Protocol for AFRIMETS Supplementary Comparison of relative humidity calibrations over the range 10 %rh to 95 %rh (5 °C to 55 °C)

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**Introduction**

The purpose of this bilateral interlaboratory comparison is to evaluate the equivalence of NMISA’s relative humidity calibration capabilities, over a wide range of temperatures, with those of MIRS/UL-FE/LMK (MIRS/University of Ljubljana, Faculty of Electrical Engineering/Laboratory of Metrology and Quality), the NMI of Slovenia.

A relative humidity hygrometer with capacitive sensor, which has previously been used for a similar comparison between MIKES (Finland) and NMISA [1], is used as the comparison artefact. It will be calibrated by MIRS/UL-FE/LMK, who will withhold their results while NMISA calibrates it. Then, NMISA and MIRS/UL-FE/LMK will exchange data and NMISA will compile the comparison report. NMISA acts as the pilot (coordinating) laboratory, and MIRS/UL-FE/LMK provides the Comparison Reference Values.

**Objectives of the comparison**

The objective of this comparison is to assess the procedures and standards used in calibrating relative humidity hygrometers at NMISA, particularly at temperatures other than ambient.

The travelling hygrometer is to pass through the following sequence:
- calibration at 10 \%rh, 35 %rh, 50 %rh, 75 %rh and 90 %rh or 95 %rh, at 5 °C, 25 °C and 55 °C

The travelling artefact details are as follows:

Manufacture: Vaisala  
Model: MI70 / HMP77  
Serial number: D0430039 & D1430001 (HMS-550)

The artefact should be handled with care. For transport, the artefact should be shipped via courier, packed in the accompanying protective case. The procedures for temporary imports required by the Department of Customs of the two countries must be followed.

**Participants**

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**Detailed instructions**

Upon receipt of the hygrometer, the host laboratory should inspect it for damage. If the travelling artefact is damaged, contact the pilot laboratory for instructions on how to proceed. If no damage has been sustained, the host should measure the hygrometer at the above-mentioned relative humidity and temperature values, using their normal procedure.

**Measurement procedures**

**NMISA**

Unsaturated salt solution ampoules, certified by an accredited commercial calibration laboratory, are used as reference standards for relative humidity measurements. Two ampoules of the same relative humidity are poured onto fibre pads in a 100 ml stainless steel chamber, placed in a temperature-controlled chamber. Two thermohygrometers, Rotronic Hygroclip S (S/N 37891 131) and Vaisala MI70 (S/N D0430039), are passed through O-ring seals into the small chamber. The measurements are done at three temperature points, i.e. 5 °C, 25 °C and 55 °C, not in a particular order. The chamber is set to the three temperatures consecutively, with typically five hours stabilisation time before each set of measurements, and a total time for all three sets of 15 hours. (The salt solution ampoules are not refreshed during this period.)
MIRS/UL-FE/LMK
Transfer standards are calibrated in a humidity generator by comparison to a reference relative humidity which is calculated according to Sonntag formulae [2] from measured dew-point temperature and temperature of the air, both directly measured by MBW 373H (s/n: 01-1108). Traceability of dew-point temperature is assured by a MIRS/UL-FE/LMK primary dew-point generator [3-5]. Air temperature measurements are traceable to MIRS/UL-FE/LMK temperature primary standard (fixed points).

At each temperature point, 5 °C, 25 °C and 55 °C, relative humidity points are set in rising and falling order to check for hysteresis of the instruments. At each set-point stability criteria are set according to standard deviation of calculated relative humidity.

Uncertainty analysis
The expanded uncertainty should be estimated at each calibration point.

References


