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**NATIONAL STANDARD OF THE  
PEOPLE'S REPUBLIC OF CHINA**

**GB/T 29820.2-2024**

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**Assessment of uncertainty in the calibration and use of flow  
measurement devices - Part 2: Non-linear calibration  
relationships**

**(English Translation)**

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## Foreword

This document is in accordance with the provisions of GB/T 1.1-2020 "Guidelines for standardization work Part 1: Structure and drafting rules for standardization documents" Drafting.

This document is part 2 of GB/T 29820 "Evaluation of uncertainty in calibration and use of flow measurement devices". GB/T 29820 has been the following parts have been published.

--- Part 1: Linear calibration relationship;

--- Part 2: Non-linear calibration relationship.

This document is modified from ISO 7066-2:1988 "Evaluation of uncertainty in the calibration and use of flow measurement devices - Part 2: Nonlinearity" Calibration Relationship.

This document has the following structural adjustments compared to ISO 7066-2:1988.

--- Appendix A corresponds to Appendix C of ISO 7066-2:1988;

--- Appendix B corresponds to Appendix D of ISO 7066-2:1988;

--- Appendix C corresponds to Appendix A of ISO 7066-2:1988;

--- Appendix D corresponds to Appendix B of ISO 7066-2:1988.

The technical differences between this document and ISO 7066-2:1988 and their reasons are as follows.

--- Changed the concepts of "random uncertainty" and "systematic uncertainty" according to the provisions of GUM and ISO 5168:2005.

In order to classify according to the uncertainty assessment method, it is divided into Class A standard uncertainty and Class B standard uncertainty;

--- Changed the symbols in Chapter 4, replacing the symbol " $e_R()$ " with the symbol " $u()$ " the symbol "random uncertainty of the quantity" and the symbol "systematic uncertainty of the variable in brackets" are represented by " $u_c(y)$  and  $u_s(y)$ " The synthesis of calibration coefficients is not Degree of certainty" replaces the symbol " $e(y)$

c) Total uncertainty of calibration coefficients", adding the symbol " $u_A()$  The variables in brackets are of type A standard Uncertainty", the symbol "Type B standard uncertainty of the variable in the brackets of  $u_B()$ " was added to adapt to my country's technical conditions;

--- ISO 7066-1 (see Chapter 5) has been replaced by the normative reference GB/T 29820.1 to adapt to my country's technical conditions.

The following editorial changes were made to this document.

--- Added a note on the term "regression analysis" (see 3.3);

--- Replaced ISO 5168 with the informative reference GB/T 27759 and included the document in the references;

--- Modified the contents of the diagram in the informative Appendix B;

- Modified the incorrect symbols and formulas in the informative appendix D, and changed  $\delta(1)$ ,  $\delta(2)$ ,  $\delta(3)$ ,  $\delta(1)$ ,  $\delta(2)$ ,  $\delta(3)$  to  $\delta_1$ ,  $\delta_2$ ,  $\delta_3$ ,  $\delta_1$ ,  $\delta_2$ ,  $\delta_3$ ,  $b_0=y-(n-1)\delta_2$  twenty four  $-\delta_1x$  dx  $\delta_2x^2$   $2dx^2$  Modify to  $b_0=y-\delta_1x$  dx  $\delta_2x^2$   $2dx^2$  ,y and  $= 3313.12-6384.74x-20312.5x^2$  modified to y and  $=3258.45-6384.74x-20312.5x^2$ ;
- Move the references in informative Appendix E to the references of this document.

## Introduction

GB/T 29820 "Evaluation of uncertainty in calibration and use of flow measurement devices" is intended to consist of two parts.

--- Part 1: Linear calibration relationship. The purpose is to determine the calibration diagrams and the process of evaluating the uncertainty of such a calibration. This section only considers the uncertainty evaluation of the linear relationship.

--- Part 2: Nonlinear calibration relationships. The purpose is to determine the relationship using the least squares criterion using quadratic, cubic or higher order polynomials.

The process of fitting a set of nonlinear calibration data and estimating the uncertainty associated with the resulting calibration curve.

Evaluation of the uncertainty in calibration and use of flow measurement devices Part 2: Nonlinear calibration relationships

## 1 Scope

This document describes the use of the least squares criterion to fit a set of nonlinear calibration data using a quadratic, cubic or higher order polynomial and to evaluate the uncertainty associated with the generated calibration curve is calculated using only polynomials raised to integer powers.

Since this type of curve fitting and uncertainty assessment usually requires the use of a computer, in most cases, A standard procedure is provided; a reference procedure is given in Appendix A.

Examples of the use of these methods are given in Appendix B.

Extrapolation beyond the data range is not permitted.

## 2 Normative references

The contents of the following documents constitute the essential clauses of this document through normative references in this document.

For referenced documents without a date, only the version corresponding to that date

applies to this document; for referenced documents without a date, the latest version (including all amendments) applies to this document.

GB/T 29820.1 Evaluation of calibration and use uncertainty of flow measurement devices  
Part 1: Linear calibration relationship (GB/T 29820.1-2013,ISO/T R7066-1.1997, MOD)

### 3 Terms and definitions

The following terms and definitions apply to this document.

method of least squares when a particular form of equation is chosen to fit a curve to the data, the technique used to calculate the coefficients of that equation is to use the sum of squares of the deviations of the data of the open curve is the minimum.

polynomial(function) for a variable  $x$ , a series of terms raised to increasing powers of  $x$ .

Regression analysis

A method of quantitatively expressing the dependence of one variable on one or more other variables.

Note 1 to entry. Regression is the process of determining the unknowns of a proposed model in such a way that the predictions of the model come as close as possible to the data.

Usually "as close as possible" means that the sum of squared deviations is minimized.

NOTE 2 Many computer programs suitable for curve fitting have the word "regression" in their names. For the purpose of this document, the terms regression and least squares are considered synonymous.

The laws are interchangeable.

Standard Deviation

The positive square root of the variance.