



Information Bulletin

TMR™ N₂

Highly effective, low cost water removal system for atmospheric breathing lubricant reservoirs



FREE FLOWING NITROGEN BLANKETS

TMR™ N₂ systems produce ≥97% N₂ gas that is extremely dry (-67.8°C/-90°F dew point and <0.01% relative humidity) using a small amount of standard compressed air at ambient conditions (24°C/75°F). The N₂ gas is introduced into the reservoir headspace at a point above the lubricant surface forming a nitrogen blanket. As the clean, dry N₂ gas sweeps across the reservoir, it will absorb water vapor which is forced out of lubricant as it moves towards moisture equilibrium with the nitrogen blanket.

TMR N₂ systems reverse the normal reservoir breathing cycle (see illustration) so that reservoirs are always discharging a small amount of high purity N₂. In this configuration, reservoirs will be continually insulated with a free-flowing nitrogen blanket which eliminates the ingress of atmospheric water, particulate, and metal ions. Lubricant and hydraulic reservoirs operating in sea water environments, heavy industrial or agricultural regions can accumulate soluble metal ions, which are catalysts that accelerate lubricant breakdown.

MOVING BEYOND WATER REMOVAL TO MANAGING OXIDATION LEVELS

TMR N₂ systems offer the additional benefit of eliminating fluid contact with

oxygen, which along with water and metals, comprise the 3 primary catalysts of oxidation. Therefore, these systems offer users the ability to move beyond reactionary maintenance and actually manage the factors that accelerate oxidation. By continually managing water and oxygen levels and by eliminating metal ion ingress from atmosphere, users can lower the rate of lubricant breakdown, reducing maintenance requirements and extending fluid life.

LONG-LIFE, LOW-COST, WITH MINIMAL MAINTENANCE

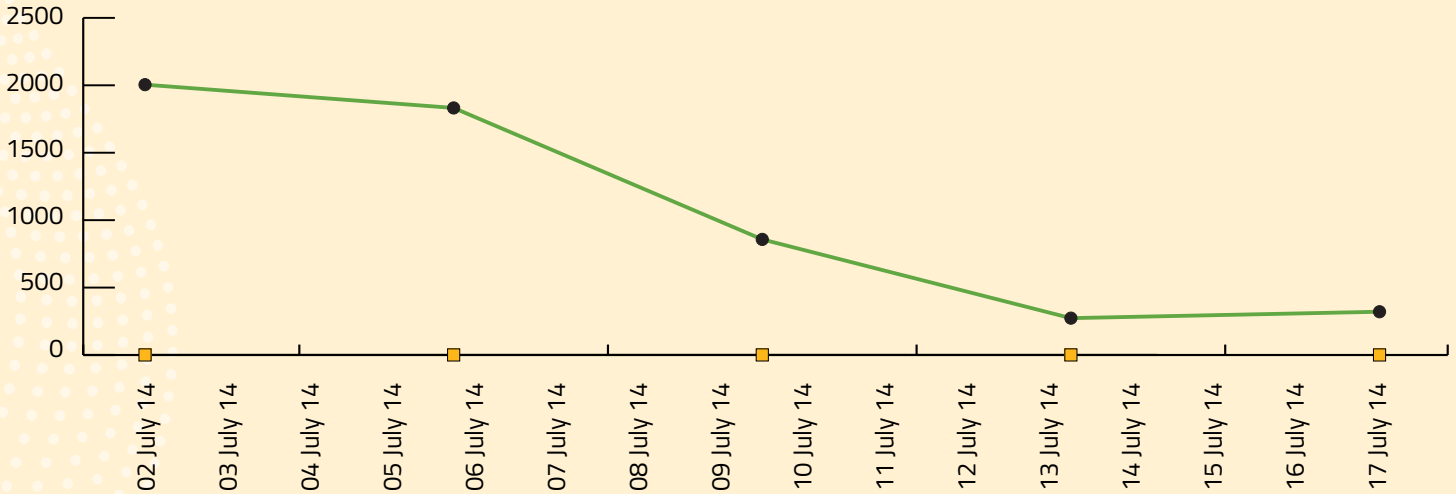
TMR N₂ systems have very low maintenance requirements. Two inlet air filters need to be replaced every 6 months to remove residual oil from the compressed air source, which would otherwise reduce system life. With proper maintenance, TMR N₂ systems should last 8 years or more at which time only the generation unit would need to be replaced. The total cost of ownership of a TMR N₂ system over 8 years is estimated to be \$5,500 – \$8,000 in total (depending on size), which in many cases is \$50,000 lower than mechanical systems frequently used in these applications. That is a return on investment (ROI) of \$44,500 or 809%. When you consider that one TMR N₂ system can be shared between two reservoirs that are close in proximity, the ROI is even more dramatic.



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Rethink. Remove. Restore.

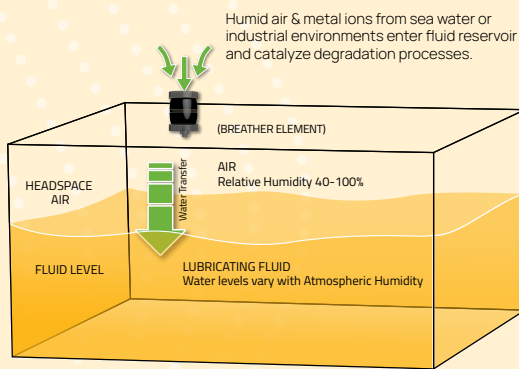
Water Content (ppm)



KEY ISSUES WITH ATMOSPHERIC BREATHING LUBRICANT RESERVOIRS

- The lubricant has unlimited access to water when atmospheric moisture levels are greater than lubricant moisture levels.
- Breather elements cannot reduce existing water levels.
- Breather elements, which are designed to reduce condensation, have limited capacity and cannot prevent water ingress from atmosphere via mass transfer. Note: extraction fans used to prevent condensation make this situation worse.
- Sea water and industrial environments will also contribute metal ions which increases the rate of lubricant breakdown.
- Common water removal alternatives including vacuum dehydrators that effectively remove water, but do not address the contamination source creating an energy intensive cycle where the fluid absorbs as much water as it can hold from atmosphere.

CONTAMINATION SOURCES



Atmospheric Breathing Lubricant Reservoirs

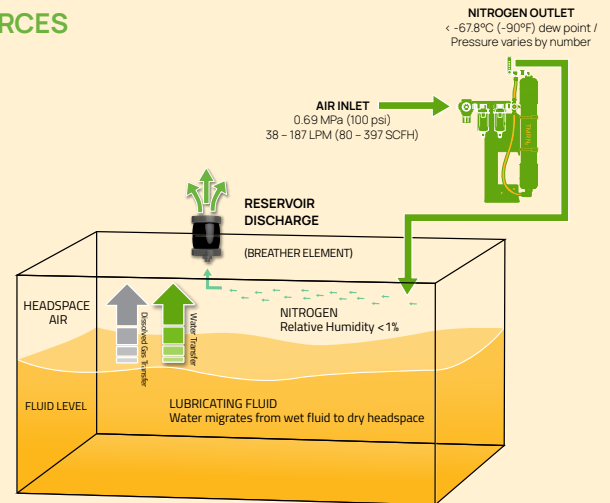
ATMOSPHERIC HUMIDITY



AIR POLLUTION



COASTAL ENVIRONMENTS



TMR™ N₂ Conditioned Reservoir

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