

Calibration of Hygrometers

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NIS

Definitions

- **Metrology**
- **Calibration**
- **Uncertainty**
- **Traceability**
- **Tolerance**

Definitions

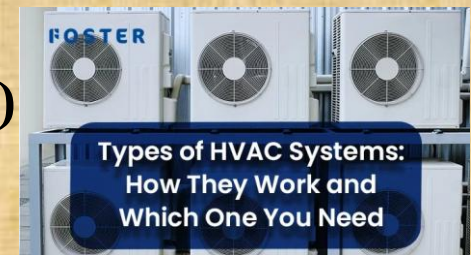
- **Method**
- **Procedure**
- **Repeatability**
- **Reproducibility**
- **Accuracy**
- **Precision**

Definitions

- **Humidity**
- **Moisture**
- **Relative Humidity**
- **Dew Point**
- **Frost Point**

Importance of Hygrometer Calibration

1. **Pharmaceutical and Drug Manufacturing**
2. **HVAC (Heating, Ventilation, and Air Conditioning)**
3. **Agriculture and Greenhouses**
4. **Museums, Archives, and Heritage Preservation**



Importance of Hygrometer Calibration

5. Food and Beverage Industry



6. Electronics Manufacturing



7. Transportation and Warehousing



8. Meteorology



9. Research and Laboratories



Calibration Conditions

- 1- Staff (Training-Experience)
- 2- Equipment (Specifications-Calibration ..)
- 3- Standard (International-In House Method)
- 4- Environmental Conditions (Temp.-Hum.)

Environmental Conditions

- Temperature
- Humidity
- Radiation
- Electromagnetic disturbances
- Electrical supply
- Dust
- Sound and vibration levels

Organizations

Environmental Protection Agency

EPA

Federal Aviation Administration

FAA

Food and Drug Administration

FDA

National Fire Protection Agency

NFPA

Nuclear Protection Agency

NPA

Calibration Types

- **Primary Calibration**
- **Industrial Calibration**

Humidity Instruments Classifications

- **** Primary Standard.***
 - - Two-Temperature Generator.
 - - Two-Pressure Generator.
 - - Two-Flow Generator.

- **** Transfer Standard.***
 - - Chilled Mirror Hygrometer.
 - - Psychrometer.

- **** Secondary Devices***
 - - Impedance Hygrometer.
 - - Polymer Film RH Sensors.

** Primary Standard.*

- Two-Temperature Generator
- Two-Pressure Generator



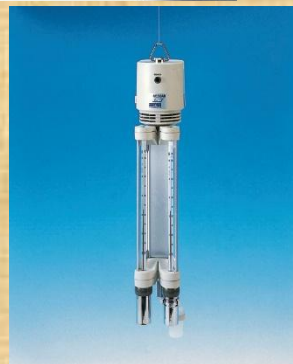
- Two-Flow Generator

* *Transfer Standard.*

Chilled Mirror Hygrometer.



Psychrometer



** Secondary Devices*

Impedance Hygrometer.

Polymer Film RH Sensors



Saturated Salt Solution

* محاليل الملح المشبعة

- LiCl 11%
- MgCl_2 33%
- $\text{Mg}(\text{NO}_3)$ 53%
- NaCl 75%
- KNO_3 93%

ISO-17025

Calibration & Validation Method

- Method Code
- Title
- Purpose
- Scope
- Definitions
- Responsibility
- Procedure
- References

Uncertainty Method

- Method Code
- Title
- Purpose
- Scope
- Definitions
- Responsibility
- Procedure (Calculation)
- References

Quality Documents

- Calibration Plan
- Maintenance Plan
- Training Plan
- Staff Matrix
- Equipment History
- Quality Assurance
- Transportation Method
- Internal Audit

Calibration Certificate

Common requirements

- a) a title (e.g. “Test Report”, “Calibration Certificate” or “Report of Sampling”);
- b) the name and address of the laboratory;
- c) the location of performance of the laboratory activities, including when performed at a customer facility or at sites away from the laboratory’s permanent facilities, or in associated temporary or mobile facilities;
- d) unique identification that all its components are recognized as a portion of a complete report and a clear identification of the end;
- e) the name and contact information of the customer;
- f) identification of the method used;
- g) a description, unambiguous identification, and, when necessary, the condition of the item;
- h) the date of receipt of the test or calibration item(s), and the date of sampling, where this is critical to the validity and application of the results;

Calibration Certificate

- i) the date(s) of performance of the laboratory activity;
- j) the date of issue of the report;
- k) reference to the sampling plan and sampling method used by the laboratory or other bodies where these are relevant to the validity or application of the results;
- l) a statement to the effect that the results relate only to the items tested, calibrated or sampled;
- m) the results with, where appropriate, the units of measurement;
- n) additions to, deviations, or exclusions from the method;
- o) identification of the person(s) authorizing the report;
- p) clear identification when results are from external providers

Calibration Certificate

Specific requirements for calibration certificates

- a) the measurement uncertainty of the measurement result presented in the same unit as that of the measurand or in a term relative to the measurand (e.g. percent); NOTE According to ISO/IEC Guide 99, a measurement result is generally expressed as a single measured quantity value including unit of measurement and a measurement uncertainty.
- b) the conditions (e.g. environmental) under which the calibrations were made that have an influence on the measurement results;
- c) a statement identifying how the measurements are metrologically traceable (see Annex A);
- d) the results before and after any adjustment or repair, if available;
- e) where relevant, a statement of conformity with requirements or specifications (see 7.8.6);
- f) where appropriate, opinions and interpretations (see 7.8.7)

THANK YOU