Trace Moisture Measurement in Inert Atmosphere Gloveboxes

Application Note

SHAW MOISTURE METERS

Inert atmosphere gloveboxes are indispensable tools for handling air and moisture sensitive materials. Their performance depends heavily on continuous control of any internal contaminants, particularly trace moisture, which even at ppm levels can trigger oxidation, hydrolysis, decomposition or failed synthesis. Maintaining ultra low moisture levels is therefore essential for product purity, experiment repeatability, operator safety and equipment longevity.



What are Inert Atmosphere Gloveboxes?

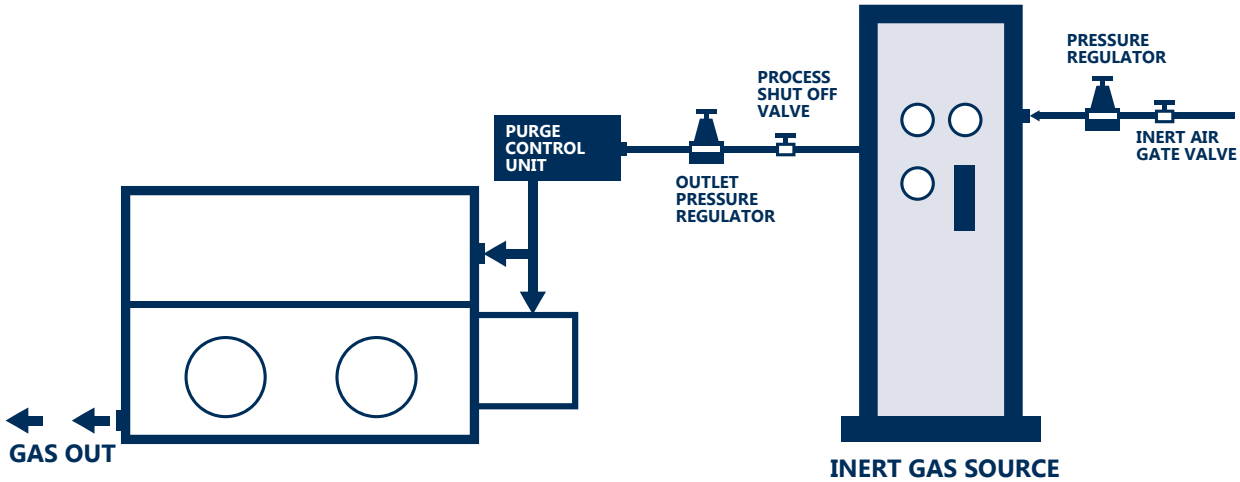
Gloveboxes are sealed, gas tight enclosures that allow users to manipulate materials through integrated glove ports while preventing exposure to ambient air. They are typically purged or continuously recirculated with inert gases such as nitrogen, argon or helium to maintain a dry, oxygen free internal atmosphere.

Typical applications include:

- Air and moisture sensitive chemical synthesis (organometallics, battery materials).
- Pharmaceutical powder handling, sterile packaging, biochemical preparation.
- Semiconductor and thin film device fabrication, including OLEDs and perovskites.
- Storage and manipulation of pyrophoric, radioactive or toxic materials.

Gloveboxes may be:

- Recirculating (closed loop) systems with purification columns for continuous removal of O_2/H_2O.
- Purge only systems relying on constant inert gas flow.
- Vacuum purge systems enabling rapid atmosphere exchange.



Trace Moisture Problems in Inert Atmosphere Gloveboxes

Impact of Moisture on Sensitive Materials

Moisture contamination, even at sub ppm levels, can degrade highly reactive materials such as alkali metals, lithium battery components, catalysts and organometallic reagents. This leads to reduced yields, unintended reactions, surface degradation or sample decomposition.

Sources of Moisture Ingress

Common moisture intrusion pathways include:

- Leaks at glove ports, gaskets, seals or view ports.
- Material transfer through the antechamber, especially if items are not pre dried.
- Moisture released from porous materials, unbaked glassware or solvent residues.
- Glove permeation, especially in systems not using ISO classified glove materials. Leak rate studies show glove permeation can be a dominant oxygen/moisture ingress source.

Moisture ingress may cause:

- Failed synthesis or contamination of research materials.
- Corrosion of internal components and filters.
- Increased load on purification columns, reducing their lifespan.
- Safety hazards when dealing with pyrophoric substances

Purification and Atmosphere Control

- Gas purification systems use molecular sieves, catalysts and absorbents to remove water and oxygen from recirculating inert gas.
- Desiccants and moisture absorbing materials support moisture removal in purge only systems or as supplementary control.
- Dry gas purging of high purity nitrogen or argon ensures minimal moisture introduction through supply lines.

Solutions for Dewpoint Measurement

Aluminium oxide capacitance moisture sensors are the most widely used for trace moisture measurement due to speed, sensitivity and low detection limits. These sensors operate via changes in electrical properties as water molecules diffuse into an oxide layer. Aluminium oxide sensors can detect moisture at very low levels (sub ppm) and are ideal for real time leak detection and glovebox atmosphere verification.

Applicable Standards for Glovebox Atmosphere Integrity

- ISO 10648 2 – Classification and test methods for leak tightness of containment enclosures.
- AGS G001 2007 – Guideline for Gloveboxes (design, operation, maintenance).
- AGS G015 2015 – Standard for Glovebox Inert Gas Recirculation Purification Systems.

Trace moisture measurement is fundamental for ensuring that inert atmosphere gloveboxes operate safely, efficiently and reliably. Moisture at even a few ppm can ruin sensitive research, degrade materials and overload purification systems. By combining robust moisture measurement technologies, compliant purification systems and best practice operating procedures, laboratories and production environments can maintain the ultra dry conditions necessary for high performance glovebox operation.



Suitable Products



Dewpoint Transmitters



Handheld Hygrometers



Portable Sample System

We design and manufacture dewpoint instruments for many different applications.

For advice, choosing the right product for your application, please contact us:

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