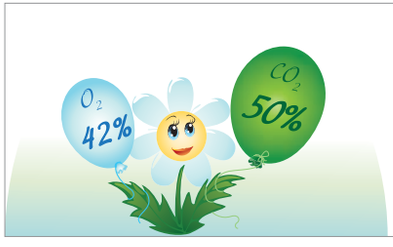
HYDROPONICS
VENTILATION BASICS

Importance of ventilation and environmental control in a grow room

Air movement, namely air supply and exhaust, is one of the most important aspects of any hydroponics installation which is often overlooked. Correctly ventilating your growing area is a vital part of greenhouse or grow room design. Adequate ventilation in the grow room is important for a number of reasons – temperature, humidity, disease and odour control, and fresh/stale air exchange.

Fresh air supply increases the amount of CO_2 which is needed for all plants to survive. CO_2 makes up approximately 50% of the dry weight of the plant, and oxygen makes up the rest 42%.

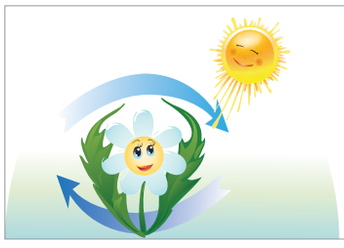


Plants require CO_2 to grow healthy

Negative impact due to lack of CO_2

The plants in any hydroponically grown crop will absorb the available CO_2 in a very short amount of time. Therefore, it is very important to supply fresh air to the plants to keep the CO_2 level from becoming too low and diminishing the crop yield. Low levels of CO_2 means slow growth and small yields.

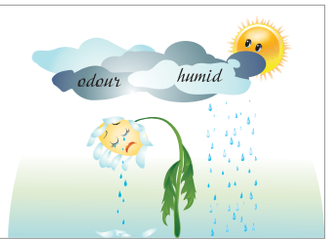
As well as increasing CO_2 nourishment level, the continuous supply and exhaust of air significantly reduces the chances of any disease to develop within a given greenhouse.



Regular air circulation provides constant grow

Diseases usually thrive and develop within environments where the air is still and humid. A humid, still environment allows disease to enter the plants through the build up of moisture on the leaves due to poor airflow and a lack of fresh air. If this is not controlled properly, the plants are likely to fail.

Still and humid air puts plants to death...



NOTE! However, this problem can be eliminated with the regulation of humidity levels using VENTS humidity sensors and temperature regulators which work in conjunction with all VENTS fans (see page 28–29).

Besides exhaust and supply of air within any greenhouse, good air circulation throughout the growing area is extremely important to minimize the potential damage caused by insects. One way to minimize insect damage is to install fixed or oscillating air circulation fan. This fan provides a continuous stream of air over the growing area making it difficult for insects to settle and damage the plants.

In summary, an efficient hydroponics air movement system will provide vital plant CO_2 nourishment, develop a strong healthy root system which enables the efficient supply of water and nutrients and minimize the damage caused by disease and insects.

Setting up your greenhouse

So, you have decided to deal with indoor gardening. Before you start we would like to tell you some basic rules you have to be aware of.

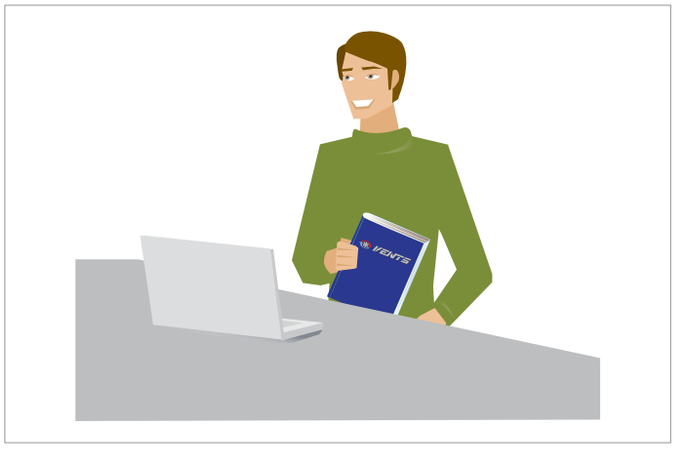
As soon as you selected where you are going to set up your indoor garden it's time to spec out exactly what you will need to make it all happen.

The design, selection and installation of any hydroponics ventilation system is therefore the top priority to ensure the healthiest and highest quality crop yields.

The calculations that are used to correctly design a ventilation system can be quite complex and require numerous known variables.

Here's VENTS' guide to setting up a basic, properly ventilated indoor garden on a budget.

The purpose of this brochure is to simplify these calculations while helping you to set up a greenhouse and to better understand ventilation in it.



This brochure shows the ventilation requirements for 2 lights grow room that are most commonly used.

Big rooms need lots of lights with a high-powered ventilation system whereas small rooms will only need a few lights with a low powered ventilation system. All sounds rather simple. But you should work out what exactly your room needs. **Here's what you need to consider:**

STEP 1: grow room size calculation

So, the first thing you need to do is accurately measure it – calculate the total volume of the greenhouse in cubic meters. You will need the length, width and height of the grow room. Use the simple formula:

Length x Width x Height = Volume of the greenhouse (m^3)
A x B x H = V (m^3)

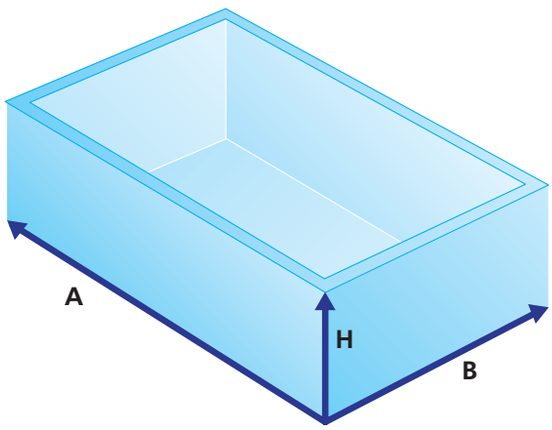


Fig. 1

As an example, your greenhouse has the following dimensions: length (A) – 3,65 m, width (B) – 2,4 m, height (H) – 2,5 m (Fig. 1).

V, m^3	=	3,65 x 2,4 x 2,5
	=	
21,9 m^3		

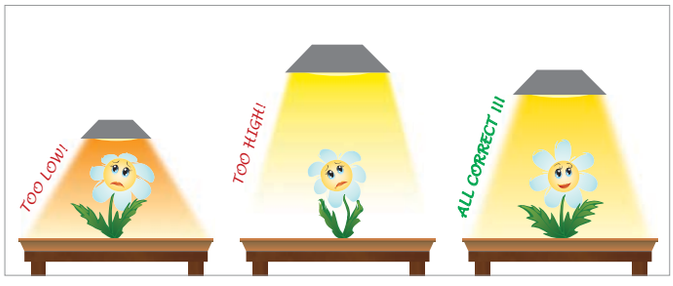
By the way, the more insulated your grow room - the better. A well insulated room will immediately lend itself to far easier environmental control.

STEP 2: lighting equipment selection

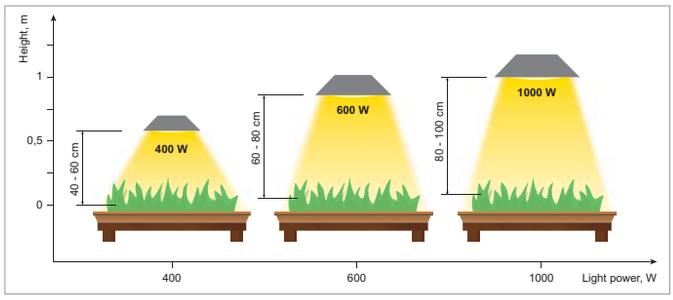
Now you know the size of the room you're working with and can calculate how best to illuminate it. Your mission is to provide your plants with all the light they need to grow and bloom, but you need to maintain your indoor garden's environment so that it is optimal for plant metabolism.

NOTE! Important thing to bear in mind is that the more powerful the light, the further away from the tops of the plants it should be.

This means that if you have a low ceiling height, you should consider using lower wattage lights. The example room has an 2,5 m ceiling height so we can use the 600 W lights, as long as the plants don't get bigger than 1,5 m. Indoor plants want to be short and wide to take the most of the light available.

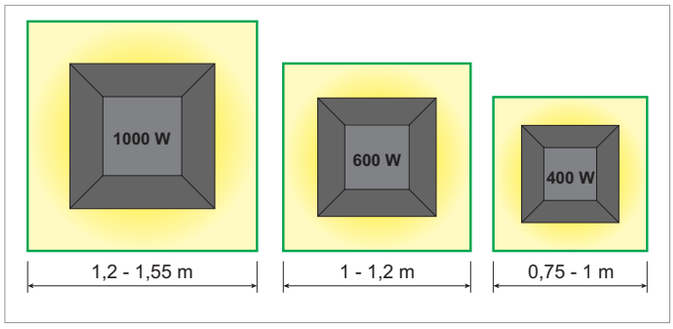


Recommended distance between the light and the canopy that most growers follow are:



NOTE! Bear in mind that the above information is for horizontally mounted lamps in normal open or closed reflectors. If you are using parabolic reflectors with vertically mounted lamps or air-cooled reflectors you can allow the light to be closer to the plants as there is less direct radiant heat.

The most commonly used light sizes for indoor growing are 1000 W, 600 W and 400 W. Each size light is suitable for a defined amount of floor space:



So the floor space available in the room is 3,65 m x 2,4 m. You could try and squeeze as many lights as possible into this room, but as well as being productive, you want to try and make your room easy and comfortable to work in. To do this you will need adequate access around your plants to make maintenance and inspections easy.

Approximately 0,66 m around your plants is a good working area (Fig. 2).

Fig. 2. Minimal distance between plants must be not less then 0,66 m.

Experienced growers may select considerably more space than this. In our example we're using 2 x 600 W lights (Fig. 3).

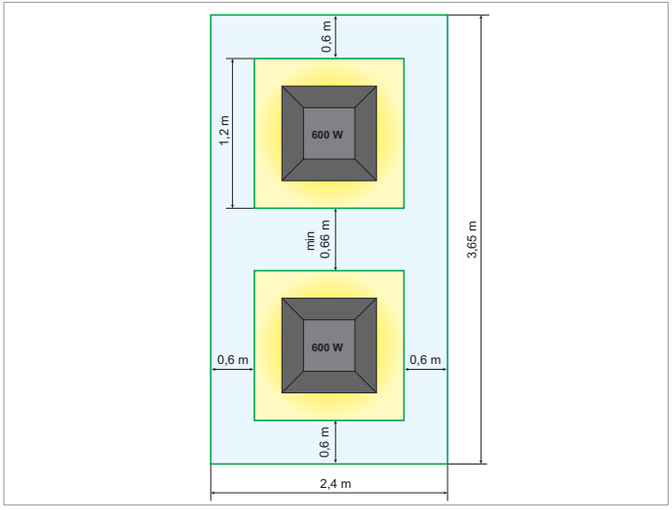


Fig. 3. Grow room plan with 2x600 W lamps. Grow room size is 2,4 x 3, 65 m.

If you want to make life difficult for yourself, you could fit a maximum of 6 x 600 W lights (Fig. 4).

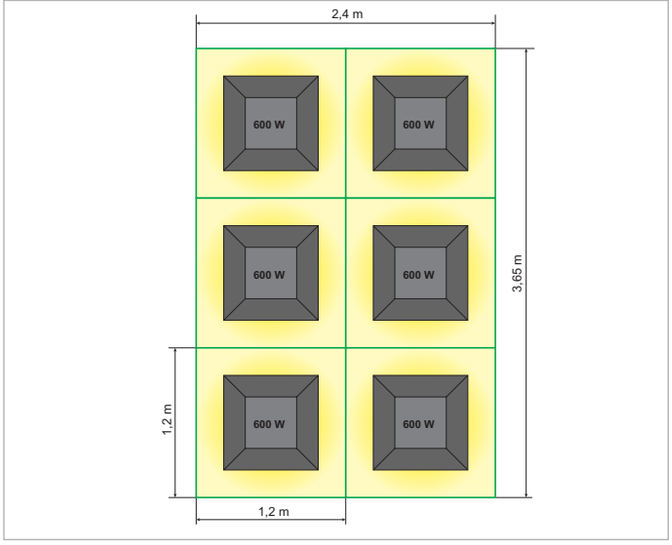


Fig. 4. Grow room plan with 6x600 W lamps. Grow room size is 2,4 x 3, 65 m.

In order to make this room work you would need to choose a growing system or technique that allows you to move the plants to gain access around the garden. This might be achieved by growing in pots/containers or movable beds.

STEP 3: ventilation equipment selection

Ventilation in your grow room comprises of two main factors: the removal of hot waste (CO_2 depleted) air and the input of fresh cooler air. Hot waste air is removed actively using an inline centrifugal fan VENTS VK series (the exhaust fan). Fresh cooler air can either be drawn in passive ventilation way (through vent-holes) or pushed in actively using an inline mixed-flow fan VENTS TT series (the intake fan), which you as well can use as an extractor.
Knowing the size of the room and the amount if light being used, you can work out the ventilation requirements rated in cubic meters per hour (m^3/h).

- **How to calculate size and air capacity of exhaust fan**

First of all, you need to find out what size of exhaust fan is needed. There are many ways to calculate the size of exhaust needed for a particular sized room, some formulas are more accurate, others are overly complicated – the following method is very popular and has served many growers well:

Required exhaust fan air capacity (m^3/h)	=	Volume of active growing area (m^3) x air changes per time unit (hour)	x	Carbon filter loses rate

NOTE! When we say the volume of the active growing area, we mean the volume occupied by the lights and plants.

To work out the volume simply multiply the length x width x height. In our example with 2 x 600 W lights this is 1,2 m x 2,4 m x 2,5 m, which gives the volume of the active growing area of 7,2 cubic meter.

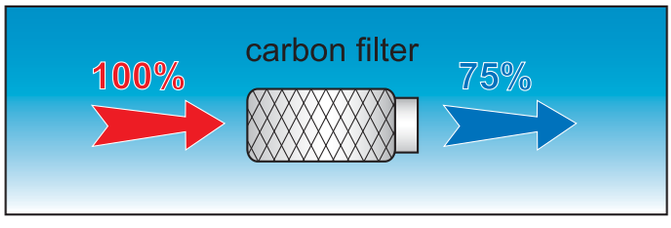
Once you have your volume, you need to multiply it by the amount of air changes needed per unit of time.

NOTE! For the majority of indoor gardens without air conditioning or supplementary CO2, the rule of thumb is one air change per minute.

So you need to multiply the volume of active growing area by 60 to calculate the amount of air changes needed per hour.

Finally, when using a carbon filter attached to the exhaust fan, expect a drop in fan efficiency by approximately 25%. This figure is not fixed and depends on the make and age of the filter, the length and course of ducting between the fan and filter and many other factors. To step up this efficiency drop of 25% - simply multiply by 1,25.

NOTE! Using a carbon filter drops in fan efficiency by approximately 25%.



If we run this equation through our grow room example, it gives us:

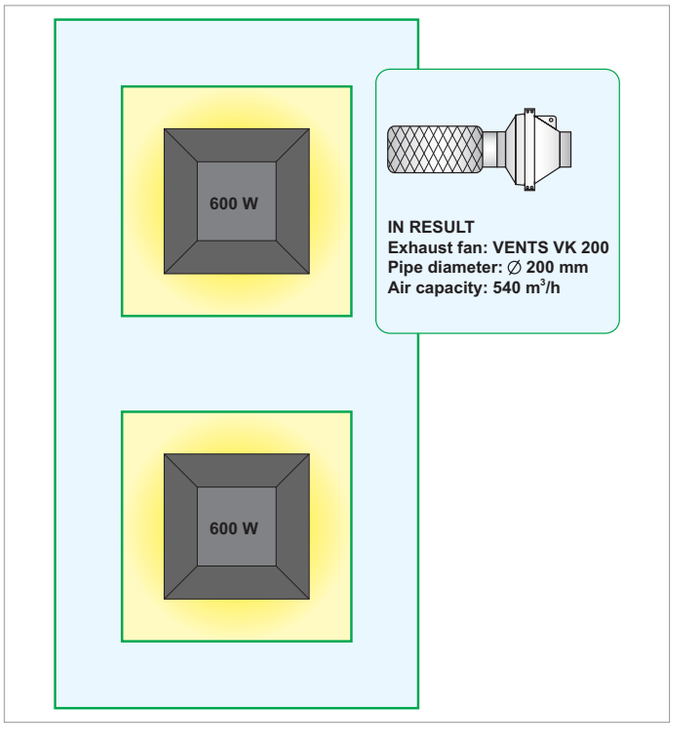
Required exhaust fan air capacity (m^3/h)	=	Volume of Active Growing Area (m^3) x 60	x 1,25

Required exhaust fan air capacity (m^3/h)	=	((1,2 x 2,4 x 2,5) x 60) x 1,25

=

540 m^3/h

This final figure is the minimum size of exhaust fan needed.



If the grow room is in a very well insulted location, such as a basement (Fig. 5), using this figure should be fine.

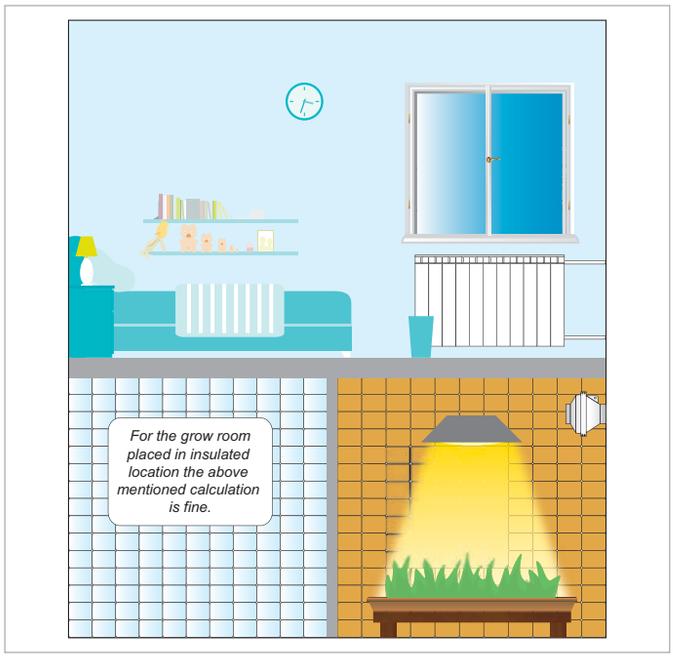


Fig. 5. Grow room located in basement.

If the garden is located in a very sun-exposed location, such as an upstairs bedroom or attic, then the exhaust fan size may need to be increased by approximately 25% (Fig. 6).

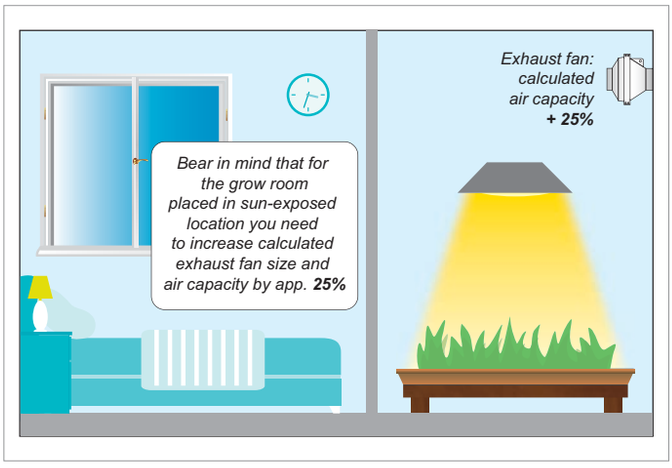


Fig. 6. Grow room located in bedroom or attic.

More often than not, you will have to match your required exhaust fan size to the nearest size available. In this instance the nearest widely available fan size is a 200 mm 780 m^3/h VENTS VK 200 inline centrifugal exhaust fan.

- **How to calculate size and air capacity of intake fan**

As mentioned above, your greenhouse must be ensured with continuous supply of fresh air from outside the growing area. This can be achieved in 2 ways:

First way:

Making passive ventilation (basically vent-holes) through which fresh air can be drawn in (through the open window)(Fig. 7).

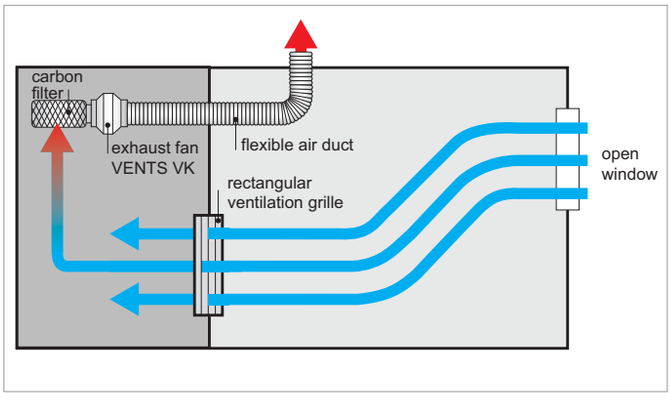


Fig. 7. Passive ventilation.

Note! As a rule, the passive vent-holes should be 2 to 3 times the diameter of the exhaust fan outlet.

This means that if the extractor has 150 mm diameter, the grow room will need 2-3 x 150 mm vent-holes or rectangular ventilation grilles with equal surface area. When installing passive ventilation, always have the exhaust fan at the opposite end of the grow room.

Second way:
Installing active inline fans that push fresh air into the greenhouse, which run more efficiently than passive vent-holes (Fig. 8).

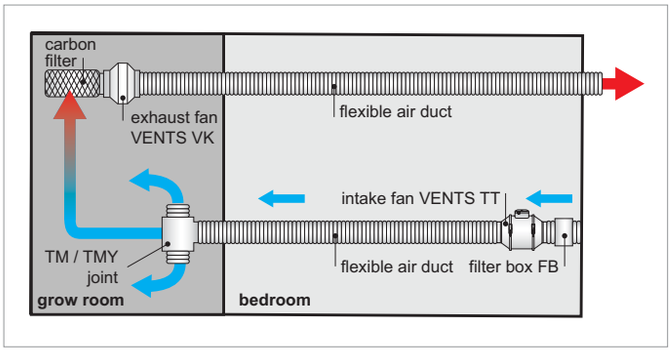


Fig. 8. Active ventilation.

By pushing in fresh air you're not putting much strain on the extractor fan and you also can choose where to pull the fresh air from.

During the cooler winter months its better not to pump in very cold air, but to pull slightly warmer air from inside your home (bedroom or living room), which is benefited being slightly higher in CO_2 (Fig. 9).

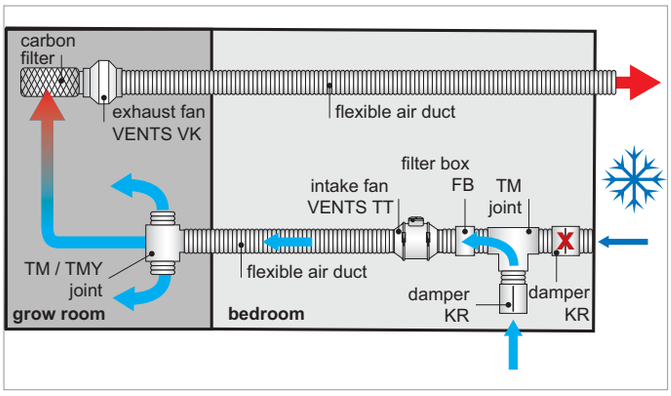


Fig. 9. Fresh air source in winter time.

During the summer months its best to pull fresh cooler air in directly from outside as air from inside your house is likely to be warmer (Fig. 10).

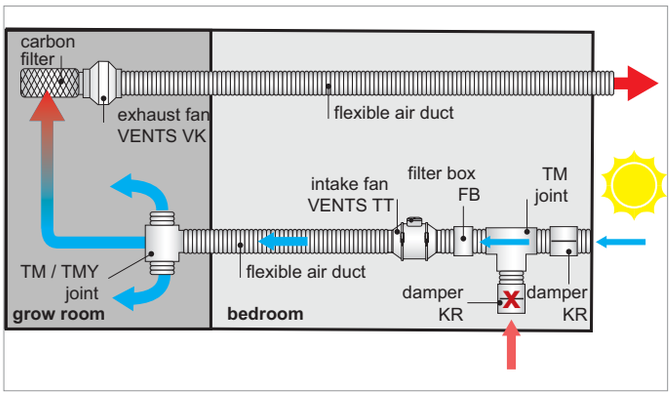


Fig. 10. Fresh air source in summer time.

Whenever you pull air straight from outside it's best to use an intake panel filter boxes ("bug screens") VENTS FB series (with flat filtering element) or VENTS FBV series (with V-filtering element, increased filtering area) to limit the possibility of sucking in pests. To prevent back draft of air use VENTS KOM spring-loaded backdraft damper series that opens when the fan turns on and closes when it turns off. This system gets installed in-line with VENTS Polyvent series or VENTS Isovent series flexible air ducting (Fig. 11).

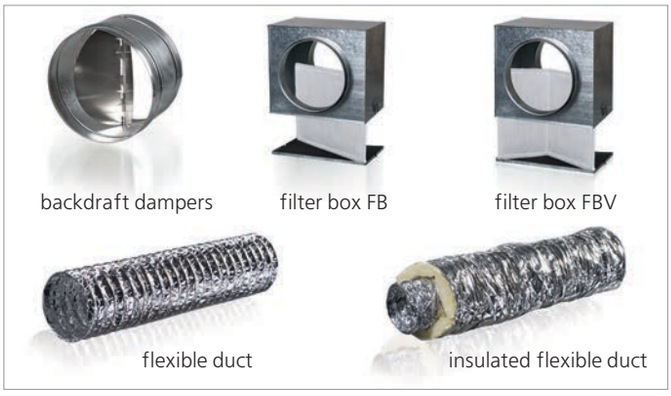


Fig. 11. Accessories (see page 30-31).

NOTE! When installing an intake fan make sure it's supplying in less air than is being removed by the extractor.

This creates a "negative pressure", ensures that all the air gets out through the carbon filter and does not strain both exhaust and intake fans. If you input more air than the exhaust fan can remove, the air will start to build up and cause a "positive pressure" forcing untreated air out of the grow room. So when selecting an intake fan it should have a maximum air flow capacity that is 10-20% lower than the actual output of the exhaust fan.

To find out the intake fan diameter you will need to take the exhaust fan size and apply an estimated reduction for the carbon filter - 25%. If our target for the intake fan is 15% less air than the exhaust we need to multiply the reduced output by 0,85. Below is a pattern through of how to size up the intake fan for the example room with 2 x 600 W lights.

Extractor VENTS VK 200 air capacity – 780 m³/h

Estimated extractor air capacity with carbon filter	=	**Extractor air capacity**	x	**0,75**	=	**585 m³/h**
Intake fan air capacity (with reduction to ensure negative pressure)	=	**Estimated extractor air capacity with carbon filter**	x	**0,85**	=	**497 m³/h**

For this intake air capacity the nearest widely available fan size is a 150 mm VENTS TT 150 fan or a 150 mm VENTS VK 150 fan.

NOTE! Installing the intake fan, make sure the exhaust fan is at the opposite end of the grow room.

It's better to split the intake air with a solid VENTS TM or TMY round duct fittings so that the cooler fresh air is distributed evenly. Also take into account that inline mixed-flow fans VENTS TT series are better at pushing than pulling air through ducting or a carbon filter (Fig. 12).

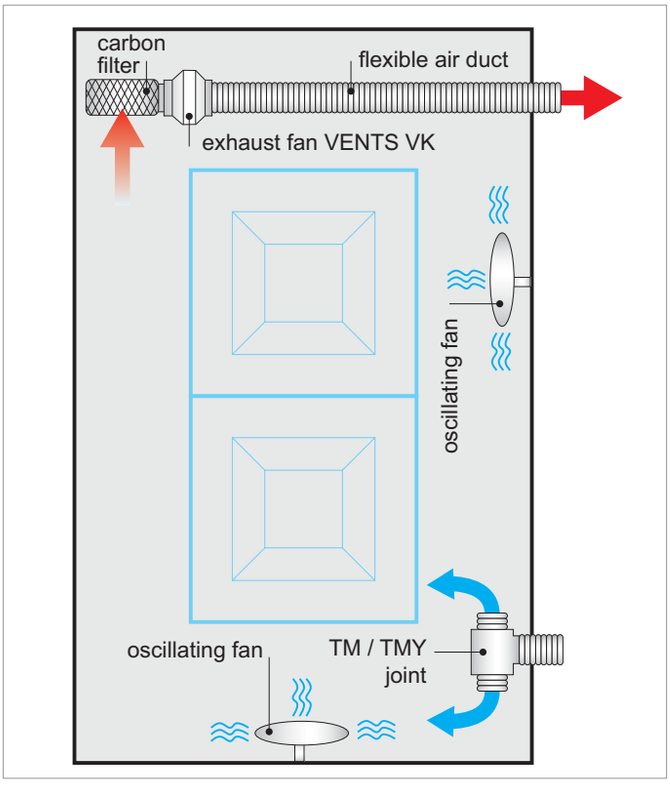


Fig. 12. Air distribution.

This means that when positioning your intake fan, it's better to place it nearer the source of fresh air and push it towards the grow room. To make the air reach the greenhouse efficiently, make sure the flexible air duct is smooth and straight.

Usefull advices to improve ventilation in your grow room

1. Position your intake fan low down, diagonally opposite the exhaust. Remember, you should mount your exhaust fan high up (Fig. 13). This will allow a fresh current of cool air to flow across your grow room, whilst removing any hot, humid air at the same time. When mounting your intake and exhaust fans, use the proper brackets to avoid vibration (VENTS TT and VENTS VK fans series are supplied with mounting brackets). You may also use fan holders VENTS PTT and VENTS PVK series.

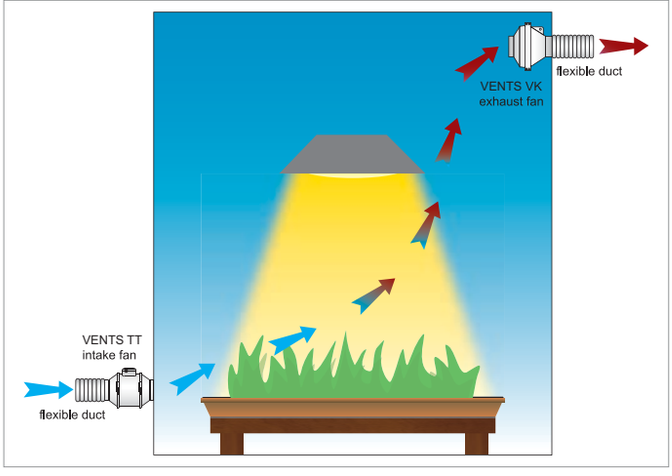


Fig. 13. Exhaust fan is to be installed diagonally opposite the intake fan for better airflow and hot&humid air removal.

2. Certain types of crop can cause bad odour. A professional carbon filter attached to the exhaust fan will help you to achieve 90-95% odour removal, meaning that just about any crop can be grown without comment. However, it's important to match the correct filter to your fan (Fig.14); odours have a measurable "dwell" time that needs to be met before they are completely absorbed. Therefore, a 750 m³ capacity exhaust fan will need a 750 m³ carbon filter. Don't try to use a lower capacity filter, it won't work!

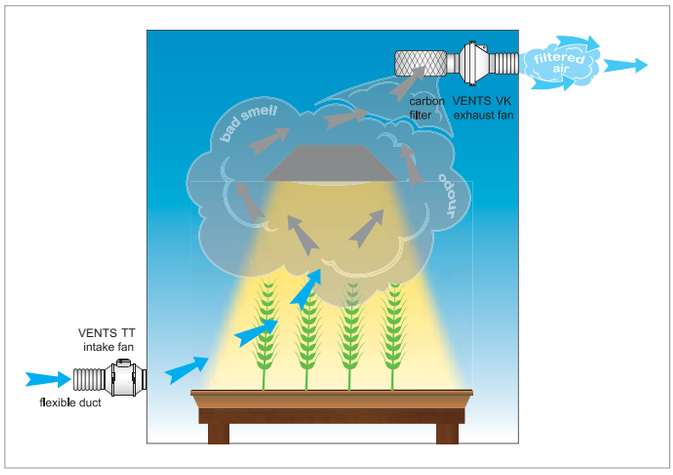


Fig. 14. Carbon filter absorbs any kind of bad odour caused by plants and some crops types. Extracted air stay filtered and odourless.

3. If the noise is a major concern, consider using acoustic flexible round ducting (VENTS ISOVENT insulated flexible ducting series). This can remove up to about a third of the noise generated by air turbulence. It's necessary to use at least one metre on both ends of the fan to get the full benefits. Using noise silencers, either rigid (VENTS SR series) or flexible (VENTS SRF or VENTS SRP series) is also a good way to reduce the noise (Fig.15). They can make it possible to run a ventilation system in a small domestic setting. Again, for full effect, fix a silencer on each end of your fan. This will help to reduce noise levels by up to a third.

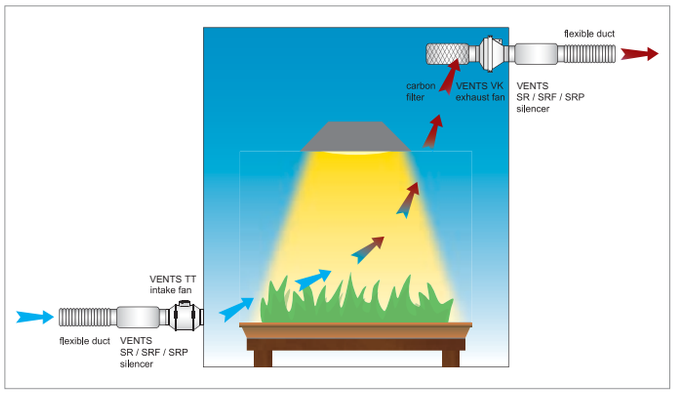


Fig. 15. Use of silencers (VENTS SR, SRF or SRP) and acoustic ducts (VENTS Isovent) considerably reduces the noise caused by airflow in ventilation system.

4. To achieve accurate climate control in hot and cold weather it's worth using fans with built-in automatic speed control module with built into the fan's duct temperature sensor (VENTS TT...U series and VENTS VK...U series) or with remote 4 m length temperature sensor (VENTS TT...Un series and VENTS VK...Un series) (Fig.16). Regular air changes are critical for good growth. A combined integrated speed control and thermostat will allow you to regulate the number of air changes per hour. It'll also com-

pensate for hot and cold weather by increasing or decreasing the air flow if necessary. Fans will run at a reduced speed continuously, only switching to full speed when triggered by the temperature sensor.

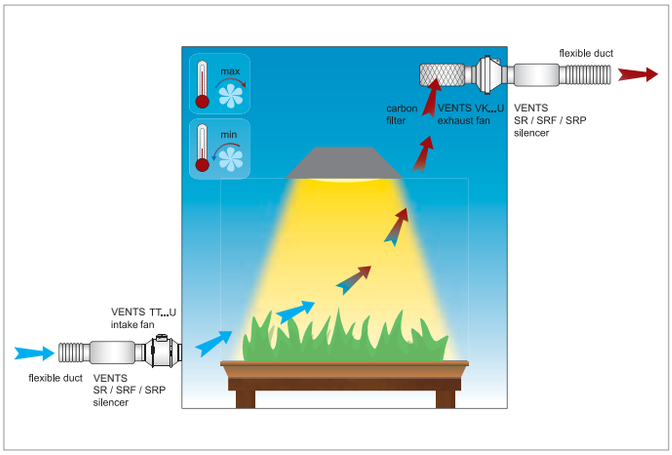


Fig. 16. Use intake fan VENTS TT...U and exhaust fan VENTS VK...U with speed and temperature control module to achieve better temperature and air quality conditions.

5. To ensure electrical safety and avoid unnecessary heat transfer, any equipment that generates heat should to be stored outside the grow room, on a shelf or any non-flammable surface (Fig.17-18).

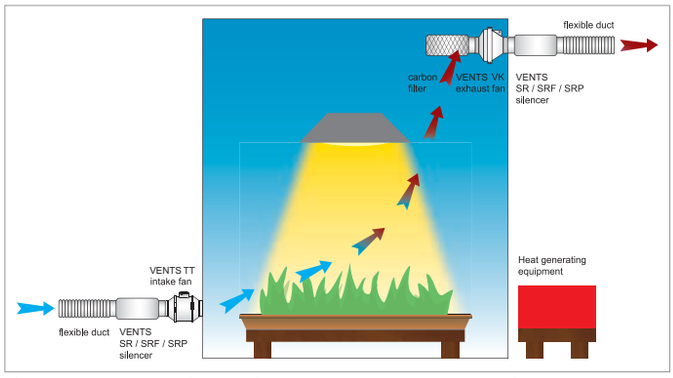


Fig. 17. Heat generating equipments must be stored outside the grow-room.

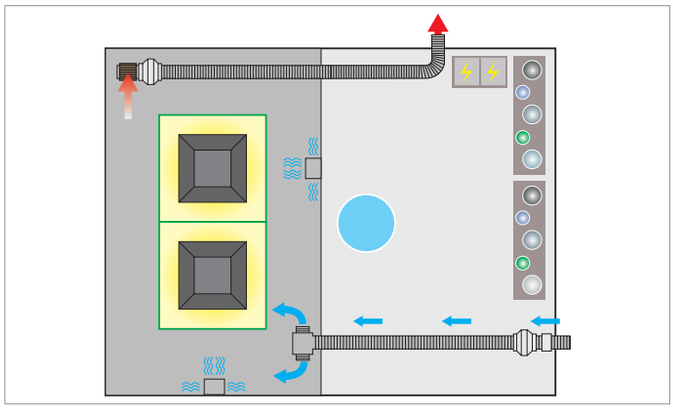


Fig. 18. Nutrient reservoir, any liquid nutrients, fertilizers and additives should also be outside your grow room.

Following the above principles you can construct an effective budget indoor garden yourself, suited around you, while creating the ideal environment for your plants.

All you need to do after is to choose a method to grow your plants: whether it's growing passively in plant pots, or using an active hydroponics system – all will flourish in your well planned indoor garden.

We wish you good luck!

With best wishes,
VENTS team