Trace Moisture Measurement in Hydrogen Cooled Generators

Application Note

SHAW MOISTURE METERS

Hydrogen-cooled electricity generators are widely used in power plants because hydrogen offers exceptional thermal conductivity and low density, enabling efficient cooling of large generators.

However, trace moisture measurement within these systems is critical for safety and performance.

This article explains why dew point monitoring matters, highlights common moisture-related issues, and references key standards.

Dewpoint measurement is essential for ensuring air quality and protecting downstream equipment.



Why Hydrogen?

Hydrogen is the preferred cooling medium for large stationary electric generators due to its unique properties:

High Thermal Conductivity

Hydrogen transfers heat more efficiently than dry air, ensuring optimal cooling.

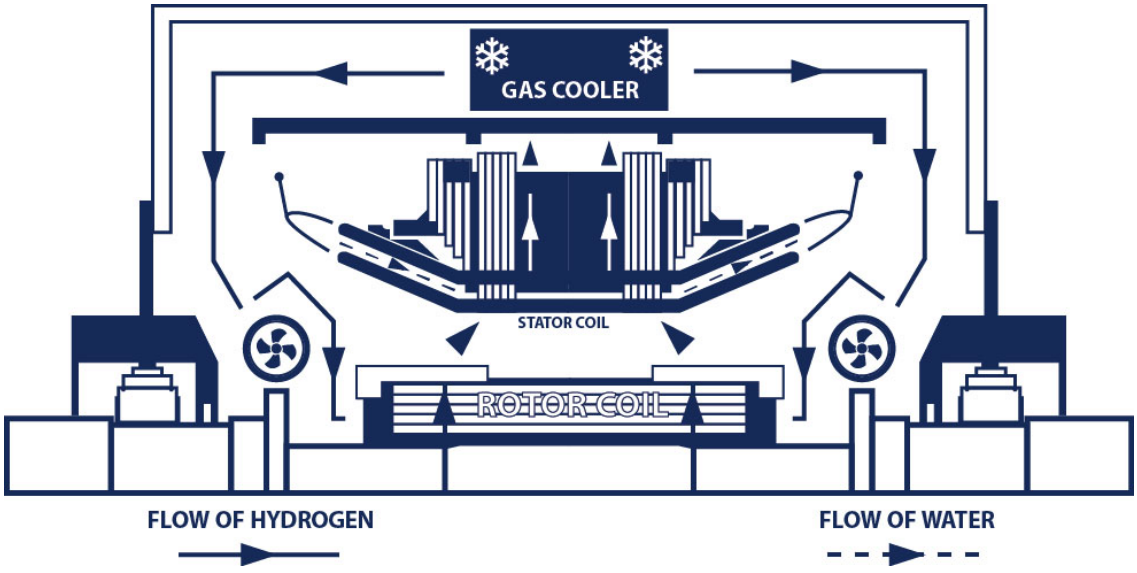
Low Density

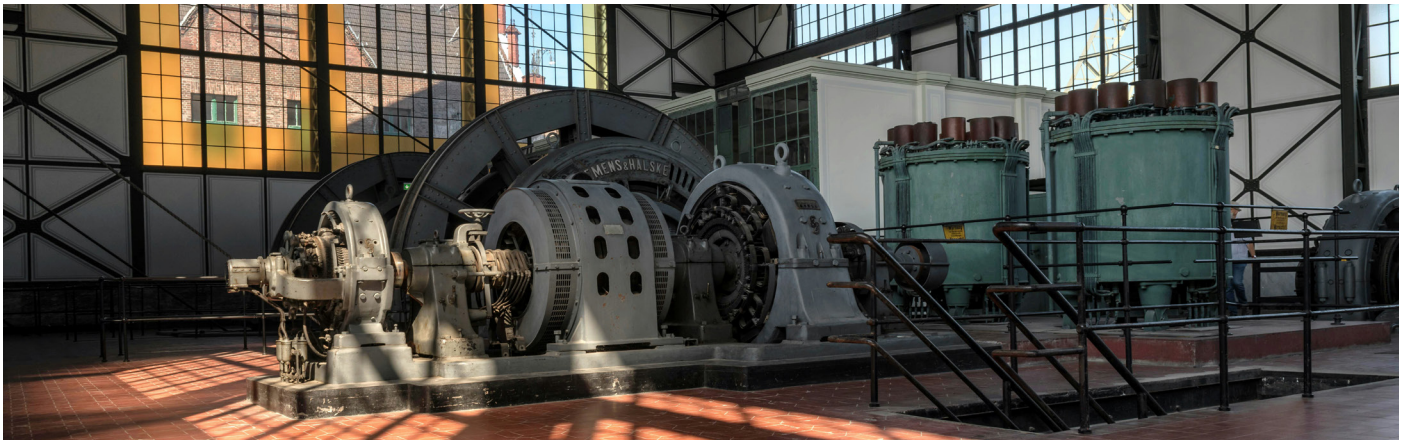
Minimises windage losses, improving generator efficiency.

Non-Corrosive and Non-Toxic

When properly managed, hydrogen is safe and does not damage generator components.

Typical Hydrogen Cooled Generator System





Moisture Problems in Hydrogen Cooled Generators

Moisture ingress can lead to severe operational and safety issues:

- **Reduced insulation resistance**
  Condensed water on windings lowers insulation, increasing electrical fault risk.
- **Corrosion**
  Moisture accelerates metal degradation, causing premature component failure.
- **Hydrogen purity reduction**
  Water vapour dilutes hydrogen, reducing cooling efficiency and increasing explosion risk.
- **Safety hazards**
  Excess moisture can form explosive hydrogen-oxygen mixtures

Dewpoint Measurement

Continuous dewpoint monitoring is essential for maintaining generator safety and performance.

Key solutions include:

- Online dewpoint sensors are used both to monitor the operation of the drying system, improving efficiency and helping to reduce energy consumption, and the status of the hydrogen gas as it exits the generator housing.
- Control systems using the dewpoint measurement are used to trigger alarms or initiate purging when moisture exceeds safe limits.
- Portable dewpoint meters can be used to check various sample points including the Hydrogen inlet and outlet, sample lines from the generator casing and downstream of the hydrogen dryers.

Dewpoint measurement is a vital aspect of operating hydrogen cooled electricity generators.

By maintaining low moisture levels, operators can ensure safe, efficient, and reliable generator performance while minimising risks of insulation failure, corrosion and safety hazards.

Implementing robust dewpoint monitoring and control strategies is essential for modern power generation facilities.



References to Applicable Standards

For best practices and compliance, refer to the following standards:

- IEEE Std C50.13: Requirements for hydrogen-cooled synchronous generators.
- IEC 60034-3: Rotating electrical machines – Part 3: Specific requirements for hydrogen-cooled synchronous machines.
- ASTM D5454: Standard test method for water vapour content in gases.

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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