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TECHNICAL SPECIFICATION

colour inside

Industrial process control devices – Radiation thermometers – Part 2: Determination of the technical data for radiation thermometers

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 62492-2, which is a technical specification, has been prepared by subcommittee 65B: Measurement and control devices, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
65B/844/DTS	65B/859/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62492 series, published under the general title *Industrial process control devices – Radiation thermometers*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- transformed into an International Standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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INDUSTRIAL PROCESS CONTROL DEVICES – RADIATION THERMOMETERS –

Part 2: Determination of the technical data for radiation thermometers

1 Scope

This part of IEC 62492, which is a Technical Specification, applies to radiation thermometry and addresses all technical data specified in IEC/TS 62492-1. It defines standard test methods which can be used by the end user of radiation thermometers to determine or confirm the fundamental metrological data of radiation thermometers with one wavelength range and one measurement field.

The purpose of this specification is to facilitate comparability and testability. Therefore, unambiguous test methods are stipulated for determining technical data, under standardised measuring conditions that can be performed by a sufficiently skilled end user to serve as standard performance criteria for instrument evaluation or selection.

It is not compulsory for manufacturers and sellers of radiation thermometers to include all technical data given in this document in the data sheets for a specific type of radiation thermometer. Only the relevant data should be stated and should comply with this specification and IEC/TS 62492-1.

NOTE Infrared ear thermometers are excluded from this Technical Specification.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC/TS 62492-1:2008, *Industrial process control devices – Radiation thermometers – Part 1: Technical data for radiation thermometers*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document the following terms and definitions apply.

NOTE The terms and definitions listed below comply with IEC/TS 62492-1.

3.1.1
measuring temperature range
temperature range for which the radiation thermometer is designed

3.1.2
measurement uncertainty
parameter, associated with the result of a measurement, that characterises the dispersion of the values that could reasonably be attributed to the measurand

3.1.3
noise equivalent temperature difference
parameter which indicates the contribution of the measurement uncertainty in °C, which is due to instrument noise

3.1.4
measuring distance
distance or distance range between the radiation thermometer and the target (measured object) for which the radiation thermometer is designed

3.1.5
field-of-view
a usually circular, flat surface of a measured object from which the radiation thermometer receives radiation

3.1.6
distance ratio
the ratio of the measuring distance to the diameter of the field-of-view, when the target is in focus

3.1.7
size-of-source effect
the difference in the radiance or temperature reading of the radiation thermometer when changing the size of the radiating area of the observed source

3.1.8
emissivity setting
ratio between the radiation emitted from this surface and the radiation from a blackbody at the same temperature

Note 1 to entry: In most measuring situations a radiation thermometer is used on a surface with an emissivity significantly lower than 1. For this purpose most thermometers have the possibility of adjusting the emissivity setting. The temperature reading is then automatically corrected.

3.1.9
spectral range
parameter which gives the lower and upper limits of the wavelength range over which the radiation thermometer collects radiation from a source

3.1.10
influence of the internal instrument temperature
influence of the ambient temperature
temperature parameter
parameter which gives the additional uncertainty of the measured temperature value depending on the deviation of the temperature of the radiation thermometer from the value for which the technical data is valid after warm-up time and under stable ambient conditions

3.1.11
influence of air humidity
humidity parameter
parameter which gives the additional uncertainty of the measured temperature value depending on the relative air humidity at a defined ambient temperature

3.1.12
long-term stability
the reproducibility of measurements repeated over a long time period

Note 1 to entry: The time period is typically three months or one year.

3.1.13
short-term stability
the reproducibility of measurements repeated over a short time period

Note 1 to entry: The time period is several hours.

3.1.14
repeatability
twice the standard deviation of measurements repeated under the same conditions within a very short time span

Note 1 to entry: The time span is several minutes.

3.1.15
interchangeability
the maximum deviation between the readings of two instruments of the same type operating under identical conditions divided by two

3.1.16
response time
time interval between the instant of an abrupt change in the value of the input parameter and the instant from which the measured value of the radiation thermometer remains within specified limits of its final value

Note 1 to entry: The input parameter is an object temperature or an object radiation, and the output value is an output parameter.

3.1.17
exposure time
time interval between an abrupt rise and an abrupt fall in the value of the input parameter, such that the output value of the radiation thermometer reaches a given measurement value

Note 1 to entry: The input parameter is an object temperature or an object radiation.

3.1.18
warm-up time
time period needed for the radiation thermometer, after switching on, before it operates according to its specifications

3.1.19
operating temperature
the permissible temperature range within which the radiation thermometer may be operated

Note 1 to entry: For this temperature the specifications are valid.

3.1.20

operating air humidity range
the permissible humidity range within which the radiation thermometer may be operated

Note 1 to entry: For this humidity range the specifications are valid.

3.1.21
storage and transport temperature
the permissible ambient temperature range within which the radiation thermometer may be stored and transported without suffering permanent change

3.1.22

storage and transport air humidity range
the permissible humidity range within which the radiation thermometer may be stored and transported without suffering permanent change

3.1.23
safety
freedom from unacceptable risk

3.1.24
risk
combination of the probability of the occurrence of harm and the severity of that harm

3.1.25
harm
physical injury or damage to the health of people, or damage to property or the environment

3.1.26
tolerable risk
risk which is accepted in a given context based on the current values of society

3.2 Abbreviations

FWHM Full width at half maximum

NETD Noise equivalent temperature difference

SSE Size-of-source effect

4 Measurement conditions

The following test conditions apply for all measurements, if not stated otherwise:

a) laboratory ambient temperature range from 18 °C to 28 °C;

b) any special ambient conditions (e.g. humidity range, maximum ambient temperature change per time) and measurement conditions (e.g. measuring distance, radiating area diameter, response time) given by the manufacturer for the specific radiation thermometer to be adhered to;

c) the radiation thermometer to be connected to a power supply in accordance to the manufacturer's instructions;

d) the warm-up time specified by the manufacturer to be adhered to;

e) internal standardization check (initial self-test) to be carried out, if available;

f) emissivity setting set to 1 (one), if available;

g) the reference temperature source shall have a radiating area diameter as large as possible and in any case greater than the radiation thermometer field-of-view (target area) diameter;

h) all tests have to be performed with the reference temperature source set to a temperature that is significantly different from ambient temperature and the internal temperature of the radiation thermometer.

NOTE The reference temperature source is a radiation source of known radiation temperature in the spectral range of the radiation thermometer. Usually it is a blackbody source realised by a cavity radiator of known temperature. It will be called "reference source" throughout this document.

5 Determination of technical data

5.1 Measuring temperature range

5.1.1 General

The purpose of this test is to determine the measuring temperature range. For this temperature range, the measurement uncertainty remains within the specified limits.

Measurement temperature range (5.1), as well as Measurement uncertainty (5.2) and Noise equivalent temperature difference (5.3), are the most important parameters that specify a radiation thermometer. These three parameters are correlated with each other and in general noise equivalent temperature difference is larger at the lower limit of the measuring temperature range where uncertainty is larger. This relation is demonstrated in Table A.1 and the equation of Annex A.

NOTE Sometimes it is useful to determine additionally a wider *indicating temperature range* over which the thermometer will display a temperature but its specifications are not guaranteed.

5.1.2 Test method

5.1.2.1 The determination of the *measuring temperature range* is performed in accordance with 5.2.2 at the top and the bottom temperature of the specified measuring temperature range.

Determination of the indicating *temperature range*:

5.1.2.2 Sight the radiation thermometer at the centre of the radiating area of the reference source.

5.1.2.3 The temperature of the reference source is sequentially adjusted and stabilised at temperatures around the minimum temperature and the maximum temperature of the indicating temperature range given by the manufacturer, to determine the minimum and maximum temperatures for which the radiation thermometer is still indicating.

5.1.2.4 These two temperatures give the indicating temperature range.

5.2 Measurement uncertainty

5.2.1 General

A detailed description of the different methods to determine the measurement uncertainty and its confidence level is beyond the scope of this technical specification. In this technical specification terms, concept and definition of uncertainty is based on ISO/IEC Guide 98-3 and ISO/IEC Guide 99.

The described method is a basic test of the measurement uncertainty across the measuring temperature range.

5.2.2 Test method

5.2.2.1 Sight the radiation thermometer at the centre of the radiating area of the reference source.

5.2.2.2 The temperature of the reference source is sequentially stabilised at, at least, three temperatures distributed at the top, the bottom and an intermediate temperature of the measuring temperature range (see Note 1 of 5.2.2.5).

5.2.2.3 The temperature of the reference source and the temperature indicated by the radiation thermometer are recorded. The difference between these two values is calculated and recorded.

5.2.2.4 The test sequence is performed three times for the same three calibration points. An average temperature difference is calculated and recorded for each calibration temperature point.

5.2.2.5 The value of the measurement uncertainty of the radiation thermometer at each calibration temperature is taken to be the average difference determined in 5.2.2.4 plus the