



BSI Standards Publication

Meteorology — Radiosonde

Part 1: Laboratory test method for calibration error
of temperature sensor in radiosonde

National foreword

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**Meteorology — Radiosonde —
Part 1:
Laboratory test method for
calibration error of temperature
sensor in radiosonde**

Météorologie — Radiosonde —

*Partie 1: Méthode d'essai en laboratoire pour l'erreur
d'étalonnage du capteur de température dans la radiosonde*

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Contents

Page

Foreword.....iv

Introduction.....v

1 Scope.....1

2 Normative references.....1

3 Terms and definitions.....2

4 Symbols and subscripts.....3

4.1 Symbols.....3

4.2 Subscripts.....4

5 Technical requirements for the laboratory setup.....4

5.1 Test chamber.....4

5.2 Reference thermometers.....4

6 Test procedure for radiosonde temperature sensors.....5

6.1 Environmental conditions.....5

6.2 Preparation of radiosonde.....5

6.3 Installation of radiosonde.....5

6.4 Examination of laboratory setups.....6

7 Test methods and procedures.....7

7.1 Test conditions.....7

7.2 Testing sequence.....7

7.3 Data collection.....7

7.4 Finalization of the test.....8

8 Data processing.....8

8.1 Calculation of the reference temperature.....8

8.2 Calculation of the measurement error.....9

9 Evaluation of measurement uncertainty.....9

9.1 General.....9

9.2 Mathematical model of measurement.....9

9.3 Formula for combined standard uncertainty.....9

9.4 Calculation of expanded uncertainty.....10

10 Test report.....11

Bibliography.....12

Foreword

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Introduction

Temperature and water vapour (i.e. humidity) are two of the basic atmospheric state variables and important initialization for weather and climate prediction models. In order to measure the temperature and humidity in the upper-air atmosphere, radiosondes are widely used. Radiosonde is an instrument intended to be carried by a balloon through the atmosphere, equipped with devices to measure one or several meteorological variables (such as pressure, temperature and humidity), and provided with a radio-transmitter for sending this information to the observing station^[1]. Radiosonde observations are often used in conjunction with other measurement techniques such as remote sensing using satellites in order to provide comparative data. For radiosonde-derived data to be useful, the measurement accuracy of the radio-soundings needs to be known.

Thermistors, thin-film platinum resistance thermometers (PRTs), and thermocouples are mostly used as temperature sensors for radiosonde. Temperature from radiosonde is mainly affected by temperature sensor calibration and long and short-wave radiation correction. The impact of radiation correction on the temperature^{[2],[3]} is treated in a separate document^[4]. The temperature-dependent physical quantities, such as resistance or thermoelectric voltage, have peculiar formulae as a function of temperature. Thermistor uses the Steinhart-Hart equation, and Callendar van Dusen (CVD) formula is applied for the PRTs^[5]. Therefore, the temperature accuracy in ground condition mainly depends on the sensor calibration and thus an essential prerequisite to improve the measurement reliability of radiosondes is to calibrate the radiosonde sensors using ground-based facilities.

The temperature generated by a laboratory setup can be traceable to the SI via International Temperature Scale of 1990^[6]. The SI traceability of the setup should then be transferred to radiosonde temperature sensors through calibration by manufacturers. This document is mainly focused on testing the calibration error of temperature sensors in radiosondes sampled from a batch of mass production.

The Standing Committee on Measurements, Instrumentation and Traceability (SC-MINT) at the World Meteorological Organization (WMO) urges users to test selected samples of radiosondes under laboratory conditions in order to ensure that the calibrations supplied by the manufacturer are valid. Unless radiosonde sensors can be produced in large batches to give the reproducibility and accuracy required by users, it is necessary to calibrate the instruments and sensors individually. Even if the sensors can be produced in large batches to meet an agreed set of standardized performance checks, it is necessary for representative samples, selected at random, to be checked in more detail^[1]. This independent testing would further improve the reliability of radiosonde measurements by verifying the calibration results applied by the manufacturers. Despite the importance of the testing, the test setup in the guide by SC-MINT are limited to stability ($\pm 0,25$ °C/min) and systematic errors less than $\pm 0,1$ °C, and more detailed methodologies or test procedures for the testing of radiosonde temperature sensors have not yet been reported.