

Textile Diffusers - Novelties in Technology, Myths in Practice

Text was published in technical article VVI (number 5/2004).

Number of significant producers of textile diffusers is growing; we can find more than fifteen of them just in Europe, and production of the diffusers is increasing. This fact proves expedience of the way of air distribution. Considering the expected EU directive concerning regular cleaning of air-conditioning tube intake branches installed in public buildings, there will probably be even more significant growth. In this article I would like to describe the last novelties, and try to clarify some of the myths.

Which is not true without any doubt

1. It seems unbelievable that I heard a renowned specialist in air-conditioning saying contemptuously that textile diffusers removed after a few years of operation are full of dirt inside. However, we are really unable to prevent it. Use of a perfect filter (EU 7 or better) may only reduce soiling. On the other hand, textile diffusers work in the same way as traditional tubes. Their great advantage is their possibility to be removed easily and quickly, they may be cleaned easily and perfectly, and their reinstallation is also very easy. This is not of little importance; it is even a fact of essential nature. Whether a tube, no matter whether made of textile or plate, is clean or it reminds you of a substrate suitable for development of a bacteriological weapon, it depends on the equipment attendants. In many cases we can say that it "sadly" depends on them.

2. On the other hand, some of the keen backers of the textile diffusers insist on the fact that the special woven fabric prevents growth of bacteria inside the diffusers. But this is not true either. Thanks to their composition, antibacterial materials are able to kill any bacteria they get into contact with, but unfortunately such the woven fabric gets dirty quickly. And such the dirt layer prevents direct contact with the material. Then, germs occur on the antibacterial material in the same amount as on a common synthetic woven fabric. But it is of essential nature for a textile diffuser of high quality that the germs don't destroy the material used or it doesn't serve as their food supporting their rapid reproduction. The woven material used should be man-made, because natural materials accelerate reproduction of the bacteria.

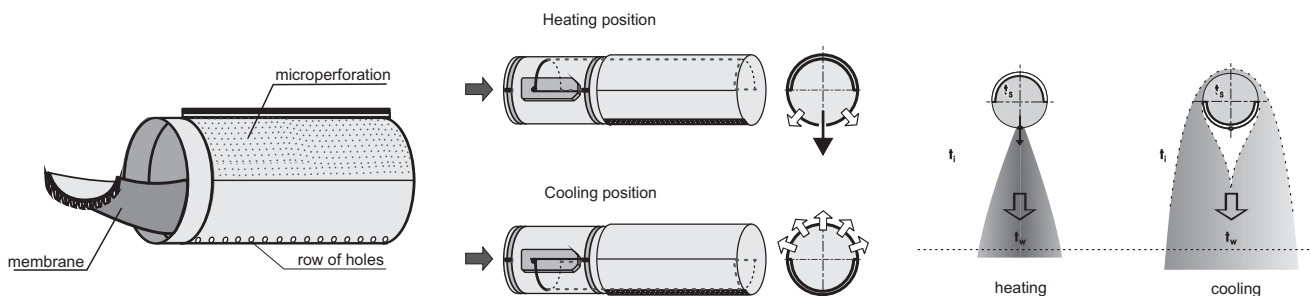
3. People are quite often afraid of appearance of the diffusers that are out of operation. They fear that workers will mind the deflated tube or it will even damage the working environment. But experience is quite different, and I never encountered such the reaction. The swollen tube signals to the workers that necessary amount of air is flowing to them and vice versa. They only should be aware that any other installed systems should not be hit with the deflated, simply hung diffuser. In this context I would like to mention another speciality. When the fan is switched on, the effect of "a dog running to a fence" occurs in the longer diffusers. This very special term was thought out by employees of a wine warehouse in France. Immediately after the fan is switched on, a wave comes through the tube, and sounds are heard that may remind you of a dog trotting if you have necessary imagination. The blinded end stops the wave, which produces a characteristic banging sound, and that may remind you of a hit in a fence. But to be serious, the sound may represent complications in some kinds of production. If it is heard unexpectedly, which is usual if the fan is started using a thermal detector, some people may be frightened. If they are engaged in activities demanding their attendance, it may be unpleasant. In such the cases switching the fan on and off should be designed in some other way.

4. Production of the textile diffusers started either from perforated breathless materials or air permeable materials without any orifices. Air is spread with minimum speed (usually about 0,1 m/s) from the most frequently used air permeable material. Probably thanks to this a point of view occurred that a current range in the textile diffuser is low, and it occurs only thanks to current thermal properties. Use of perforated air permeable woven fabrics has been growing rapidly for about the last three years. Orifices with various diameters cut using laser allow reaching unexpectedly high current range. For example, if diameter of the orifices is 10 mm and they are located in one line with pitch 20 mm, isothermal current and overpressure is 100 Pa, we may obtain 0.5 m/s in the current axis even further than 10 m from the diffuser! Grouping of the orifices and their diameters are very important. Using computer programs and calculation methods based on hundreds of trials, air current may be calculated with the similar accuracy as in the case of the traditional diffusers. It is obvious that every material has its specific constants, and what's more, they depend on the technology of the orifice cutting. In other words, which is true about one producer or one type of fabric, needn't be true about the others. In the case of very high requirements for rate of flow, close cooperation with the producer is always very important. Effect of temperature differences is also of essential importance.

5. Especially among the “coolers” the point of view is spread that textile diffusers also filter air, and that is why the traditional filters are not necessary. Others suppose that if we use the EU 7 filter in the unit, the diffuser material (that represents approximately EU 6 filtration level) won't soil. Dust receptivity of the woven fabrics used in production of textile diffuser is very low if compared with the traditional filtering materials. That is why they become choked much more quickly. It may happen that in dusty environment the diffusers are blocked within two weeks. On the other hand, even higher level of filtration won't prevent choking of the diffuser woven fabric; it will only be decelerated. I think that the best way is to choose a compromise, and to use the EU 5 filtration. Such the filter does not increase pressure loss and the equipment price very much, and it ensures proper filtration. In practice, use of filter is expedient for about a six months' washing interval. Use of the orifices in the fabric is a great method how to reduce the susceptibility to choking. If we choose the appropriate diameter and direction of the orifices, we obtain optimum results from the point of view of both flow and the washing interval.

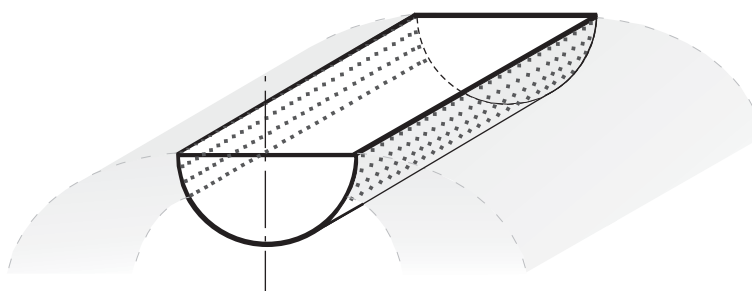
Producers' new trends

1. Membrane diffuser. Use of breathless membrane dividing longitudinally the diffuser into upper and lower halves may solve the contradiction between requirement for cold air dispersion and warm air rectifying. We will be able to achieve efficient heating and draughtless cooling only thanks to use of a single unit. A special flap with a servomotor is a part of the unit, and a detector or a pushbutton signals it to switch over heating to cooling and vice versa. When heating, the membrane covers the upper part of the diffuser, and air flows down through lines of the larger orifices to reach operational area. When cooling, the orifices and the whole lower part are covered with the membrane. Air is then rectified through the upper part, which is usually free of larger orifices.



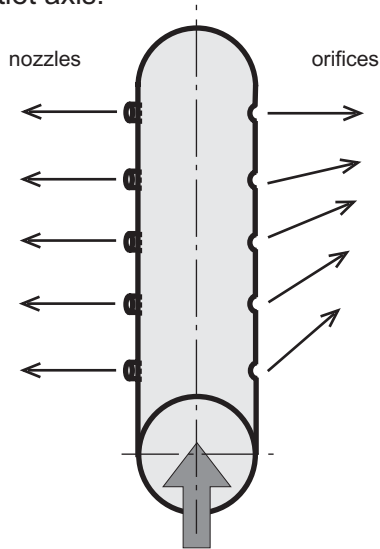
1. Principle and implementation of a membrane diffuser

2. Microperforation. This method of woven material finish modifies substantially the way of obtaining higher air permeability. Some time ago producers used a few types that were available in several grades from 50 up to 2000 m³/h/m² at overpressure 120 Pa. In practice, they chose the type, which was the closest to the calculated air permeability. The new method consists in use of a single material with minimum air permeability (30 to 60 m³/h/m²), and the material is adapted by punching a huge number of small orifices. The number is about 16000 orifices, diameter of which is 0.4 mm if we want to obtain air permeability 100 m³/h at 120 Pa. The number of orifices is really huge if we take into consideration quite frequent necessity of air permeability above 1000 m³/h/m²! A perfect and quick-acting machine for fabric adaptation is necessary for this operation. In spite of the fact it seems that the method will be very requested in the future. It will enable to lower the price of the product, because instead of a special and expensive woven fabric we will be able to use a common one, adapted using the appropriate equipment. And at the same time, we will be able to modify the air permeability both in length and in perimeter. The microorifices also prolong the maintenance interval. Customer will receive equipment dimensioned exactly according to its requirements for airflow.

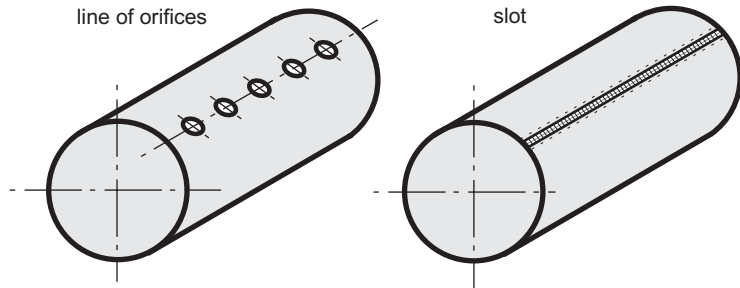


2. Possible arrangement of a diffuser with microperforation

3. Plastic nozzles. Use of plastic tubes with diameter approximately 10 to 20 mm fixed in the woven fabric may continue to increase the current range. Their suitable shaping may also eliminate the outlet bevel due to flow rate compounding parallelly with the axis inside the diffuser, and perpendicularly to the outlet axis.



3. Comparison of air outlet from a line of orifices and nozzles



4. Line of rectifying orifices and slot of a sieve

4. Orifices in air permeable woven fabric. As we noted above, this may prolong periods between maintenance operations, and direct or disperse air in the most suitable way. We expect that the lines of orifices soon replace slots that have been produced so far by sewing in sieve strips longitudinally into the diffusers. The new method is cheaper and more aesthetic, and performance remains the same.



1. Textile air distribution in the kitchen



2. Draughtless cooling in the office

It is obvious from what was stated above that continuous improvement can be seen in this area, and quite new solutions are developed. Harsh competition of the leading producers is the driving force of the process. And customers may be happy, because they will be the first to profit from the development. And based on my own experience, I guarantee that there aren't any "cartel" agreements in the area. Writing the article I got into conflict of interests, because the textile diffusers are made by my firm, and e.g. the microperforation method is my proprietary solution. I tried to be unbiased as much as possible, and I would like to point out that I welcome any discussion or polemic.



3. Even cooling in the flower warehouse