Don't Forget to Breathe: A Discussion on Desiccant Breather Use & Application

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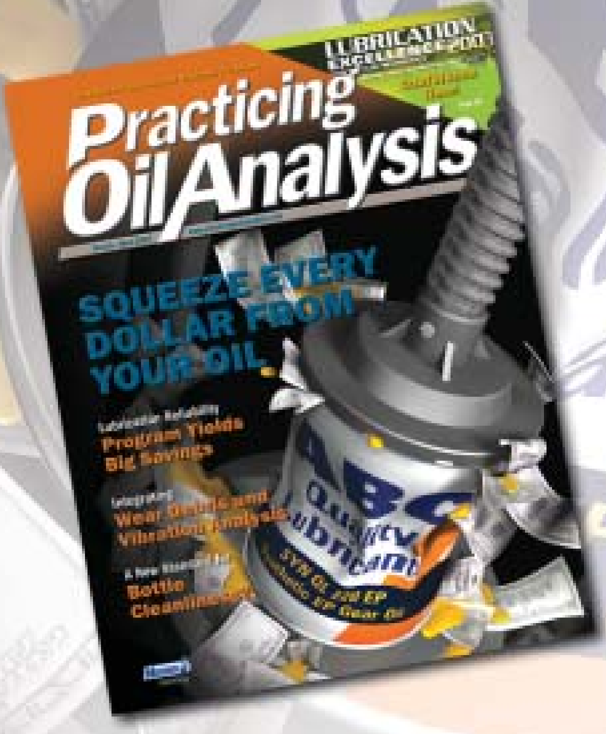


"Preventing lubricant contamination by eliminating filler/breather caps as a major source of ingression is an integral step toward increasing equipment reliability."

DES-CASE® CORPORATION

Don't Forget to Breathe: A Discussion on Desiccant Breather Use and Application

By Jon Haworth and Jim Waller, Des Case Corp.

Even with today's highly sophisticated lubrication and maintenance programs, most contamination control efforts still focus on removing contamination after it has entered the lubricant. Preventing the ingression of dirt and water into the lubricant is the most effective, yet least fully utilized method of controlling contamination. Often the use of high-performance desiccant breathers is found to be extremely valuable for front-end protection and reliability optimization.

Typically, common machinery vents or breather caps do not provide adequate protection against atmospheric ingression of moisture and dirt. Because this is a common point of entry, replacing these standard caps with quality breathers will protect lubricants and machine components and help maintain desired cleanliness levels.

A desiccant breather incorporating a high capture-efficiency filter can help sustain desired cleanliness levels by removing even minute particulate matter and also by creating low relative humidity levels in the headspace, making condensation and absorption by the lubricant unlikely. When a system is properly fitted with a breather containing drying and filtration media, the contaminant ingression is greatly reduced.

Selecting and Sizing A Breather: The Role of Airflow

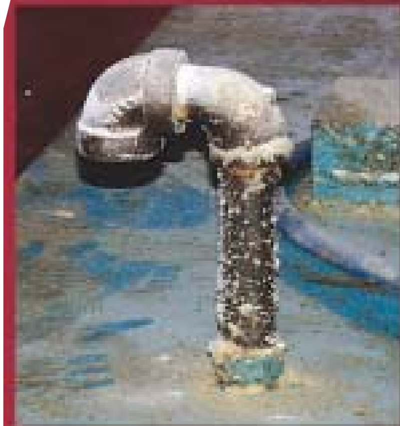
Properly fitting a breather to an application involves a number of factors (Table 1), with the two most important being flow rate and operating environment.

Breathers are sized based on the required cubic feet per minute of air exchange for each machine application. Airflow is caused by temperature variations (ambient heat, machine start-up and cool down) and changes in fluid volume (cylinder stroking, emptying/filling processes). The breather's airflow or liquid flow rating must at least match that of the tank's fill and draw-down rate. Higher flow rates require larger units. For hydraulic and circulating oil systems, a good rule-of-thumb is that the minimum air flow rate is typically one-fifth the reservoir volume. For example, a 50-gallon reservoir should have a minimum flow rate of 10 gallons per minute. Pump size is also a good indication of flow. Flow rate, in cubic feet per minute (CFM), can be obtained by dividing gallons per minute (GPM) by 7.48. Flow rate in this example would equate to 1.34 CFM.

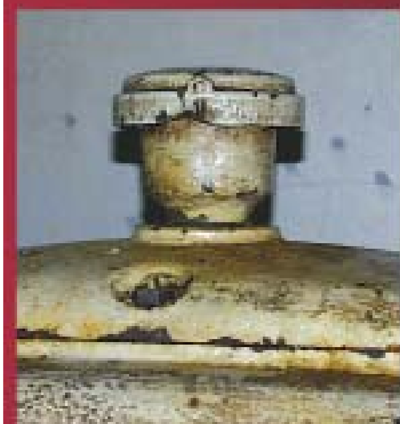
Pressure drop as it relates to airflow is also important when selecting a breather. Pressure drop is the amount of additional pressure or vacuum created inside the reservoir due to airflow restrictions caused by forced air movements (inward or outward) in the breather. There are three factors that contribute to pressure drop caused by the breather: filtration media, breather configuration and air flow rate (CFM). The filter media or a combination of media for

Industry	Typical Application	Special Considerations	Breather Recommendation
Paper	Gearboxes in paper mill and wood yard	High humidity, paper dust	Desiccant breather or desiccant breather/diaphragm combo
Steel	Gearboxes on rolling mill	High humidity, steam	Desiccant breather or desiccant breather/diaphragm combo
All Industries	55-gallon storage drums	Thermal expansion/contraction	Desiccant breather
Paper	Oil slinging pumps	Oil mist harmful for environment	Oil coalescing breather
Food Processing	Conveyor gearboxes	Daily washdowns	Desiccant breather/diaphragm combination
Power Generation	Hydraulic power units	Downtime is costly	Desiccant breather
Stamping	Hydraulic units	High volume, oil misting	Oil coalescing/desiccant breather combo
Injection Molding	Hydraulic units	Moderate to high volume, potential oil misting	Desiccant breather or oil coalescing/desiccant breather combo

Table 1. Application Descriptions and Breather Recommendations



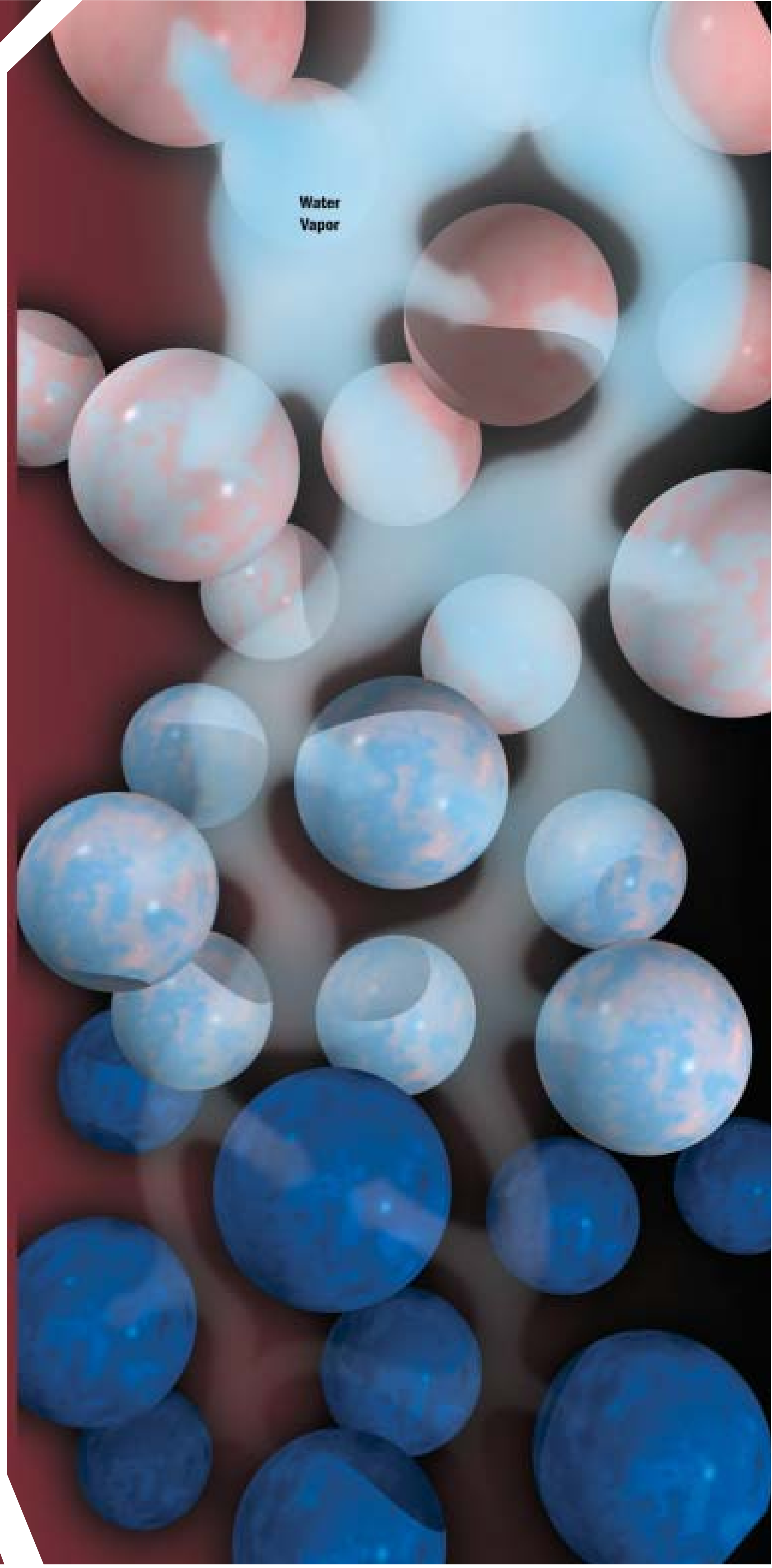
Snorkel Breather - Not Best Practice



Filler Cap Breather - Not Best Practice

Spin-on Filter - Best Practice

Dessicant Breather - Best Practice



multistage designs used inside the breather will influence the airflow restriction. In general for the same surface area, the smaller the breather's micron rating, the higher the pressure drop.

The shape or configuration of the breather also plays a role in airflow. Air that is forced through an orifice or caused to make a sharp turn will create a higher pressure drop than air flowing through a straight pipe. Therefore, breathers incorporating a complex airflow pattern usually cause higher pressure drops.

The velocity of the air flowing through a breather is influenced by airflow rate (CFM) and breather configuration and effects pressure drop. The pressure drop created by an increase in velocity is not a linear relation but rather an exponential one. Thus, it is imperative that the breather airflow operating range be matched to its intended application. Too much pressure created by flow resistance may compromise the system's integrity. However, proper sizing ensures a low pressure drop (maintained at one-half to one psid) and upholds the integrity of the system and components. For additional protection, especially in large storage reservoirs, a vacuum/pressure relief valve may be installed.

Breather airflow patterns should be designed to maximize both the filtration media and drying properties of the desiccant. Flow patterns that allow regeneration of the drying agent - warm dry air passing back over the desiccant, rather than venting to atmosphere - may help extend the breather's life. An added benefit is that by containing the exhaust air, the working environment is not polluted by oil mist; instead the breather captures it. Even though a small fraction of the desiccant is spent by the oil mist, breather life should not be significantly compromised.

Variable airflow control or "controlled breathing" will also extend breather service life and maximize the life and efficiency of the desiccant. Breathers offering this option contain vent holes that can be adjusted to meet the protected system's specific airflow requirements. More desiccant isn't necessarily better, but efficient use of existing desiccant is better.

New diaphragm/desiccant combo breathers offer controlled breathing, yet allow for expansion and contraction of airspace using membrane technology. Creating a nearly sealed system, these bladder or expansion type breathers are ideal for applications where volume changes are minimal and the environment contains high levels of particulate or moisture.

The new technology prevents moisture ingress, even in wash down situations, without allowing increased pressure to raise operating temperature and compromise lubrication. By maintaining slight system pressurization, yet releasing excess pressure, fluid temperatures are safely controlled.[1]

Particle Retention and Water Adsorption

Particle retention is another important breather design consideration. Breathers with a rating of at least $\beta \geq 200$ (99.5 percent capture efficient at 3 microns) exceed most industry standards. Most breather manufacturers use synthetic surface filtration media, such as glass fibers or polymers. Synthetic media provides superior performance when water is present and also offers better airflow for the same micron rating and surface area than its non-synthetic counterpart. To extend breather life, it is important to look for a filter media with backflushing capabilities. Filters with this capability release particulate matter during system exhalation, creating a self-cleaning process.

Larger breathers typically employ a pleated filter element that provides significantly more filtration surface area. If oil mist, like that often found in injection molding and certain extruding operations is a primary concern, oil coalescing/desiccant combination breathers are available.

Many breathers incorporate a hygroscopic or drying agent known as a desiccant. Desiccants do not simply absorb, but rather adsorb moisture. Adsorption occurs when a liquid or gaseous substance physically adheres to the surface of a solid, whereas with absorption, a liquid (moisture) penetrates the inner structure (pores) of a solid.

Silica gel is the most commonly used adsorption material in desiccant breathers because it is highly efficient at high humidity levels. Silica gel has a porous molecular structure that forms a vast surface area and attracts and holds up to 40 percent of its weight in water. Silica gel also regenerates (dehydrates) at lower temperatures than any other type of commercial adsorbent. Carbon may also be added to the desiccant mix for oil mist applications and/or odor retention.

The appropriate volume of silica gel should be chosen based on frequency of air exchange, ambient humidity levels and the breather's desired lifespan. More gel offers more adsorptive capacity, but doesn't necessarily equate to longer life. Silica gel will seek out moisture by diffusion from the headspace or ambient air even when the system doesn't require make up air. Again, controlled breathing can help increase the life expectancy of the desiccant.

The use of a color indicator or another foolproof method of determining when replacement is necessary is important in maintaining system protection. Desiccant dyes are a common means of accomplishing this. When these dyes are applied, the silica gel changes color when saturated, (for example, from blue to pink) alerting maintenance personnel of the need to change the breather. Visual checks of desiccant breathers should be part of routine maintenance schedules.

An important note about silica gel - on the initial breather installation, breather life may be compromised simply because the breather is working to dry air already in the system. For best results and maximum life, install the breather on a clean and dry system; and make sure to replace the initial unit as soon as the color change indicates it is time to do so.

Operating Environments and Material Compatibility

The construction of the breather filter housing, whether plastic or steel, is an important consideration because the breather must be able to withstand the environment in which it is operating. Likewise, breather materials must be compatible with the fluids being protected (such as sulfuric acid tanks). In addition, the breather operating temperature range should fall within system parameters.

Disposable units work great for most industry applications. Rugged steel units are often preferred for high heat, corrosive or extremely dirty environments. Stainless steel is common in many military applications. Steel casings or sturdy adapters are used in high-vibration applications. Tank breathers are often recommended for large volume, outside storage tanks. In wash-down and/or extremely dirt-laden application environments, bladder type breather technology provides the ideal solution and fills a previous void in the breather marketplace.

Performance-Enhancing Accessories

Just as there is a breather to meet nearly every application, there are accessories available to enhance performance. A few worth mentioning include:pressure/vacuum relief valves, baffles, breather adapters with nonintrusive filler quick-connect ports, breather manifolds and remote mounting options.

Conclusion

It is important to note that breather technology should be employed along with other contamination control tools, such as mechanical seals, proper sampling techniques and appropriate lubricant storage/dispensing systems. These elements work together toward the common goal of achieving lubrication excellence in prolonging the life of the lubricant and machine.

Preventing lubricant contamination by eliminating filler/breather caps as a major source of ingression is an integral step toward increasing equipment reliability. Standardization of desiccant breathers is a simple solution with a potentially exponential payback. **POA**

Reference

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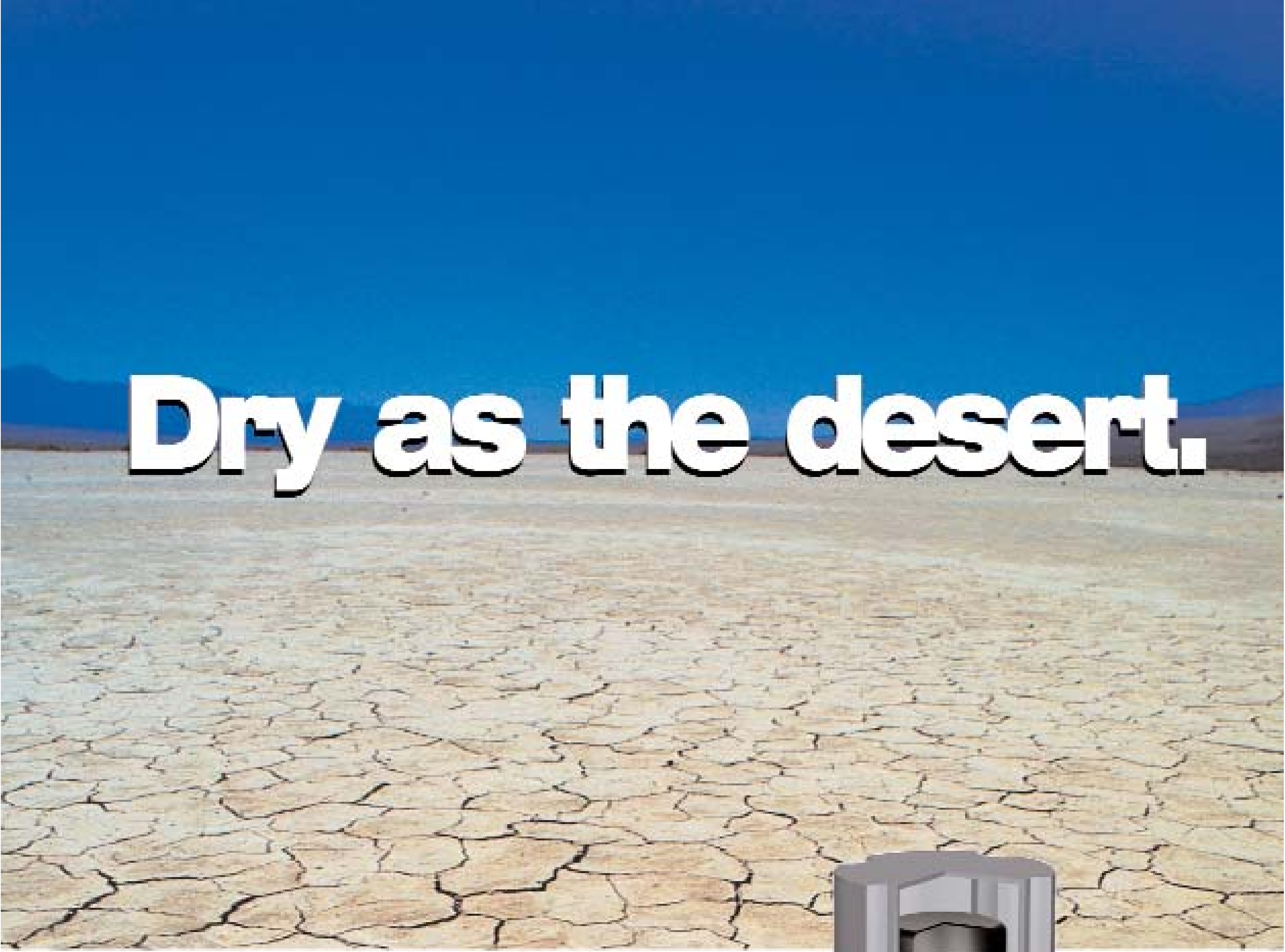

Introducing Hydroguard™ breathers by Des-Case.

Des-Case Corporation is taking the breather market to places it's never been before. By incorporating desiccant, filtration and membrane technology, dirt and water don't have a chance. Now it is easier than ever to keep your lubes clean and dry, especially in high humidity applications.

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*Patent pending.

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** Des-Case breathers meet all U.S. and European Community regulations.*