Calibration Traceability of Vaisala Calibration and Repair Services

What does traceability mean at Vaisala?

All Vaisala Calibration and Repair Service (CRS) calibrations are traceable to SI-Units. This means there is an unbroken chain of calibrations from the product being calibrated up to a national or international measurement laboratory.

The working standards used for the calibration of each individual product and their traceability are specified in the product's Calibration Certificate.

Vaisala CRS has Calibration and Repair Centers in:

- Helsinki (Finland)
- Boston (USA)
- Tokyo (Japan)
- Beijing (China)

The reference standards used at each location are calibrated by local calibration services or international calibration services as appropriate for each parameter. Vaisala uses only the best laboratories available for the source of traceability. Some in-house calibrations are performed by Vaisala's Measurement Standards Laboratory (MSL, Helsinki), or Calibration Standards Laboratory (CSL, Boston).

Unbroken chain from SI-units to each product

This document explains the traceability schemes for different product calibrations.

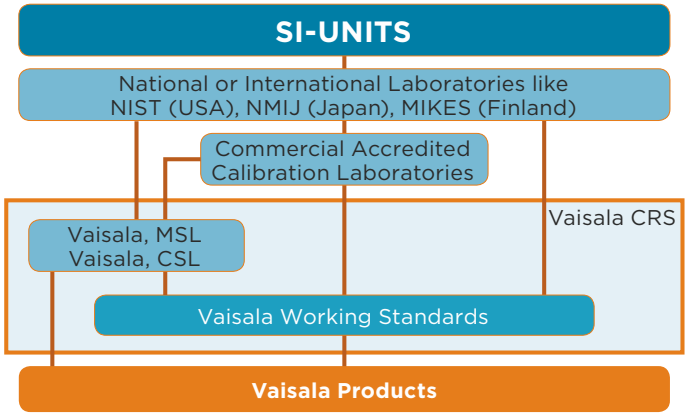

Figure 1. The general traceability scheme for Vaisala CRS

- NIST, National Institute of Standards and Technology, USA
- NMIJ, National Metrology Institute of Japan
- MIKES, Finnish national laboratory, MIKES – Metrology is part of VTT (Technical Research Centre of Finland LTD) starting 1'st of January, 2015.
- Vaisala MSL, Measurement Standards Laboratory, Helsinki, Finland
- Vaisala CSL, Calibration Standards Laboratory, Boston, USA
- Vaisala CRS, Calibration and Repair Services located in Regional Calibration Service Centers in Helsinki (Finland), Boston (USA), Tokyo (Japan) and Beijing (China)

Relative Humidity Measurement Products

The Traceability Chain

In all Vaisala humidity calibration systems the reference humidity values are generated with precision humidity generators. Depending on the measurement solution the precision humidity generator itself calculates the reference humidity value, the reference humidity value can be calculated from measured dew point temperature and air temperature values or the reference humidity value can be measured with calibrated Humidity Transmitters.

The References used in the Humidity and Temperature Traceability Chains

The Working Standards for relative humidity in CRS are:

- Dew point meters calibrated at national or commercial accredited calibration laboratories. The dew point meters are used together with temperature and pressure references and the relative humidity values are calculated from the measured values.
- Precision humidity generators calibrated in-house or at commercial accredited calibration laboratories.
- Vaisala HMT330 humidity and temperature transmitters and PTU300 combined pressure, humidity and temperature transmitters calibrated in-house.

The Working Standards used for temperature in CRS are:

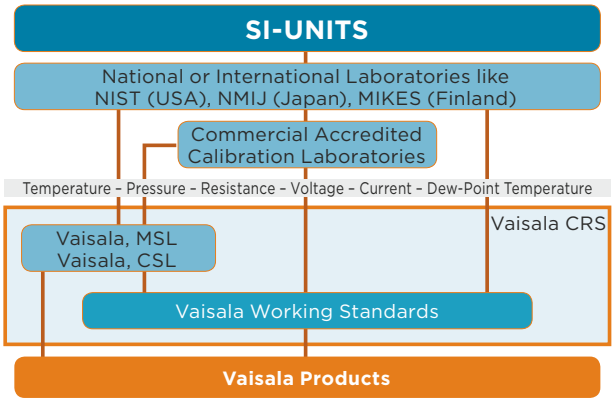

Figure 2. Traceability of the Relative Humidity Measurement Products

- Vaisala HMT330 humidity and temperature transmitters and PTU300 combined pressure, humidity and temperature transmitters calibrated in-house.
- Pt-100 temperature sensors connected to digital thermometers or digital multimeters. The temperature sensors and thermometers are calibrated in-house or at commercial accredited calibration laboratories.

Special calibration points for humidity and temperature as well as Accredited Calibrations are available by separate order.

Dew Point Measurement Products

The Traceability Chain

The reference dew point values are generated with precision dew point generators and either measured directly with calibrated dew point meters or the generator itself calculates the reference dew point value.

The References Used

The Working Standards for dew point temperature in CRS are:

- Dew point meters calibrated at national or commercial accredited calibration laboratories.
- Precision dew point generators calibrated in-house or at commercial accredited calibration laboratories.

The Working Standards used for temperature in CRS are:

- Vaisala HMT330 humidity and temperature transmitters and PTU300 combined pressure, humidity and temperature transmitters calibrated in-house.
- Pt-100 temperature sensors connected to digital thermometers or digital multimeters. The temperature sensors and thermometers are calibrated in-house or at commercial accredited calibration laboratories.

Special calibration points for dew point and temperature as well as Accredited Calibrations are available by separate order.

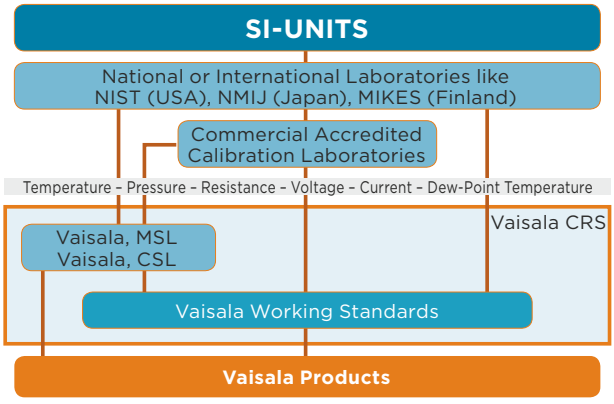

Figure 3. Traceability of the Dew point Measurement Products

Pressure Measurement Products

The Traceability Chain

The reference pressure values are generated and measured directly with calibrated Pressure Calibrators/Controllers.

The References used in the Pressure Traceability Chains

The Working Standards used for pressure in CRS are Pressure Calibrators/Controllers calibrated at national or commercial accredited calibration laboratories.

Accredited Calibrations are available by separate order.

For Combined PTU Transmitters the corresponding humidity and temperature traceabilities apply.

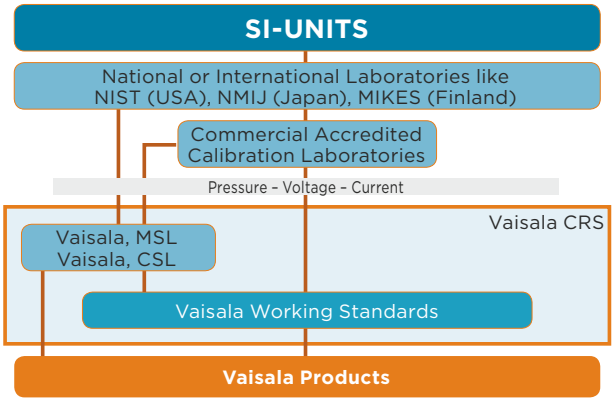

Figure 4. Traceability of the Pressure Measurement Products

Carbon Dioxide Measurement Products

The Traceability Chain

The reference gas concentration values are either produced and measured with calibrated Precision Mass Flow controllers by mixing pure Nitrogen and Carbon Dioxide or using certified gas concentrations.

The References Used in the Carbon Dioxide Traceability Chains

The Working Standards in CRS are:

- Digital Mass Flow Controllers calibrated regularly against the MSL Primary Flow Standard.
- Certified pure CO_2 and N_2 gases used for mixing gases of high CO_2 concentrations.
- Gravimetrically produced and analyzed (by gas supplier) CO_2 mixtures used as reference gas mixtures.

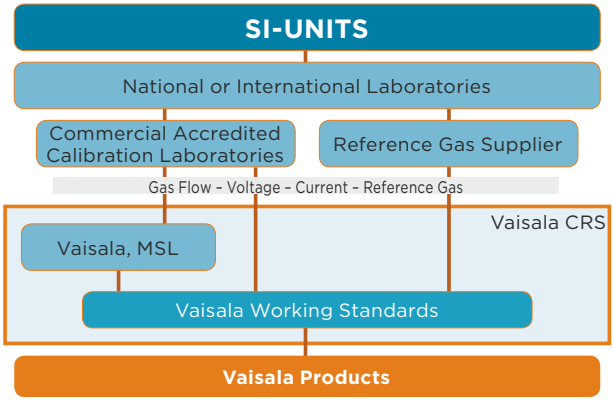

Figure 5. Traceability of the Carbon Dioxide Measurement Products

Analog Inputs and Outputs

If installed the analog inputs (voltage or current) are calibrated separately using a calibrated precision Voltage/Current Source.

If installed the analog outputs (voltage, current or resistance) are calibrated separately using a calibrated Multimeter and calibrated Current Shunt (for current output).

The Voltage/Current Sources and Multimeters are calibrated at commercial accredited calibration laboratories and the current shunts are calibrated in-house.

Calibration Intervals of the Reference Equipment

All the reference equipment included into the traceability chains are calibrated at regular intervals decided to each type of instrument based on the stability and accuracy level of the equipment.

The stability of the reference instruments is monitored using Stability Charts. See example of PPC3 and PPC4 Pressure Calibrators/Controllers stability Charts in Figures 6 and 7.

- The Cumulative drift shows how much the unit would be off if not calibrated at all.
- The Sequential drift shows what was the observed correction before adjustment, the blue limit lines are the stability values used in uncertainty estimation.

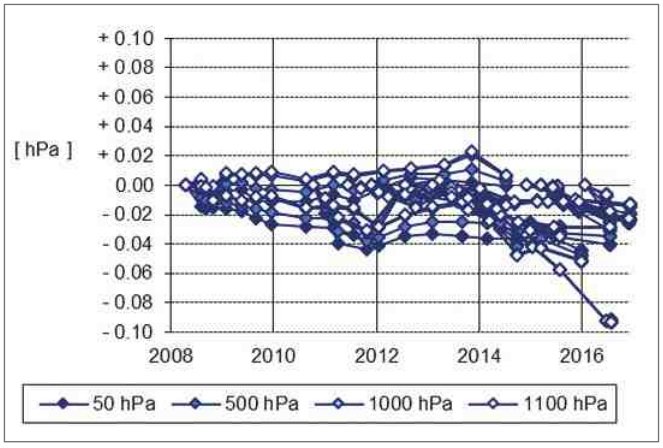

Figure 6. Cumulative drift

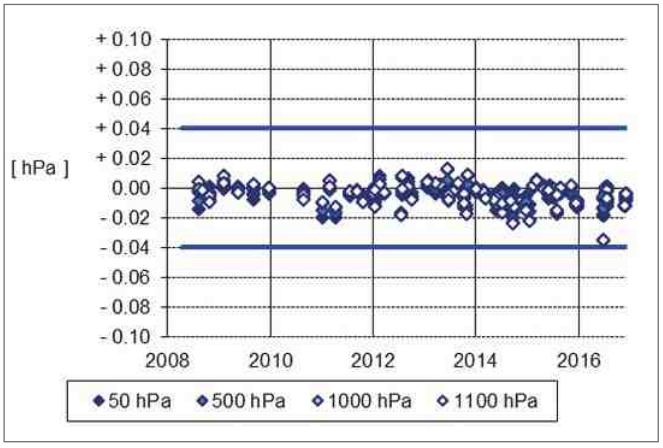

Figure 7. Sequential drift

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