TERRA UNIVERSAL.COM
Critical Environment Solutions
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IsoDry® Rapid Moisture Control System

IsoDry® desiccator cabinets are the latest innovation in desiccators from Terra Universal. Many conventional desiccators depend on unassisted gas displacement. This mode of operation can significantly inhibit RH control, drive up operating costs, and increase the risk of damaged stored materials. The driving concept behind IsoDry is that unassisted gas displacement is significantly slower without a substantial physical force to actively mix nitrogen gas through the entire cabinet.

Problems with Conventional Nitrogen Desiccator Cabinets:

For critical moisture control applications, RH set-point recovery time is one of the most important considerations to achieving the required quality, safety, and shelf life of stored materials.

RH recovery is the time needed to reach a relative humidity set-point after a desiccator chamber or cabinet is accessed. A fast RH recovery time minimizes exposure of stored materials to harmful moisture levels. Thus, the ideal desiccator quickly and efficiently reaches and maintains the desired RH level.

A conventional nitrogen-purged desiccator cabinet is typically configured with a single gas inlet and relies on unassisted gas diffusion. This may not achieve low-humidity set-points fast or efficiently enough due to (1) uneven gas distribution and (2) high nitrogen gas consumption. **These problems tend to amplify with larger size cabinets.**

Uneven Gas Distribution

Uneven gas distribution in a desiccator cabinet leads to a wide variance of RH readings across different chambers in the cabinet. With simple geometries (for example, a narrow pipe) a displacement system introduces gas uniformly, creating a piston-like displacing effect. This idealized concept is near impossible to achieve in a multi-chamber desiccator cabinet with several dead-end cavities.

With such complex geometries, the effectiveness of mixing and displacing moisture depends more on turbulence from the inert gas entering the enclosure. Turbulent airflow in the cabinet tends to improve with increased inlet velocity. Slower velocity tends to inhibit turbulence needed to mix purge gas with water vapor in dead-end cavities. In large multi-chamber cabinets with a single gas inlet and unassisted gas diffusion, the velocity and turbulence at the inlet can quickly dissipate resulting in uneven humidity concentrations throughout the cabinet. Furthermore, as the turbulence dissipates, **pockets of inert gas can stream or arch from the inlet to the release valve, leaving untouched pockets of moisture-laden air throughout the cabinet.**

Some desiccator cabinet designs include a rear gas distribution plenum to help alleviate these problems, but a few significant drawbacks remain:

- First, the gas distribution plenum tends to experience higher pressure closer to the gas inlet, which translates into higher rates of displacement in some chambers, and lower rates in others. The end result can still leave significant RH variances from chamber to chamber.
- Second, gas entering each chamber is not a uniform laminar front, but a series of lower velocity micro-streams. This means the inert gas can still stream or arch from the inlet to the release valves, leaving eddies of moisture-filled air throughout the chambers.
- Third, a combination of the two drawbacks mentioned above can result in eddies of either moisture-laden air, or dry inert gas. These pockets can occur in multiple locations of a cabinet and potentially trigger inaccurate readings on the humidity sensor. In a worst case scenario, this could result in the gas purge process ending prematurely, further damaging valuable materials stored in the cabinet.

Thus, even with a gas distribution plenum, many conventional desiccator cabinet designs suffer unequal gas distribution that results in lower uniformity and slower set-point recovery times.

High Nitrogen Gas Consumption

In addition to a quick recovery time, users seek to achieve a low RH set-point as efficiently as possible to reduce wasteful gas consumption. Unfortunately, due to the problem of uneven gas distribution, the conventional unassisted displacement design requires relatively high consumption of nitrogen gas without the guarantee of reaching the desired relative humidity set-point throughout the cabinet. This high nitrogen gas consumption drives up overhead cost and can lead to nitrogen gas supply constraints, a common concern, particularly those who rely on gas canisters that must be frequently replaced.

IsoDry Rapid Set-Point Recovery:

The patented IsoDry system addresses all the problems explained above, setting a new standard for all desiccators. Unlike a conventional desiccator cabinet design, the IsoDry concept optimizes forced dilution in lieu of unassisted displacement. It's still cost-effective, using only one sensor and one inlet valve, but it's far more efficient and accurate. With faster recovery times and optimal uniformity, you can be confident in knowing your products are well protected:

Faster Recovery Time Optimal Uniformity

IsoDry's powerful gas-flow engineering ensures that any moisture that enters the cabinet when doors are opened is quickly and efficiently diluted and purged from the cabinet, before it can affect stored contents.

The dual fan system rapidly mixes and circulates dry nitrogen at approximately 100 CFM. This quickly reduces moisture concentration plus provides adequate airflow velocity to effectively sweep through the entire cabinet and maintain uniform RH (+/- 10% of set point). The improved RH uniformity eliminates moisture "blind spots" that can degrade sensitive components while minimizing nitrogen gas consumption.

Minimize Spread of Contaminants

When a door is opened, the door sensors de-activate the dilution fans to minimize the spread of incoming moisture and contaminants throughout the cabinet. Simultaneously, the main RH control module activates a high flow gas purge, to hasten dilution of any moisture that enters the cabinet.

Once a door is closed, the fans immediately activate to expedite the mixing and dilution process. The moisture in the previously accessed chamber is rapidly dispersed throughout the entire volume of the cabinet within seconds and set-point is recovered within minutes. The high flow of inert gas continues until the set-point is reached, at which point the system relays to a low flow setting.

Versatile Applications

Terra's IsoDry desiccator cabinet system provides unsurpassed moisture control to reduce moisture-related degradation of semiconductor components, electronics, medical devices, pharmaceutical powders, and other moisture sensitive materials.

IsoDry Dual Purge/NitroWatch Systems

The complete IsoDry control system includes a relative humidity sensor mounted inside the chamber and Terra's IsoDry Dual Purge and NitroWatch systems, which work in tandem to ensure fast set point recovery times.

The NitroWatch provides continuous monitor/display of both measured RH and set point levels. It signals to the Dual Purge system when to switch between high-flow and low-flow purge. High-flow is activated to reach the

programmed set-point. Once this set point is attained, the system switches to an economical low-flow purge to maintain the set point. The system activates high-flow purge again the instant a door opens to recover back to set point with minimal nitrogen waste.

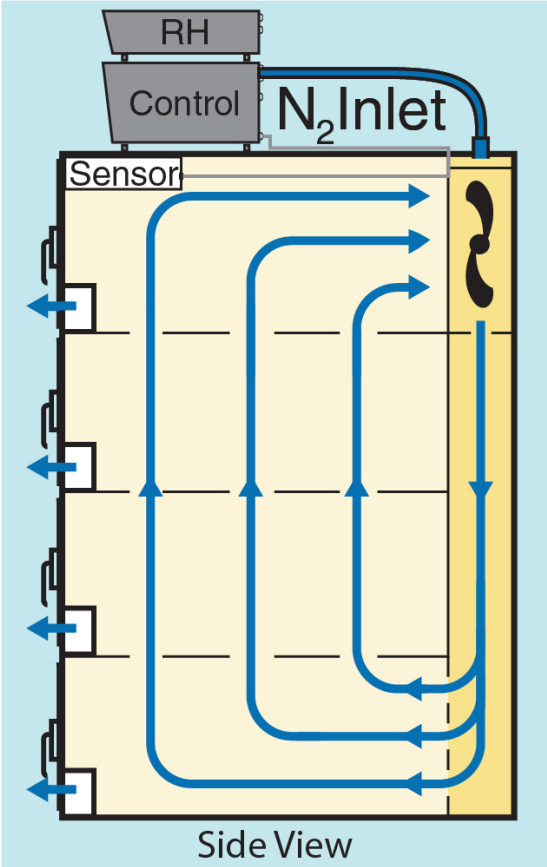
Status alerts built into the IsoDry Dual Purge System warn if incoming nitrogen line pressure falls below operational rates (signaling an interruption in the gas supply) or if the system remains in high-flow purge for an excessive period (signaling a door left ajar).

- **Power Requirement:** 24V: draws power from IsoDry Dual Purge system
- **Fans:** 120 CFM each
- **Display:** 5-digit LED
- **Display Resolution:** ±0.1%RH
- **Sensor Accuracy:** ±2% RH @ 20°C
- **Measuring Range:** 0 - 100% RH
- **Calibration:** None required for standard accuracy range

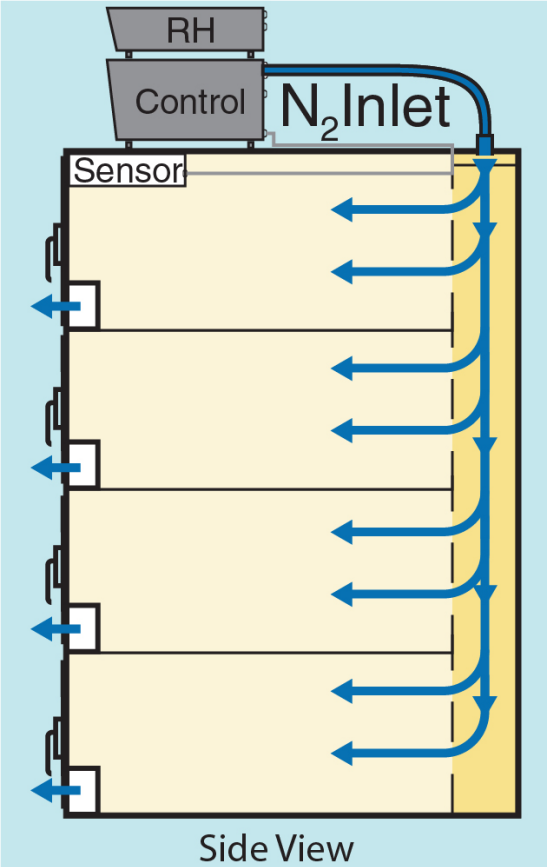
Smart Performance - and Big Savings!

IsoDry's forced dilution system drastically improves moisture removal to quickly and efficiently attain low RH set-points.

At 10% RH setpoint, the IsoDry configuration cuts recovery time and Nitrogen consumption by 80%, passing 10% RH in just 15 minutes, and 5% RH in less than 30 minutes.



IsoDry Desiccator



Desiccator without IsoDry Technology

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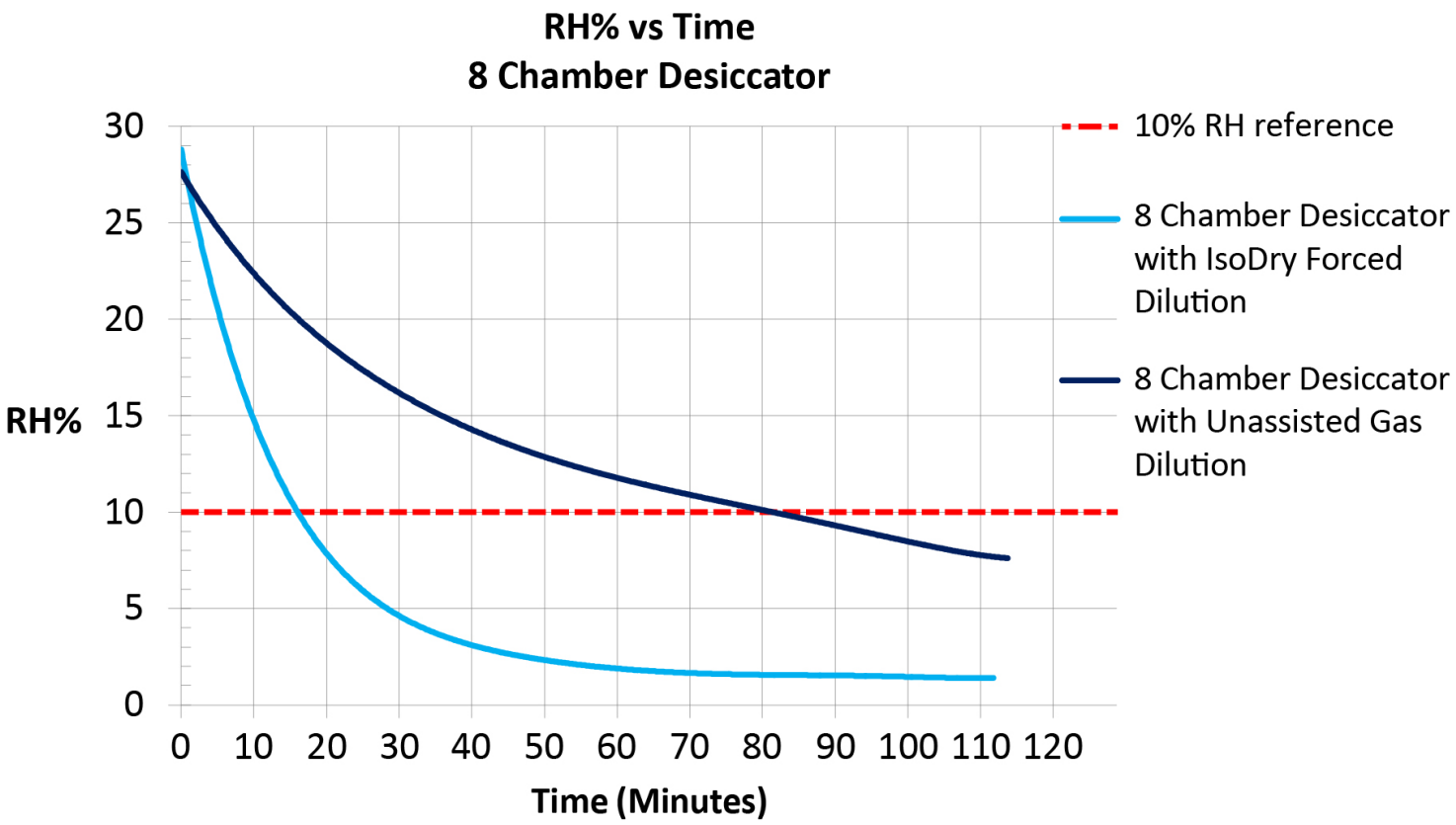

Results With IsoDry:

- **Time to reach 10% RH:** 15 minutes
- **Approx. N2 Used:** 16 cubic feet (15 minutes on high flow, approx. 65 SCFH)

Without IsoDry (cabinet uses rear gas distribution plenum):

- **Time to reach 10% RH:** 80 minutes
- **Approx. N2 Used:** 86 cubic feet (80 minutes on high flow, approx. 65 SCFH)

Parameters:

- **Cabinet Size:** 46"W x 24"D x 48"H
- **Cabinet Volume:** 31 cu.ft.
- **Chambers:** 8 (2 x 4)
- **Ambient Humidity:** 28% RH
- **Temperature:** 80F
- **Test Period:** 2 hours (120 min)

Notes:

- For each cabinet, RH measurements of all chambers are average together.
- Both tests performed with 60 PSI (approx. 65 SCFH) N2 system line pressure into the Dual Purge.