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# MACHINE DESIGN

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# Even containers gotta vent

**The right kind of packaging vents can eliminate expensive maintenance and regulatory issues by letting off a little pressure.**

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Collapsed or bloated containers, condensation, damaged labels, and containers that simply refuse to open have one thing in common: They're bad for business. Package redesign may seem the obvious solution. But many engineers do not realize these problems stem from pressure differences that create vacuums in sealed containers.

For over 25 years, thermally stable ePTFE membranes have satisfied a wide variety of airflow and liquid-resistance needs in the packaging industry. But as companies continue to regard safety and brand appeal as growing priorities, both nationally and globally, membrane vents are becoming even more vital.

For the consumer side of the packaging segment, brand appeal at point-of-purchase is critical. And for industry, the issue of safely transporting chemicals and other goods is a major concern. So more and more companies are turning to venting to solve packaging issues.

These membranes have been incorporated into vents for containers



**Pelican Products Inc., Torrance, Calif., uses custom-designed pressure-equalization membrane vents to prevent vacuum lock in high-impact, watertight equipment used by the military. When a soldier hits the ground after an airdrop, he doesn't have to wait for the pressure inside a case to equalize. The membrane helps maintain equal pressure so he can open it immediately, no matter the altitude from which it descended.**

as small as 50-ml pill bottles and as large as 55-gallon drums. They are used in housings for small handheld glucose monitors and large commercial Wi-Max equipment.

## **ALL THINGS BEING EQUAL**

The simplest way to equalize pressure inside a container is to put a hole in it. Of course, this solution can cause even bigger problems. The packaging engineer's challenge is to equalize pressure without hurting the contents or causing leaks or spills.

A vent containing expanded poly-

tetrafluoroethylene (ePTFE) is an economical and reliable means of equalizing pressure. This chemically inert membrane lets air flow in and out freely, continually equalizing internal pressure. At the same time, surface properties of the membrane prevent liquids with both high and low surface tension from passing through, thus keeping out contaminants and avoiding leaks. Oleophobic ePTFE membranes repel liquids with low

**Edited by Patrick Mahoney**



**Vented liners offer a tight seal and enhanced security.**

surface tension, such as oil, soaps, and alcohol.

### CHEMICAL PACKAGING

Leaks, spills, and damage to packing labels can bring problems with regulatory compliance. Agencies such as the United Nations and DOT insist that chemical packaging retain full integrity. But outgassing from peroxides can cause bloating. And organic solvents, because they consume air, can collapse containers.

In these cases, engineers often make container walls thicker or reduce the amount of active chemicals within. They may also change the manufacturing process, for example, by replacing oxygen in the container with nitrogen. But

**Pressure can cause containers to bloat or collapse.**



**Bloated Normal Collapsed**

making containers thicker boosts costs, and using nitrogen, which requires an additional step, is not reliable.

The two major factors in choosing an ePTFE membrane for liquid or chemical products are surface tension of the product and the amount of gas it releases.

There are significant differences in airflow and liquid-resistance performance in membrane vent materials. The product's chemical properties dictate the choice of membrane. Caps and closures typically integrate vents through the insertion of a plastic molded component or liner with membrane attached. Induction liners are made with an aluminum foil seal that can be high-frequency induction sealed. Pesti-

cides and fertilizers often use induction liners, which offer a tight seal and more security.

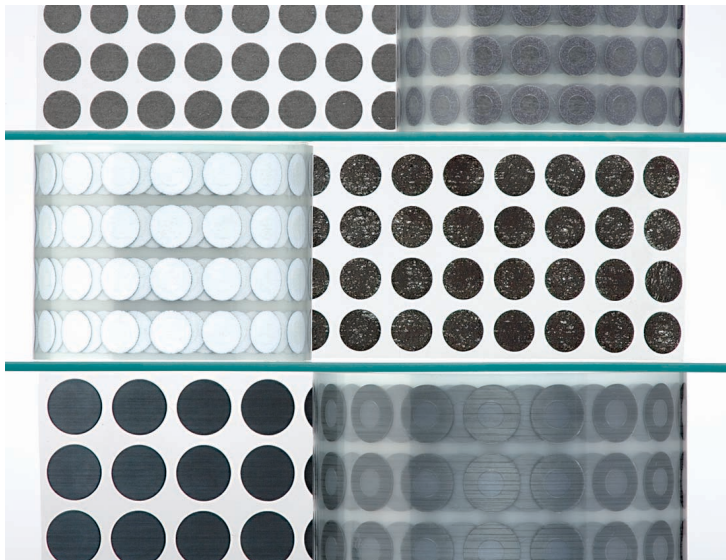
Using ePTFE membranes can also improve productivity. The free exchange of air lets manufacturers hot-fill and seal containers immediately. As a result, filling lines can run hotter, less-viscous liquids at faster fill rates.

### TRANSPORTATION CHALLENGES

It's not unusual for 80% of liquid containers to collapse in response to drastic pressure changes. This was the case with one agrochemical company before it began using vented caps. The switch essentially eliminated the problem. Venting also let the same company cut the weight of its 1-liter HDPE containers by 25%. The company had previously tried to correct the problem by making thicker containers, without success.

Containers, whether metal or PET, equalize pressure by drawing in air, which can damage seals and contents. Cargo travels in aircraft bellies, tractor-trailers, and freight cars, none of which are pressurized. And engineers don't always consider the varying temperatures and climates packages will be exposed to. Some products are shipped several times. They can sit in the hot, dry sun during the day and cool, moist air at night.

The advantages of ePTFE vents go beyond transportation issues. Such vents satisfy IP



**Low-profile adhesive vents, here shown on a carrier roll, work well when space is limited.**

immersion standards, United Nations, and Dept. of Transportation packaging requirements, as well as static-pressure and drop testing. IP ratings determine how much water pressure an enclosure can withstand and, therefore, the strength of the membrane.

Molded metal, plastic, and adhesive vents often come on carrier rolls. While plastic vents work for most applications, metal vents suit the harsh oil and gas-industry environments. Adhesive vents, with their low profiles, work where space is limited. They can slide into the cap or adhere to the outside or inside. To install adhesive vents manually, the vent is placed over the vent hole in the housing. Light finger pressure applied to the adhesive ring seals the vent. High-volume applications often use automation. When handling vents, manufacturers recommend using gloves and tweezers to ensure mounting surfaces are free of oils, particles, and other contaminants. Molded vents can be snap-fit, threaded, bolted, adhesive bonded, or heat/ultrasonic welded into place. **MD**

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