



# 3Mä Medical Specialties

## Frequently Asked Questions

July 2003

### POROSITY vs. MVTR

3M Medical Specialties is the trusted source for quality medical tapes. The terms Porosity and Moisture Vapor Transmission Rate (MVTR) are typically used to describe the breathability characteristics of a medical tape and define how the product is likely to perform when applied to skin. At times there is confusion as to the meaning of the two terms and this document will help clarify the difference.

#### What is Porosity?

The porosity of a tape is a direct measure of how well air flows through the tape. It can also be thought of as a measurement of a material's resistance to airflow. It does not describe how moisture might flow through the material. Typically, a tightly woven material will offer more resistance to air flow than a loosely woven material. In other words, porosity is a measure of how fast air passes through a material.

#### How is Porosity measured?

Porosity is measured in terms of the time it takes a fixed volume of air, at a fixed pressure, to pass through the test sample. A material possessing good breathability will have a shorter time than one that is not as breathable.

#### Test method summary for Porosity measurement

Porosity is measured by using a piece of equipment called a Gurley. The Gurley consists of a leak proof air reservoir of known volume. A piece of the test sample is clamped with an air tight seal against the mouth of the reservoir. The air in the reservoir is then forced through the test sample at a constant pressure. The time to move the air through the test sample is measured.

The porosity is calculated per unit area of the test material. It is typically reported as seconds/100cc/square inch. In other words, it is **the time required to move 100 cubic centimeters of air through 1 square inch of the test material**. Thus, the shorter the time the higher the porosity (as in a loosely woven or a non-woven material) and the longer the time the lower the porosity (as in a tightly woven material or polyolefin film). For materials that are very porous, the time is so short that it cannot be measured accurately so it is reported as <1 second. The lower the number, more porous the material.

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### What is MVTR?

MVTR is a measure of the amount of moisture vapor that will pass through a material in a given time. This includes moisture passing through the pores as well as that permeating or diffusing through the nonporous part of the backing. MVTR is a good indicator of the amount of moisture that evaporates through the material of a skin patch or dressing, which affects the comfort level as well as the long term wear properties of the material on skin. The moisture may come from sources such as sweat or a weeping wound.

### How is MVTR measured?

MVTR is measured in terms of the weight of moisture lost through a known area of the test sample in 24 hours, when kept under controlled temperature and humidity conditions. A higher loss number means higher MVTR.

### Test method summary for MVTR measurement

Two general methods may be used for testing MVTR. One is the bottle method and the second is the 'inverted MVTR method'. The inverted method is only used with materials that are waterproof and prevent leakage of liquid from the test cup. Most medical tapes are tested with the bottle method.

In the bottle method, 50 ml of water is placed in the test bottle and the test sample is clamped onto the neck of the bottle with a specially adapted bottle lid that seals tightly with a sealing ring. The lid has a standard sized hole cut in it that allows the moisture vapor to pass through it.

The sealed bottle is weighed and placed upright in a humidity controlled oven at 40° C and 20% relative humidity. After 24 hours the bottle is removed and weighed again and the weight of the moisture lost is recorded. Knowing the exposed area of the test material (equal to the hole size in the lid), the amount of moisture lost per square meter of the test material is calculated.

**The results are reported in terms of the weight of the moisture lost in grams per square meter per 24 hours ( $\text{g}/\text{m}^2/24\text{hr}$ ).** The higher the values, better the vapor transmission.

For waterproof films or water absorbent materials such as hydrocolloids, the 'inverted MVTR' method is used. The two methods are fairly similar in the sample preparation. 20 ml of the test liquid is added to a specially designed aluminum cup and the test sample is clamped to the mouth with a securing ring. The sealed cup is weighed and then placed in a 40° C, 20% relative humidity oven for 24 hours. However, in this case the cup is inverted when placed in the oven such that the liquid is in contact with the test sample. The cup is weighed again after 24 hours and the weight of liquid lost is measured. The results are again reported as the weight of moisture lost in grams per square meter per 24 hours ( $\text{gm}/\text{m}^2/24\text{ hrs}$ ). The higher the number, better the vapor transmission.

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### An example:

Some materials can have both, good porosity and good MVTR and yet be water resistant.

The following picture graphically demonstrates the difference between porosity and MVTR. In the left side container the fish is alive and well, indicating that air is getting into the chamber even though the water does not leak past the test material. The right side container of the picture demonstrates that even though the test material did not allow water leakage, it allows water vapor to escape from the material as the liquid is heated.



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