

GREENHOUSE - Q AND A TIPS AND ADVICE

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Ask the Experts

Question : What are some tips and recommendations and choices for roof venting ??

Part One

The most common question is what size of vent do I need. This is an important question but there are several other factors to consider other than how many sq. feet of vent you require. Height differentials plays a very major role in the performance of your vent system.

Natural Venting of Greenhouse Structures

General Natural Ventilation Rules

Several general rules should be observed in designing a greenhouse for natural ventilation. (I.e.: By roof vents/ridge vents or gutter vents and or sidewall vents.)

- Systems using natural ventilation should be designed for effective ventilation regardless of wind direction. THERE MUST BE EFFECTIVE VENTILATION WHEN THE WIND DOES NOT COME FROM THE PREVAILING DIRECTION.
- The greatest flow per unit area of total opening is obtained by using inlet and outlet openings of equal area.
- The neutral pressure level tends to move to the level of any single opening, with a resulting reduction in pressure across the opening.

- There must be a vertical distance between the vents for temperature difference to product natural ventilation. THE GREATER THE VERTICAL DIFFERENCE, THE GREATER THE VENTILATION (flow) rate will be.
- Openings near the neutral plan level are least effective for ventilation.
- Protect roof vents against high winds / rains with outdoor weather stations.

FLOW DUE TO THERMAL FORCES

In most greenhouses, there is no significant internal resistance to affect total flow rates so this formula is an effective tool.

- $Q = C * A * \text{sq. root}(h(t_1-t_0)/t_1)$

where

- Q = flow, L/s or CFM
- A = free area of inlets or outlets, Sq.M or Sq. Ft.
- h = height from inlets to outlets, M or ft
- t1= indoor temperature at height h, Deg C or Deg F
- t0=outdoor temperature, Deg. C or Deg. F
- C = constant of proportionality, 116 (if metric), 9.4
 - This applies if t1>t0, if t1<t0 replace t1 in denominator with t0.
 - Reference source ASHRAE - fundamentals handbook
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- Interesting formula for sure and it does work. Backing up to the basic rules though please note, sure the areas of the openings are important..... but what is really important is the height differential between the openings.

Let's look at a couple situations.

Common factors no wind. Inside temperature up at roof vent 120 deg. F. Outdoor temperature 85 deg. F. Roof vents total area of 500 sq. feet. (1/2 inlet / 1/2 outlet, 1000 sq. ft. total) and are located at same distance from the peak. Both houses at 240 feet long.

House 1 was built using a slope of 1/4" per 12 feet for roof drainage.

House 2 was built using a slope of 1 1/2" per 12 feet for roof drainage.

Will the vents on both houses work the same at the same common factor conditions ??? Nope house 2 will always provide more ventilation than house one.

Remember the height differential plays a very very strong role.

House one has a total elevation drop of 5" along the length of the gutter or and average of 2.5" (.4')

House two has a total elevation drop of 30" along the length of the gutter or and average of 15". (1.25')

House one will ventilate 19,810 CFM

House two will ventilate 36,020 CFM

Just due to the thermal force acting.

Hm same house .. but with different slopes on the gutter.

I know which house I'd build, if cooling was a concern.

Remember the height differential plays a very very strong role.

How to improve house number one ??? It's easy. You don't need to add exhaust fans. Just introduce some low level openings how about sidewall vents or shutters

As an example on house # one if only 200 sq. feet of low level vent/shutters were added and were centered at the 6 foot mark off grade. The vents on the roof are 14 feet above grade. This provides a height differential of 8 feet. All other conditions the same.

Now the roof vents will flow 46,00 CFM air flow at a ratio of 500/200 (500 sq. feet of roof vent --- 200 sq. feet for the sidewall vent area). Nothat's an increase on air flow.

The thing to note: It is not always the size of the vent but the height differentials between the vents.

Flow Due to Wind

- Remember it is foolish to size the vents based on prevailing wind (we know many companies and suppliers do but it is foolish). Here's a handy little formula.
 - $Q=CVA_v$
 - Q = air flow in L/sec or CFM
 - A = area if inlet openings
 - v = velocity of wind, M/sec or MPH
 - C_v = constant of effectiveness of openings (0.50 to 0.60 with wind perpendicular, 0.25 to 0.35 for diagonal wind)

A 10 MPH wind acting perpendicular on the above examples would cause an extra 7500 CFM air flow in and out of the structure.

Required Flow

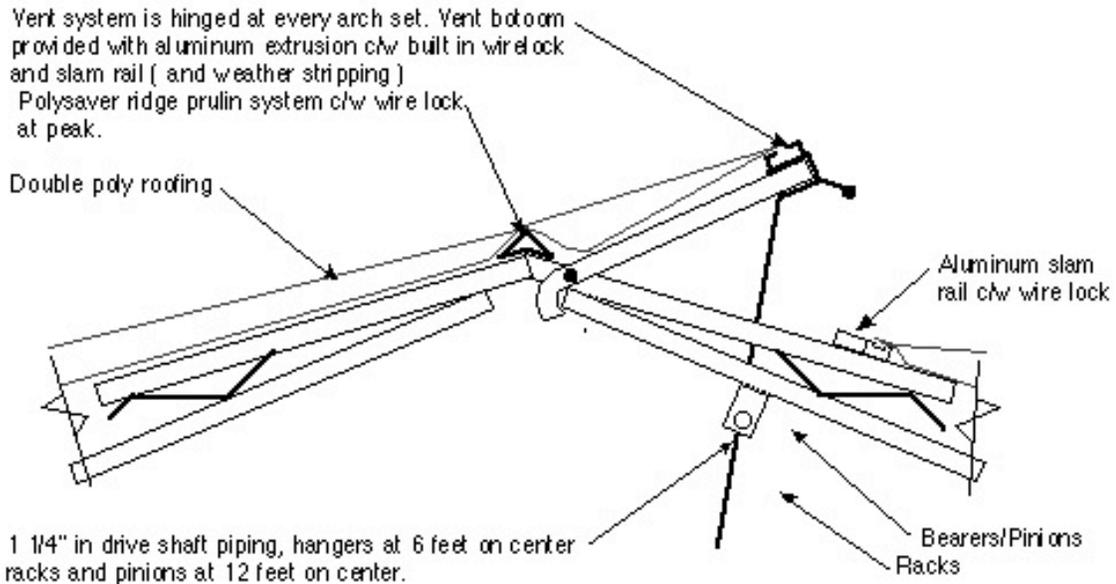
The required flow is dependent on the total heat to be removed and the difference between outdoor and indoor temperatures (at the vent heights). As an example, a greenhouse is subjected to a total conducted and solar gain load of 3,600,000 BTU's, 120 deg. F at the vent opening and 85 deg. F outdoor air, the required air flow rate would be 93,294 CFM. Based on air density of 0.075 lbs/cubic feet, specific heat of 0.245 BTU/lbF.

Using the above formulas you them can figure out the vent sizes that you need.

Just remember..... Closely read and consider the ventilation rules. If you do so... Your ventilation blues can be solved.

Common Venting Methods

Double Poly Roof Vent System



Vent in Open Position Reinforced Arch Shown

Double poly ridge vent systems are provided in widths of three and four feet for the length of the house.

The vents are comprised of arch pivots placed at 6 feet on center (to match arch spacing), pivots and attachments, aluminum base rail c/w built in wire lock and flashing, aluminum slam rail c/w built in wire lock, corner windbracing, end arch pivot provide with end flashing for air seal air gable ends. Inflation jumper kits are provided to double poly vent inflation.

Motor operator (manual or automatic must be ordered separately.)

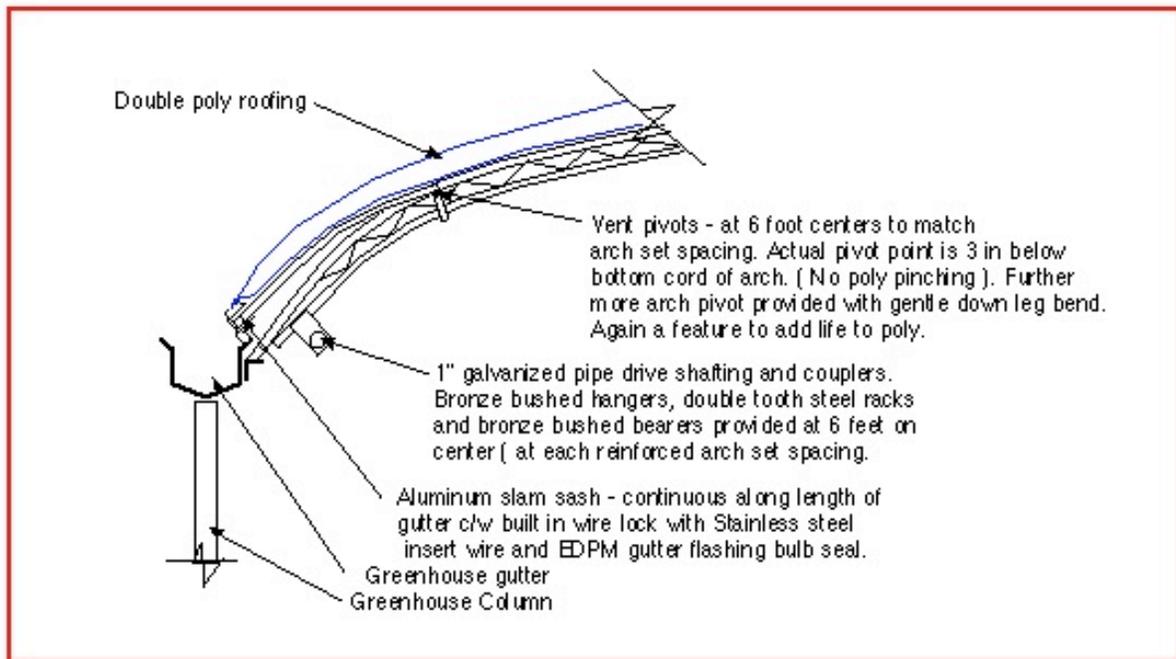
This vent is of similar configuration as our gutter vent with exception of vent wide and curvature on vent arms.

Reinforced arches shown are for 21 foot, 24 foot and 27 1/2 foot models. The 30 foot model is similar with exception bottom cord of arch carries through right to reinforced ridge bracket. See arch profiles.

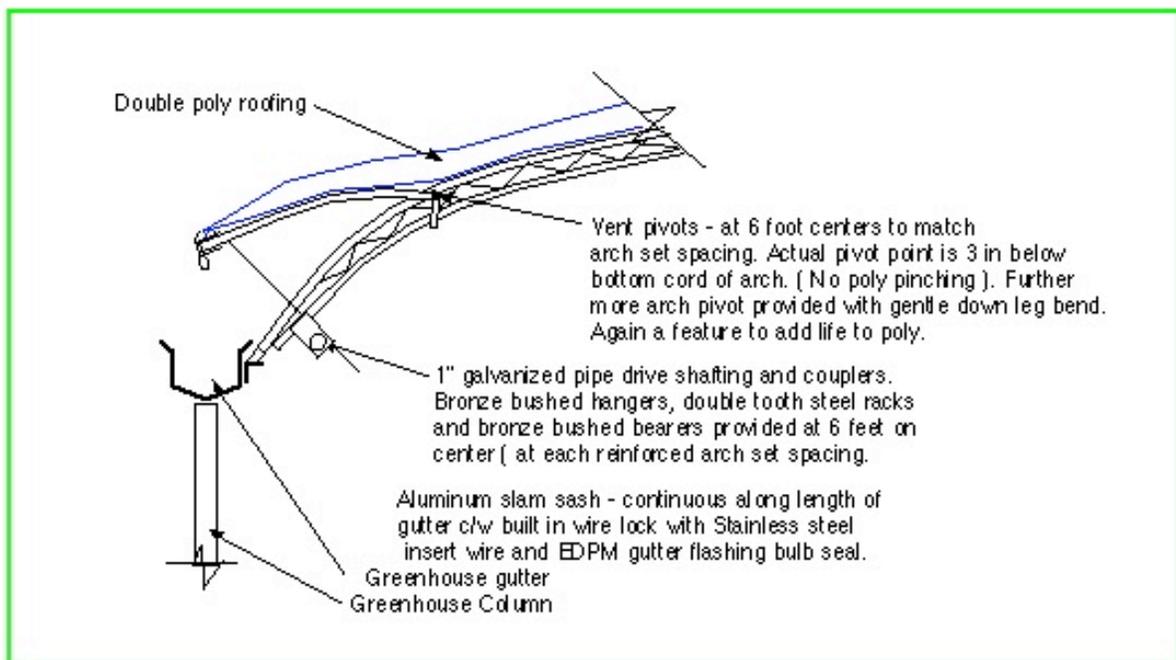
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Double Poly Gutter Vent Systems



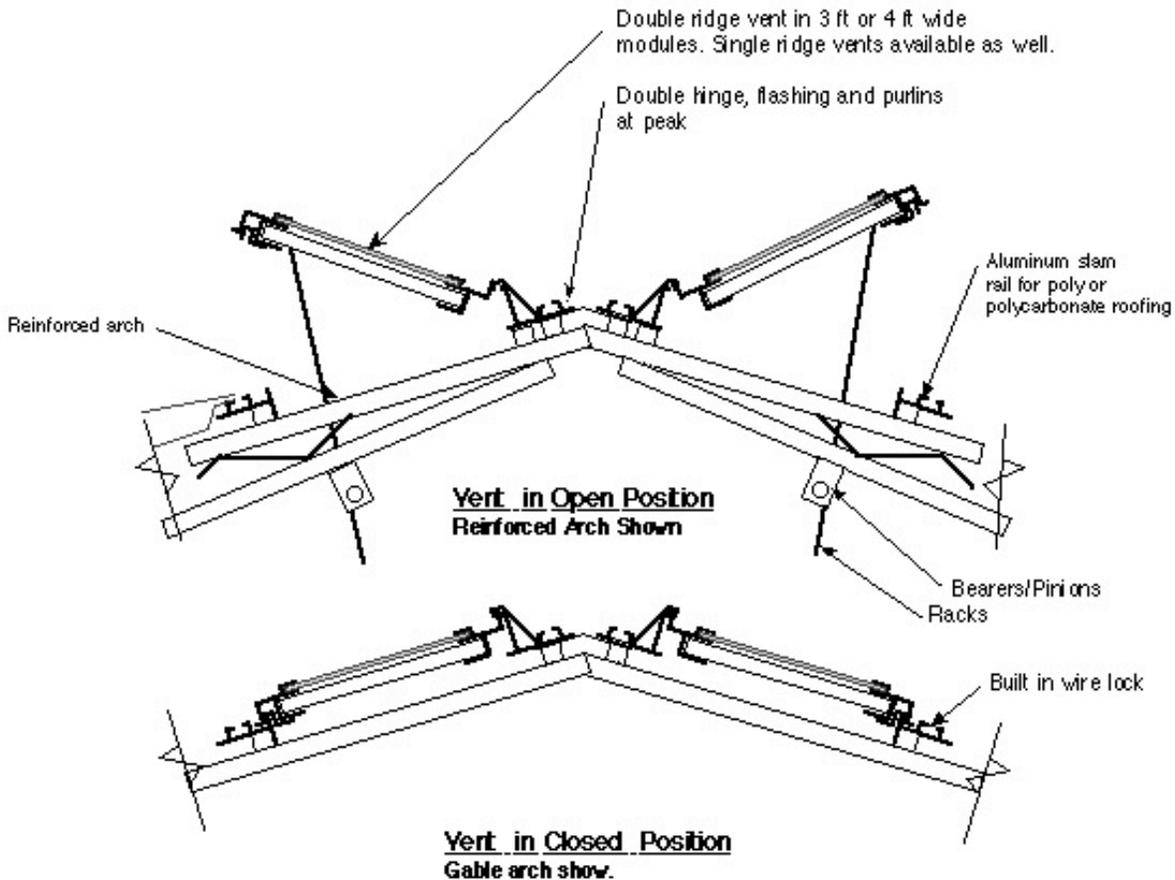
Vert. In Closed Position



Vert. In Open Position

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Ridge Vent Option



Ridge vents are available in modular lengths of 12 feet in 3 or 4 foot widths. They can be ordered in a single vents for double vents as shown above. Vent packages are comprised of aluminum continuous hinge, aluminum header and base frame, 1" square aluminum horizontals placed at 2 feet on center, aluminum side shields and gaskets, 6 mm polycarbonate cladding, aluminum slam rail with built in drip, 1 1/4" galvanized pipe shafting, racks, pinions and bearers at 6 feet on center. Vents come assembled in 12 or 24 foot lengths to suit order.

On special order the vents can be ordered without polycarbonate and provided with double poly package.

The ridge vents can also be used on any of our freestanding greenhouse structures.

On poly clad greenhouses ridge vents usually run the full length of the building. In snow belt areas ask for our snow dam option. This will save the roof poly from ice sliding off vents and tearing the poly.

Our double ridge vent provides 8" flashing on roof. This flashing provides a walkway for those that poly the roof. A real time saver, when it comes time to pull poly.

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Consultants, Suppliers and Installer to the Commercial Greenhouse Industry