TMR™ N_2 TOTAL MOISTURE REMOVAL NITROGEN SYSTEM

HIGHLY EFFECTIVE, LOW COST WATER REMOVAL SYSTEMS FOR ATMOSPHERIC BREATHING LUBRICANT RESERVOIRS

Overview

Water is the most common and damaging contaminant found in hydraulic and lubricating systems. Water can exist in 3 forms: free, dissolved and emulsified. EPT's Total Moisture Removal Nitrogen (TMR™ N_2) systems cost effectively remove all 3 forms of water from lubricants and hydraulic fluids through mass transfer which is a highly effective, non-mechanical process. Most water removal systems use heat, vacuum and pumps, which are all expensive to operate and maintain, to force the separation of water from the lubricant. The TMR™ N_2 system exploits the principle of chemical equilibrium to remove all types of water in a much more gentle, and energy efficient methodology.

In many applications, the primary mode of water ingression is atmosphere, which provides an unlimited source of water whenever the moisture content in the atmosphere is higher than in the lubricant. Atmospheric water ingression rates are typically low and constant, which lends itself perfectly to the TMR™ N_2 system. Using mechanical separation systems in this scenario would simply dehydrate the lubricant to an unsaturated state so that it can absorb more water from atmosphere. This creates an energy intensive cycle that fails to address the primary cause of water ingression.

4772 - 50 AVE SE, Calgary AB T2B 3R4, Canada **T** 403.246.3044 **E** sales@cleanoil.com

Free Flowing Nitrogen Blankets

TMR™ N_2 systems produce ≥97% N_2 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 N_2 gas is introduced into the reservoir headspace at a point above the lubricant surface forming a nitrogen blanket. As the clean, dry N_2 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™ N_2 systems reverse the normal reservoir breathing cycle (see illustration) so that reservoirs are always discharging a small amount of high purity N_2. In this configuration, reservoirs will be continually insulated with a free-flowing nitrogen blanket which eliminates the ingression 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™ N_2 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 ingression 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™ N_2 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™ N_2 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™ N_2 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™ N_2 system can be shared between two reservoirs that are close in proximity, the ROI is even more dramatic.

High Performance with Predictable Results

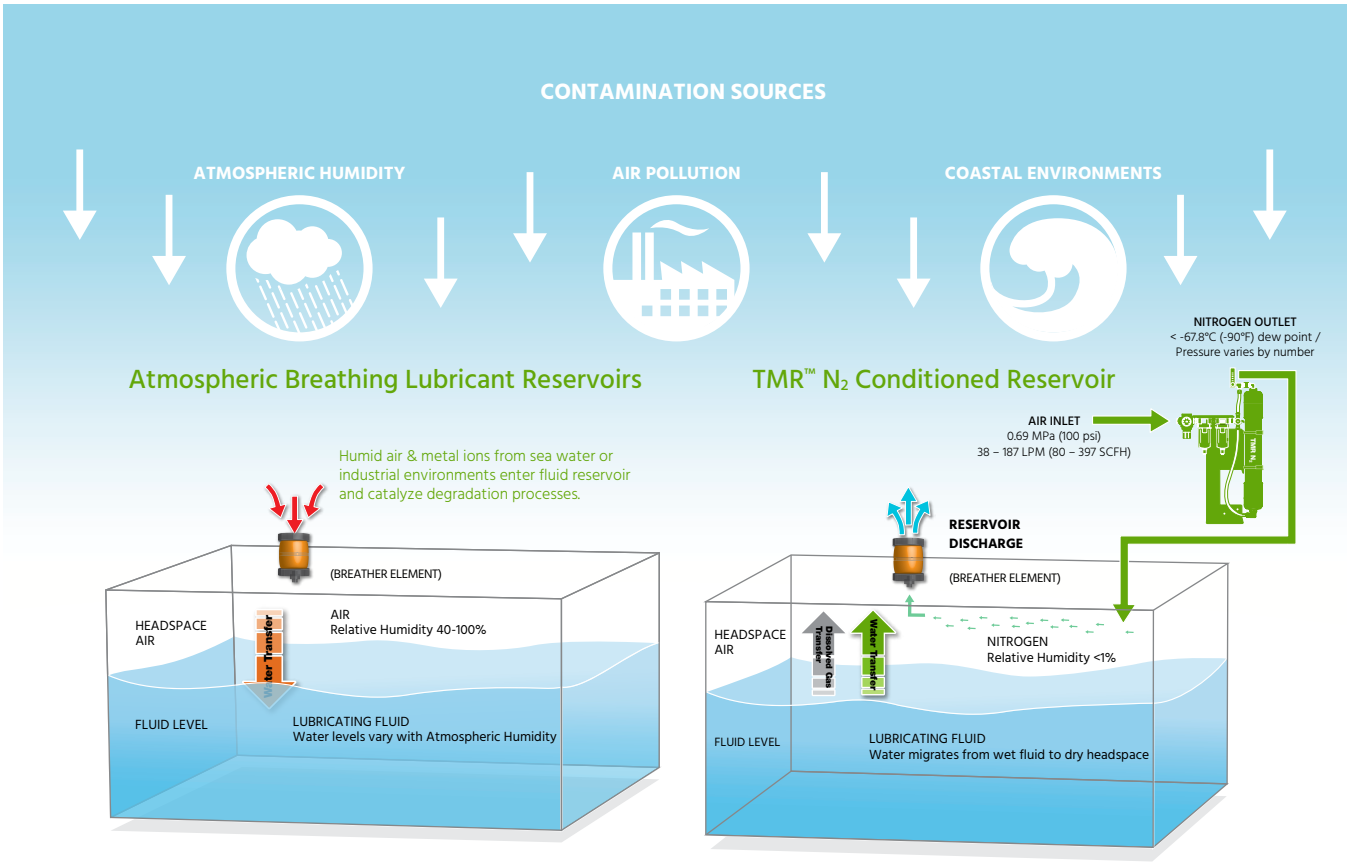
CASE STUDY

TMR™ system started on 2-Jul-14

EPT
cleanoil.com

When Results Matter

4772 - 50 AVE SE, Calgary AB T2B 3R4, Canada **T** 403.246.3044 **E** sales@cleanoil.com



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 ingression 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.

Key Benefits of TMR™ N_2 Systems

- High purity N_2 (≥97%) is generated at the source providing unlimited capacity to reduce existing moisture.
- Maintains water at very low levels (<50 ppm total or <350 ppm for EHC fluids) reducing the rate of lubricant breakdown.
- Free flowing N_2 is exhausted out the breather element or facility exhaust, reversing the typical flow configuration and eliminating one of the key ingression points for water and particulate contamination.
- Eliminates lubricant contact with oxygen, reducing oxidation and promoting the removal of H_2, CO, C_2H_4 and other harmful breakdown gases.
- Normally eliminates the need for expensive vacuum dehydration equipment or disposable filter elements when water ingression rates are low or solely from atmosphere.
- Very low maintenance requirements (30 minutes per year).
- Quick return on investment (ROI).

EPT
cleanoil.com

When Results Matter

4772 - 50 AVE SE, Calgary AB T2B 3R4, Canada **T** 403.246.3044 **E** sales@cleanoil.com

TMR N_2 System Sizing

TMR™ N_2 systems are regulated, intrinsically safe and have a manually adjusted flow control valve with flow meter. They are designed to remove up to 100 – 300 ppm water per day and sized according to the headspace volume. Reservoirs need a breather element (or suitable exhaust) and excessive atmosphere access points should be sealed. Reservoir extraction fans are not ideal in applications without bearings and should be removed if feasible.

SIZING AND TECHNICAL SPECIFICATIONS				
PART NUMBER	**601902**	**60190**	**601904**	**601905**
Reservoir Volume (L/gal)	≤1532/400	≤3028/800	≤7570/2000	≤11356/3000
Daily Water Removal (ppm)	100-300	100-300	100-300	100-300
Connections: Inlet/Outlet FNPT (in.)	¼	¼	¼	¼
Dimensions LxWxH (mm/in.)	466 x 162 x 762/ 18⅜ x 6⅜ x 30	466 x 162 x 1217/ 18⅜ x 6⅜ x 47⅞	499 x 168 x 1217/ 19⅝ x 6⅝ x 47⅞	442 x 365 x 1769/ 17⅜ x 14⅜ x 69⅝
Shipping Dimensions LxWxH (mm/in.)	508 x 254 x 864/ 20 x 10 x 34	534 x 280 x 1296/ 21 x 11 x 51	534 x 280 x 1296/ 21 x 11 x 51	**PART 1** 508 x 250 x 607/ 20 x 10 x 29 **PART 2** 127 x 127 x 1677/ 5 x 5 x 66
Shipping Weight (kg/lb)	10/21	20/44	22/48	**PART 1** 11/23 **PART 2** 10/20
N_2 Output – Manual Control with Flow Meter (LPM/SCFH)	0-25/0-50	0-25/0-50	0-50/0-100	0-100/0-200
Pre-set Flow Rate (LPM/SCFH)	14/30	21/45	35/75	70/150
% N_2 at Pre-set Flow Rate at 0.69 MPa/100 psi Air Temp. of 21°C/70°F	97%	>97%	>97%	>97%
Air Consumption Max. at 0.69 MPa/100 psi (LPM/SCFH)	0-38/0-80	0-64/0-136	0-114/0-241	0-187/0-397

Note: Temperature of membrane must stay ≥24°C/75°F for optimal performance. Nitrogen recovery will be hindered if temperature averages ≤24°C/75°F.

REPLACEMENT PARTS				
PART NUMBER	**601902**	**60190**	**601904**	**601905**
Particulate Filter	601265	601265	601265	601265
Oil Coalescer	601514	601514	601514	601514
Pressure Gauge	601556	601556	601556	601556
Replacement Membrane	601341	601551	601599	601609

AVAILABLE OPTIONS	DESCRIPTION
M1	Manifold to share 1 TMR™ N_2 with 2 reservoirs.

Additional Resources

1. White Paper: Effectively Eliminating Water Contamination from Hydraulic and Lubricating Fluids
2. TMR™ Air System Product Information

4772 - 50 AVE SE, Calgary AB T2B 3R4, Canada **T** 403.246.3044 **E** sales@cleanoil.com