

profit from mooij

issue 4, October 2009



Profit from Mooij is our new email newsletter about the storage of potatoes and onions. It is a free monthly issue. As the storage technique is in full swing, there is a lot to tell and learn about it.

This issue deals solely with the subject of Sound and Noise because we want to publish this subject as a whole.

The 'silent' power of the fan system

Silence please

More and more we live closer together. New neighbours complain about the noise of the storage that was already there. New storage facilities need to comply with present noise regulations. We ourselves also like to enjoy a silent environment for work and living, if only to enjoy a sound sleep. Why then do fans make such a noise.



Fans produce noise

Fans produce noise because a lot of air is circulated at a certain pressure. The noise level is dependent on the multiplication of the amount of air and the pressure. This pressure is called Total pressure and results from static pressure and dynamic pressure.

Static pressure is the pressure needed to suck the air, press it through ducts, blow it in the product and then bring it outside. In case of clean potatoes in large grade, the static pressure will be low (about 100 Pa). In case of seed potatoes or if you dry seed onions, the static pressure will be high (300 Pa or more) and the fan needs to deliver the high static pressure. Dynamic pressure is the pressure dependent on the speed of the air in the fan. The increase is quadratic. For instance if the speed is 6 m/s, the dynamic pressure is 22 Pa; with a speed of 12 m/s, the dynamic pressure already amounts to 86 Pa.

The total pressure is the sum of the static and dynamic pressure. The higher the total pressure, the stronger the motor. Thus motor capacity is a good indication of the amount of noise produced.

Why indicate noise in dBA?

Noise consists of vibrations in various frequencies. Our hearing can only receive frequencies within a certain range. Volume of noise is indicated in Hertz. Noise measurement is done in various octave bands (frequencies) of 63, 125, 250, 500, 1000, 2000 and 4000 Hz. The octave band of 63 Hz gives a low tone and at 4000 Hz you hear a very high tone.

The A-correction (in dBA) compensates the sensitivity of the human hearing for the octave bands. We do not find a low tone of 63 Hz annoying, but tones between 500 and 2000 Hz are. Therefore the noise requirements are determined at for instance 50 dBA at daytime, 45 dBA in the evening and 40 dBA at night.

Practice

At night the outside temperature drops and your controller decides that this is the time most suited to switch on the fans. The motor gearbox starts working (unless the hatches jam) and opens the hatches gradually. Meanwhile the first fan starts working and the non return valves open with a bang. 20 seconds later fan 2 starts, the procedure demands 8 times as much current and the noise is much louder than during continuous operation. Now also a bang of the non return valves occurs. Maybe you have 10 fans? After a while it stops and peace returns. But, maybe after half an hour, or only ten minutes the orchestra in your storage starts all over again. Can something be done?

How to reduce noise?

Are there no silent fans?

Fans with a relatively large housing have a lower air flow resulting in a reduction of dynamic pressure. Then the Total Pressure reduces as well, with a lower volume of noise as a result of this.

The choice of impellor is important as well. The pitch angle of the blades is less with an impellor consisting of many blades than with an impellor with fewer blades. The air follows a less scooping blade longer and better, therefore producing less noise. Moreover an impellor with fewer blades produces a lower tone than an impellor with many blades.

Decrease of fan capacity by a partial stop

Naturally, the controller is equipped with block timers to prevent too much noise at night. But to stop everything during cold nights is heartbreaking. By switching on only half of the fans, the volume of noise reduces with only 3 dBA. If you switch of $\frac{3}{4}$, the reduction will be 6 dBA. The fan capacity will also be reduced to only 25 %.

Decrease of fan capacity by using frequency converters

We refer to page 4 where you can read how this energy saver also allows you to meet noise requirements, while you still ventilate most air.

Sound-absorbing hatches

If a hatch is used for inlet of air as well as of mixed air the hatch is mounted with the hinges on the upper side. With the position 'open' the angle of the hatch is 45 to 60° and the noise will be perfectly reflected outside. We deliver sound-absorbing hatches with perforated insulation panels with mineral wool inside. The noise will be absorbed and this results in less noise outside. Especially in case of newly built stores this is a small investment that reduces the volume of noise with up to 14 dBA!

Silencer on fan

We deliver cylindrical silencers mounted onto the suction side of the fan in various sizes and versions. The reduction of noise is adequate, but the investment is large.





Sound-proofing outer wall grid.

The outer wall grid has a sound-proofing version. The intake is less, so more surface is needed. See our website, air inlet and air outlet.

Architectural facilities

A lot can be achieved by architectural adjustments. The fan floor can be placed lower and the air intake hatches higher. Thus the distance between the noise source and the outgoing opening will be greater. It will be easier to build in sound-proofing facilities. The overhang can be lengthened so that it will be closer to the ground. Noise is produced at a lower level and will reach less far.

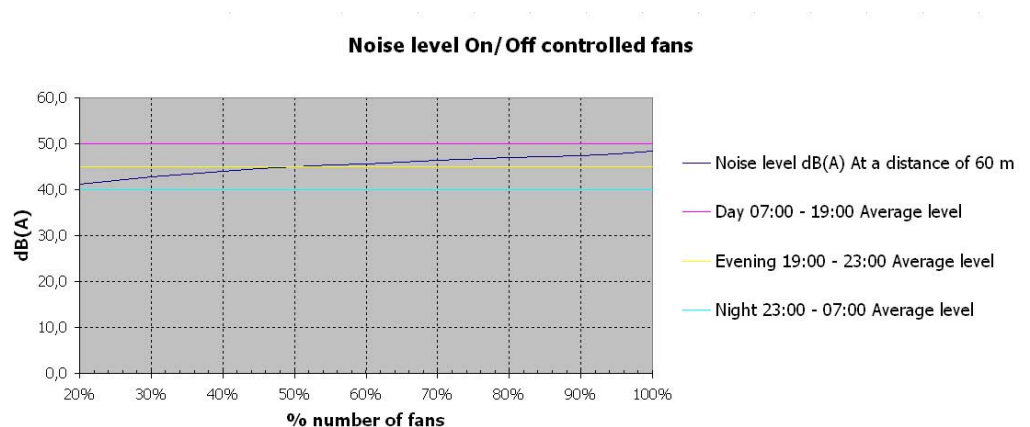
An earthen wall can be placed; the reach of the noise is less. Another possibility is to supply the walls of the pressure chamber with material that allows better sound proofing and restricts the reach of noise. A wall with sheet-piling profile is a fine resonance box. A mason or concrete wall admits less noise.



Meeting noise requirements

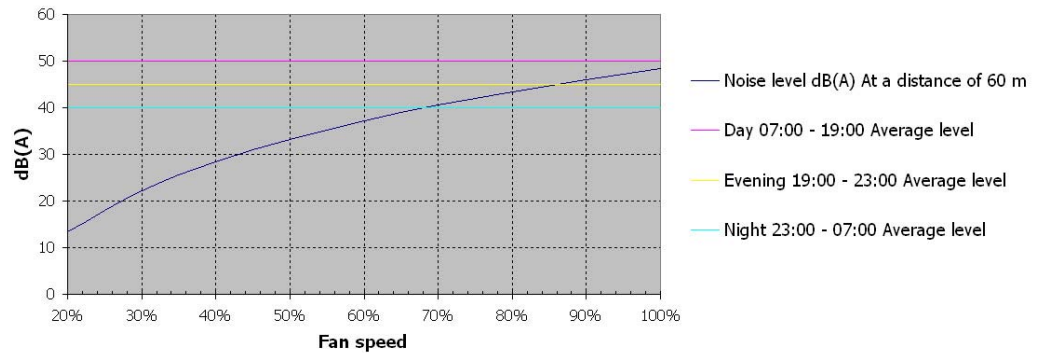
Noise requirements depend on the storage place and are different for daytime, evening and night. See below for an example, worked out for the storage of Mr. Kerkhofs in Maastricht The Netherlands. The measurement point is 60 meters from the storage. There are 6 fans with a 800 mm diameter and a 3 kW motor.

Underneath you will find a comparison between the on/off controlled fans and the fans that use frequency controllers.



Above you will see a graphic that shows the total volume of noise of 48 dBA at a distance of 60 m. De fans are switched on/off. To achieve 45 dBA, it is necessary to ventilate at 50%. This also means 50% of the amount of air. The requirement for the night (40 dBA) cannot be met. This can only be achieved if 10% of the fans are working. This means that per 24 hours, ventilation is allowed 12 hours at 100%, in the evening 4 hours at 50%, and at night zero hours with 0%. Assuming that the outdoor conditions are favourable for cooling between 19.00 and 09.00 hrs, 4 hours (of the 14) of 24 remain available at 100%.

Noise level frequency controlled fans



Above you will find a graphic showing the same total volume of noise of 48 dBA at a distance of 60 m. Frequency converters have been used. In order to achieve 45 dBA, ventilation at 86% is necessary. This also means 86% of the amount of air.



The requirement for the night is met if 68% of the capacity is ventilated. In other words, per 24 hours, 12 hours at 100%, in the evening 4 hours at 86% and at night 68%. Assuming that the outdoor conditions are favourable for cooling between 19.00 and 09.00 hrs, 10,9 hours (of the 14) of 24 remain available at 100%. This is two and half times as much.

Projects with sound proofing

We realized many projects in which it was very important to meet noise requirements. Our fans are not noisier than others. Our storage computer is fully equipped to use each period at the fullest. Our calculation of the volume of noise can be used with your inquiry.

If you have any questions about noise in and around storage places, we are happy to be of service. All issues of **Profit from Mooij** can be downloaded at our website. Look at www.mooij-agro.nl/News.

Do you have any remarks, additional information or do you want to share experiences, please let me know. Would you like to learn more about this subject, please contact me.

Kind regards,
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