Volume	Exhaust Vents	Average wind speed / day	Exhausted air volume / hr	Completed air exchanges / day
Example 1	20' container	1300 cu ft.	1	3 mph	540	10
	40' container	2600 cu ft.	1	3 mph	540	5
Example 2	20' container	1300 cu ft.	1	5 mph	900	17
	40' container	2600 cu ft.	1	5 mph	900	8
Example 3	40' container	2600 cu ft.	2	5 mph	1800	16
	53' High cube	3900 cu ft.	3	5 mph	2700	16

Important Note: This is to show the relevance of wind speed. If low, more vents might be required. In some locations 10 mph is common; if that is the case a 40' container might only need 1 exhaust primary @ 16 exchanges /day.

Air Intake (a passive vent that feeds the exhaust "360 Wall Vent"): Recommend 1 Intake for every 2 Exhaust Vents

A container is almost air-tight, intake vents are required. Do not count on the small rectangular stock vents, the actual air passageway is smaller than a dime. With three exhaust vents you should consider adding a second intake vent. In the event you already have a passive vent such as the metal hooded units, they will also work.

How Many Air Exchanges? Ten air exchanges per day in the PNW might be sufficient to eliminate condensation but not necessarily in Florida.

Arizona might get by with less than 10 a day. At this point it appears the exchange range can vary from 10 -20 / day. Every climatic region is going to be different, that is why its beneficial to have as many things in your favor as possible, such as the first few points in "8 steps to dry"

Now that you have an idea for vent requirement, installation location is important to catch the most wind as possible. Please see "**Vent Location**".

Vent Location

Vent Location on a Container

The exhaust drives the ventilation, priority is placing the vent where it is subjected to most wind as possible. Once determined place the intake on the far end of the exhaust, the North, NE or East side is usually the shadiest / coolest.

Exhaust Vents on the windiest part of the container. On the end or sides close to the end



Shipping Container



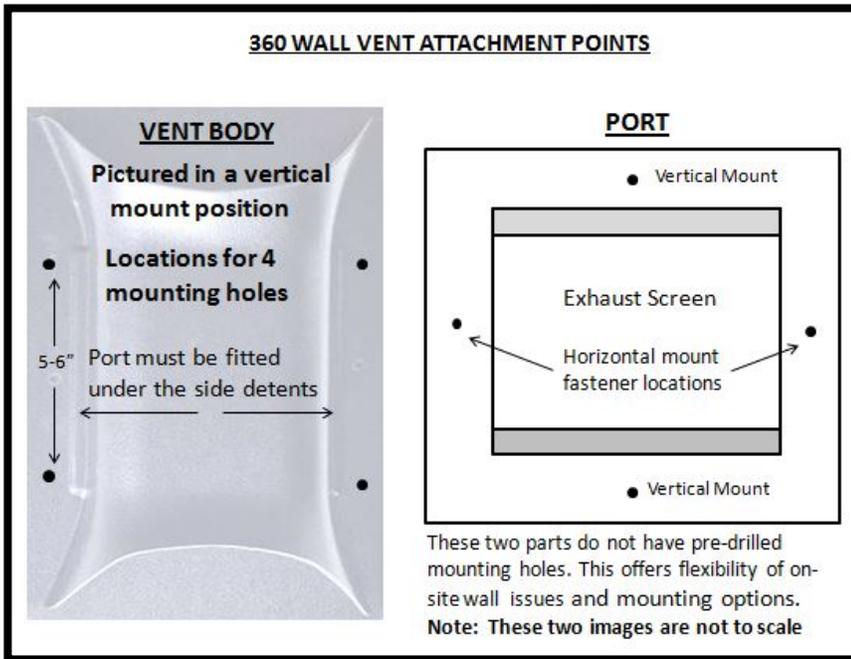
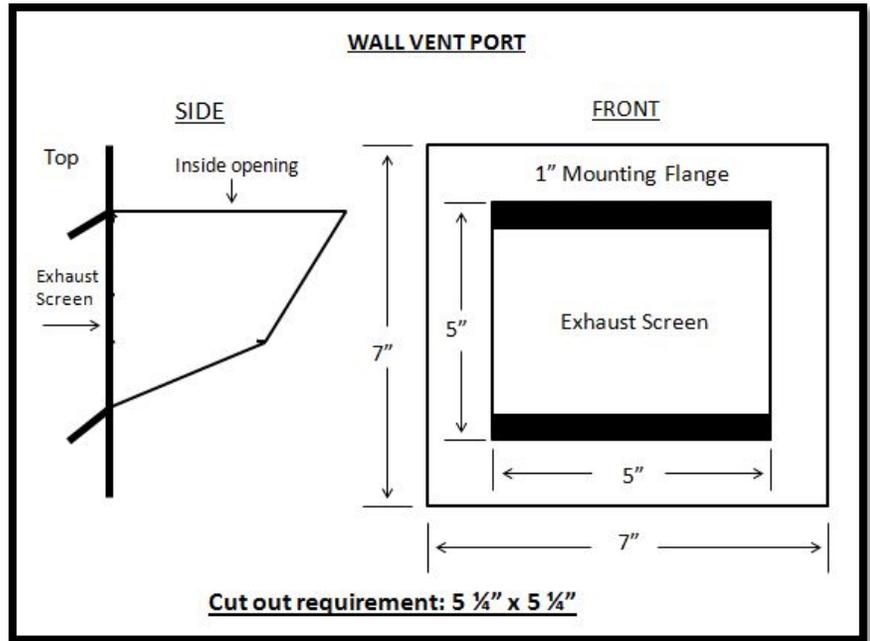
Intake Vents somewhere on the opposite end as the exhaust, preferably in the shade.

- Our Intake vents cannot be mounted on the doors. Back end and side walls only.
- Exhaust vents can be mounted anywhere on a container. If not on the doors, adapter plates will be required for the walls.
- If multiple exhaust vents are used keep a minimum of 2' separation.
- Exhaust vents should be installed on the highest flat panel for a door mount. If adapter plates are used for the walls, the vent will be tucked under the top support beam, same as the Intake Vents

- Door mounted exhaust vent will inhibit the doors from opening fully to latch to the side walls.
- The back end wall profile is different to the side walls; note the different products for each.

"360 Wall Vent" Installation

First priority is planning your vent location for maximize wind exposure. See "Vent location Design". Consider physical obstructions on both the inside and outside of the vent, it protrudes about 4 1/2 inches on either side. Insure a flat mounting surface for the vent (10" x 15"), attempt to keep as far as possible from wind obstructions. In most cases we suggest the vent cover be mounted in the vertical position. The port must always be mounted in the up position so that the interior port opening is facing up, louvers down. It is not a large flange area so care must be taken on the cut-out for the port, 5 1/4" x 5 1/4". To prevent possible rust lines, ensure all the metal filings are cleaned off, from both the cut out and the mounting holes.



On a vertical install do not secure the sides of the port, only in the center of the top and bottom flange. Fasteners on the sides will interfere with the placement of the vent cover. For a horizontal install secure the port with one fastener on each side. The vent body must fit properly on top of the port to fit into the side indents located on the vent body. Use two fasteners on the top flange of the vent body to help secure the seal the top of the port. A couple fasteners on either side of the vent cover 5-6" apart will also secure the port. Do not over tighten the fasteners, flanges could split.
Sealant/ Fastener Recommendations: Proper sealant is important for a water barrier for the port, not as crucial for the vent cover. Dycore, Sikaflex, 3M 5200 or equivalent. Use SS self tapping screws or rivets. Do not use tapered screws, could damage flanges.

Container door installation: mark for the port cut out 5 1/4" x 5 1/4", centered on the upper panel, mount vertically equal distant from the vertical latching bars, if there is a choice, the bars furthest apart. Also centered between the upper and lower panel welds so the vent body mounts flush. Use a good sealant; Sikaflex. On large enclosures where multiple exhaust vents are used, vent separation should be a minimum of 2 ft. to maximize the draw rate of each vent

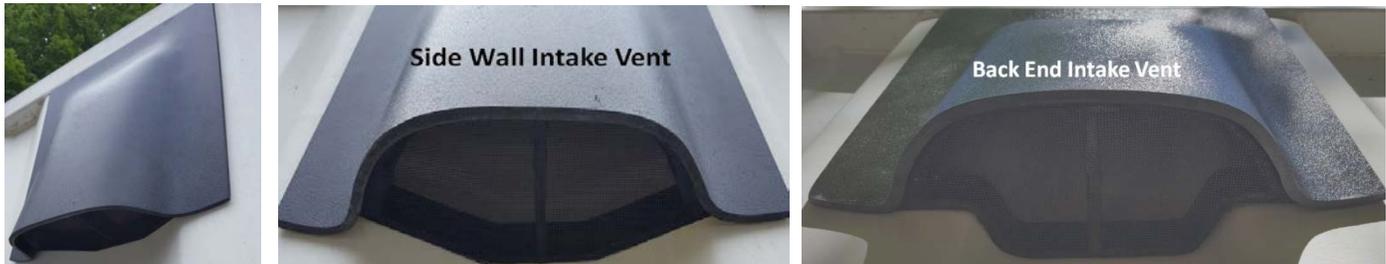
Note: A container door mounted vent will prevent the doors from opening fully to the securing points on the container sides.

Container Wall Installation: For a wall mount install, the port will come attached to the appropriate adapter plate, as per your design location, side wall or back end wall, please see "Exhaust Vent Plates" for detailed installation

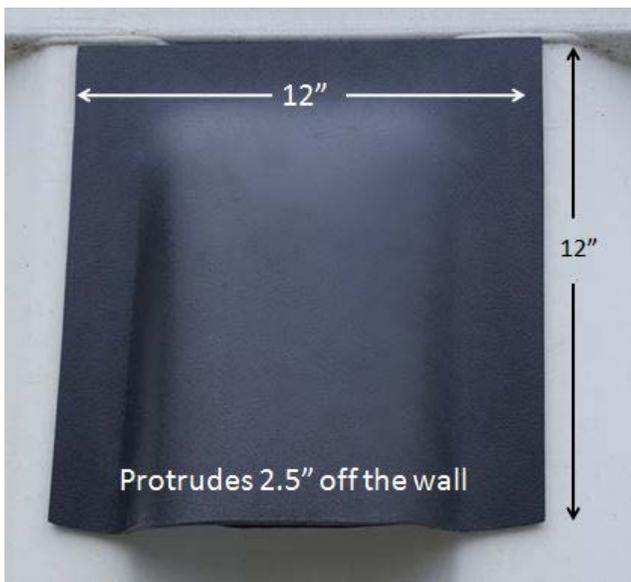
The vent body and port are constructed of light gauge ABS. Its durable, takes paint well and is flexible so if lightly impacted it return to its original shape. The vent cannot be distorted or it will not function as designed. The mounting locations indicated do not have to be precise, that is why they are not predrilled. As long as the port is properly sealed and the vent body is positioned properly over the port unit, it will exhaust as designed. If used on a sealed enclosure or room with no air inlet (such as a shipping container) an intake vent will be required to allow the proper exhaust volume. See "Container Air Intake".

Air Intake Vent Designed for a Container Wall

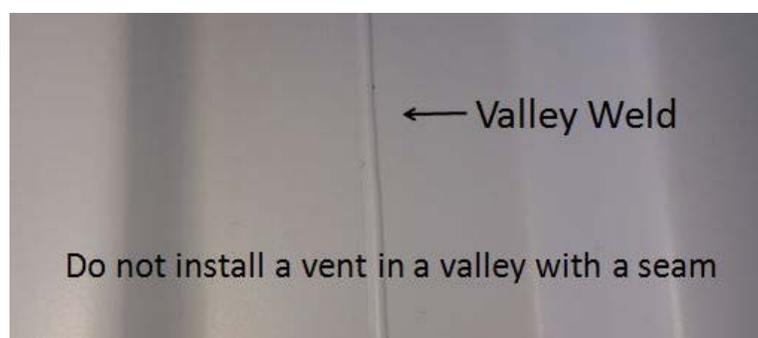
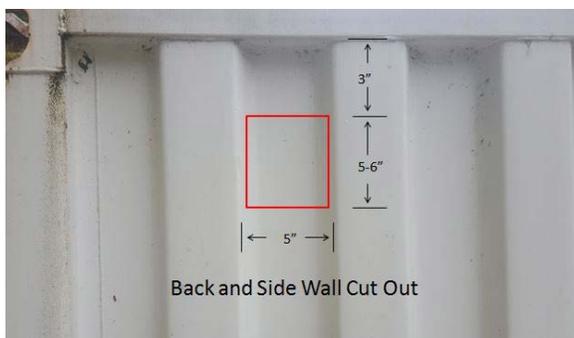
This vent is designed to allow air into a container to feed our "360 Wall Vent" as it exhausts. There are two versions; one fits into the side wall profile of any container, the other fits in the rear or back wall profile as pictured below. The purpose is to allow air in from the opposite end of the ventilation driver, the exhaust.



The only difference of the two versions is the shape of the screened port that fits into the wall profile. To be installed at the top under the structural cross member to allow for a proper seal. The ABS plastic is 1/4" gauge with the dimensions below. The aluminum screen has a port area of approximately 22 sq. In.

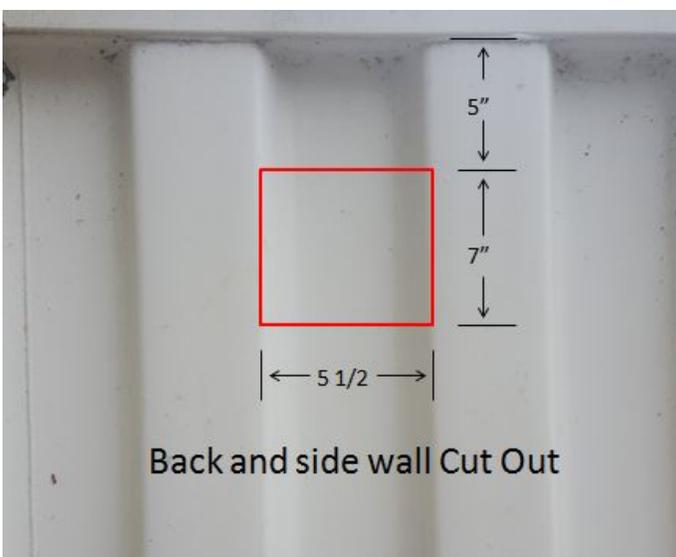
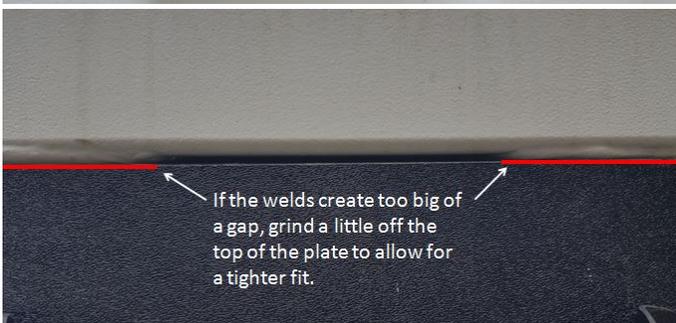
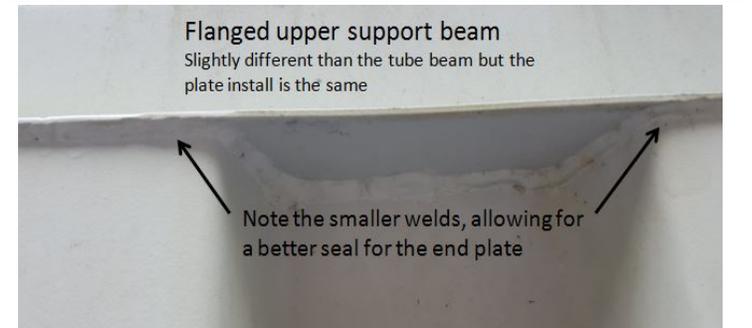
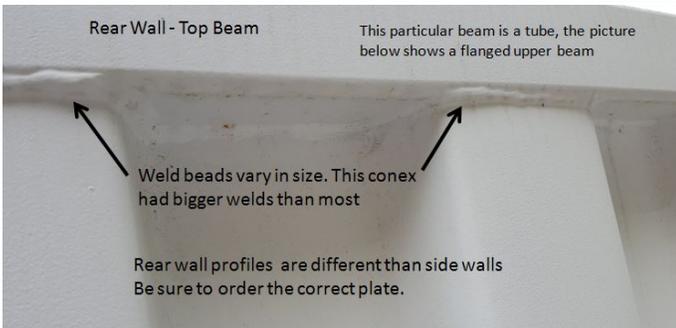
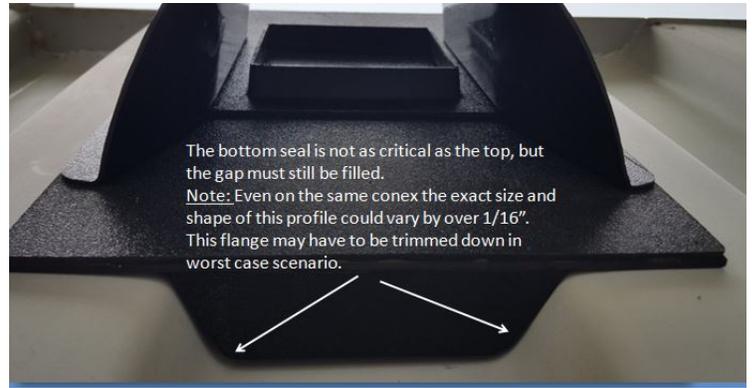
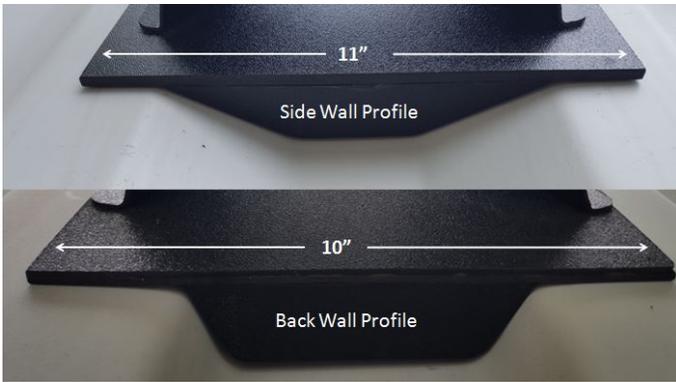


The cut out is not crucial but we suggest 5" wide and 5-6" high. Three SS self-tapping screws down each side, or rivets. Do not over tighten or use tapered screws, could possibly damage the ABS. Do not install on a seamed valley, as pictured. Use a good sealant, Sikaflex, 3M 5200 or equivalent. To prevent rust lines running down the exterior walls, ensure all the metal filings are removed.



Like any passive vent, it will not drive the ventilation but will allow an inflow of air to allow air exchanges.

Wall Adapter Plate for Universal Exhaust Installation

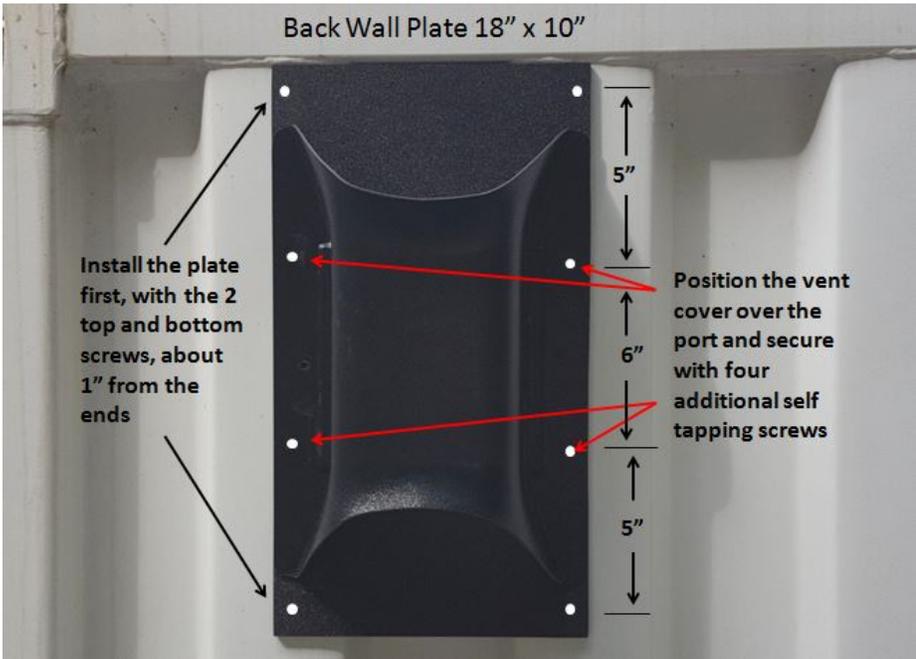


Please note the side wall plate is 11" wide and the back wall is 10" wide. The two plates are not interchangeable; they will come with the port attached. Insure the plate is positioned properly and the intake is facing up. The small sealant shelf on the plate (top) fits under the Conex roof support beam.

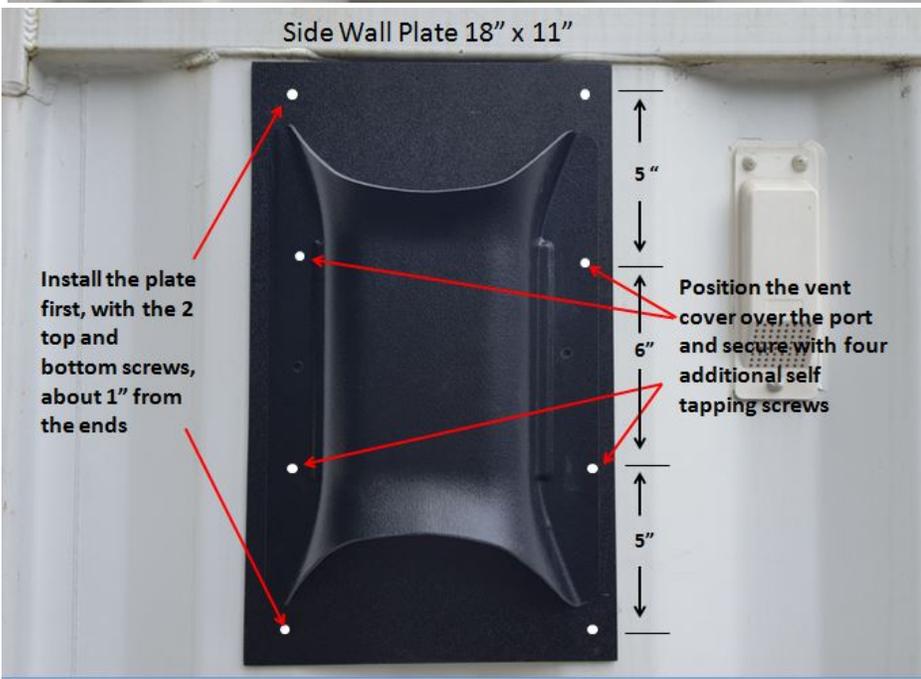
To prevent rust lines running down the exterior walls, ensure all the metal filings are removed.

The seal is important; use a good sealant, Sikaflex, 3M 5200 or equivalent

Back Wall Plate 18" x 10"



Side Wall Plate 18" x 11"



“360 Wall Vent” Data Sheet

Part Specifications

Parts: **External Vent Body** with mounting flange; 14. 1/8” x 9.5” x 4 1/8”
Internal Port with exhaust screen, water proofing and attachment flange. 7” x 7” x 5 3/4”

Composite: ABS **Color:** Black **Port Bug screen:** mesh 18 x 16, aperture .0445” x .0515”

Attachment: A good exterior caulking must be used on the port to wall seal; the vent body should also be sealed. Do not use tapered screws; flat head with a washer or rivets depending on the wall material. Note, the vent construction is a light gauge plastic; a tapered fastener could split the mounting flange. **See Drawings.**

Installation: Determine the location of vent; see “Vent Location” below.

The vent body can be placed vertically or horizontally depending on the application and available space. The square port must always be mounted in the up position so that the interior port opening is facing up, outside louvers down. If it’s a vertical install do not secure the sides of the port, only in the center of the top and bottom flange (fasteners on the sides will interfere with the placement of the vent body) the vent body will secure the sides of the port. For a horizontal install secure the port with one fastener on each side. The vent body must fit properly on top of the port to fit into the side indents located on the vent body flange surface. Use two fasteners on the top flange approximately 6” apart to ensure a secured water seal for the top of the port. The wall mounting surface should be vertical within a couple degrees to ensure reliable water protection.

Cut out requirement: 5 1/4” x 5 1/4”. **Flange width 1”**

Note: The vent protrudes 4 1/8” off the exterior mounting surface and protrudes 5” on the inside. Watch for door opening clearances and interior obstructions. The vent will prevent a container door from opening to its side wall latching point.

Air Flow Specifications

Minimum threshold: less than 1/2” mph of external air movement

Operational incoming wind angles: All

High Pressure Block (preventing blow-in): 99%

Draw rate (exhaust volume): 4 cu ft / min / for every 1 mph with wind direction 90 degrees to the tunnel.
3 cu ft / min / for every 1 mph with wind direction parallel to the tunnel.

Vent Mounting Location

If possible, choose the most exposed wall to the wind. The vent was designed around objects (container door latches) in close proximity of the exhaust ports, but further distance away the better. Even thermals rising above a paved driveway or wall subjected to the sun creates a good draw. Neighbouring buildings and large obstacles create turbulence and gusts, these areas are also good for driving the exhaust. If the location consists of a row of buildings or containers this often creates a wind tunnel effect, with a more consistent low turbulent horizontal wind. In this case a vertical install would provide maximum draw.

Important Note: This vent performs as stated. It will inhibit wind generated high pressure, simultaneously creating a low pressure close to the stated numbers. We cannot guarantee a condensation free enclosure or a fume free environment with the use of this vent, due to the numerous variables such as; enclosure size, location, exposure to wind, intake, and the actual physical characteristics of the application.