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

GB/T 29820.1-2013

**Assessment of uncertainty in calibration and use of flow
measurement devices -- Part 1: Linear calibration relationships**

流量测量装置校准和使用不确定度的评估 第1部分：线性校准关系

(English Translation)

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Foreword

GB/T 29820 "and use of flow measurement calibration uncertainty of the evaluation unit" consists of the following components.

--- Part 1. Linear calibration relationship;

--- Part 2. non-linear calibration relationships.

This section GB/T Part of 129,820.

This section drafted in accordance with GB/T 1.1-2009 given rules.

The partial modification of the use of ISO/T R7066-1.1997 "means the calibration and use of flow measurement uncertainty assessment - Part 1. Wire Calibration relationship. " this part of ISO/T R7066-1.1997 compared to the following technical differences in terms of these differences have been involved in through the outside Vertical singlet margin position

(I) were marked.

ISO/T R7066-1.1997 referenced ISO/T R5168.1998 has been ISO 5168:2005 replaced. And ISO/TR 5168. compared to 1998, ISO 5168:2005 has been a major change in the concepts and terms "random" and "system" components of uncertainty, "with Machine "and" system "uncertainty component is preferably no longer classified following two main reasons.

1) and GUM (ISO Guide to the Expression of Uncertainty Measurement method) consistent components of uncertainty due to random or systematic causes, the same treatment after the evaluation;

2) These terms may be ambiguous or confusing when in use. For these reasons, ISO 5168:2005 is no longer the uncertainty minutes Amount into "random component" or "system components", but according to the evaluation method of classification, the uncertainty components are divided into "A Class standard uncertainty" and "Class B standard uncertainty" were evaluated.

To this end, section by ISO 5168:2005 made technical corrections.

--- No longer use the "random effects lead to uncertainty" and "System error limit" concept, but according to the evaluation method of uncertainty into the Line classified into Class A and Class B standard uncertainty standard uncertainty;

--- Normative references file to GB/T 27759-2011 (ISO 5168:2005, IDT) replace ISO/T R5168.1998;

--- "Terms, definitions and symbols", press the uncertainty evaluation standard of the original random-effects lead to uncertainty and systematic error limit the term may be ambiguous or confusing when used to modify the Class A and Class B standard uncertainty standard uncertainty of terms Definitions; symbol u () "standard uncertainty in parentheses variables" instead of the symbol e_r () "random uncertainty brackets variables Degree "and the symbol e_s () "system error limit brackets Variables "; added" 3.1.16 Precision Measurement "content; 3.2 Symbols, "theta influence coefficient" and GB/T 27759-2011 express agreement known as the "sensitivity factor";

--- 6.4 in GB/T 27759-2011 Annex D instead of ISO/T R5168.1998 Annex E;

--- After 8.2.2 added a "note", describes the method of least squares to determine the correlation coefficient of linear correlation method;

--- Chapter 11 from "Measurement uncertainty" with "Class A computing standard uncertainty," Chapter 12, limited by a "system error and reports Program "to" Class B standard uncertainty and reporting procedures ";

--- Delete B.2 of the "note" that "Note. Many of the standards for flow measurement, A class standard uncertainty u_A (Q) with the symbol $2s_{mr}$, Where s_{mr} defined as the standard

error of the mean Relations. "Because the current flow is no longer used in the standard notation, and and this article is not associated with the note back and forth in this section.

After verification, ISO/T R7066-1. two examples of 1997 Appendices B and C is given, there are individual formula clerical error, the number of According to calculation errors and tables of individual header symbol writing errors, this section gives the calculation and verification of modification, as follows.

- a) Table B.1 of the header. Q rewritten as Q_i ; xy rewritten x_{iy} , x_2 rewrite x_{2i} ;
- b) Table B.1 "observation No. 25" in, $\ln Q_i (y_i)$ data from the 4.4096 to 4.2096 modification;
- c) Table B.2 of the header. Q Rewritten as Q_i ; $\ln Q (Y)$ is rewritten as $\ln Q_i (y_i)$; $(y_i - y)^2$ is rewritten $(y_i - y)^2$;
- i) $2; eR (\ln Q)$ change
Written $u_{Arel} (\ln Q)$
- i), and add the unit "%";
- d) Table B.2 "observation No. 14" and "observation No. 15", the last one to modify the data from the 1.66 to 1.16;
- e) B.5, the equation (B.7). $sR = \sum \ln Q_i - \ln Q ()^2 / n ()^2 - 1/2$ modify $sR = \sum \ln Q_i - \ln Q ()^2 / n ()^2 - 1/2$;
- f) B.6 formula (B.9) in. $u_{Arel} (\ln Q)$ is amended as $u_{Arel} (\ln Q)$
- g) B.7 in. $u_{Arel} (\ln Q)$, $u_{Arel} (\ln Q_i)$ is amended as $u_{Arel} (\ln Q)$
- h) C.4.1 in. $(1/Red)^{1/2}$ revised to $103/Red^{1/2}$;
- i) C.6.1 in. $u_A (1/Red)^{1/2} = 8.1 \times 10^{-7}$, $u_A (C) = 9.5 \times 10^{-4}$ is amended as $u_A (1/Red^{1/2}) = u_{Arel} (X) \times X = 8.1 \times 10^{-7}$, $u_A (C) = u_{Arel} (C) \times C = 9.5 \times 10^{-4}$; $\gamma = 1144$ as modified $\gamma = 1173$;
- j) C.6.2, in order to express clearly. Equation (C.7) by the $C = 0.5827 \cdot 8.2597 / Red^{1/2}()$ is amended as $C = 0.5827 (8.2597 \times 10^{-3}) \times 103 / Red^{1/2}()$;
- k) Table C.3. Value $s_2 (x)$ is modified by 1.087864 to 0.1087864; $Cov (xy)$ by the value 8.985401×10^{-7} modification it was 8.985401×10^{-4} ;
- l) C.6.3 of $0.0082597 \pm (2.06 \times 0.0005007)$ is amended as $0.0082597 \pm (2.06 \times 0.0005109)$
- m) C.6.4 in. $sR = 8.42 \times 10^{-4}$ is amended as $sR = 8.26 \times 10^{-4}$, $u_A (C) = 3.469 \times 10^{-3}$ modify $u_A (C) = 3.399 \times 10^{-4}$;
- n) C.6.5 in. $U'RSS (C) = (0.0352 \cdot 0.752)^{1/2\%} = 0.75\%$ revised to $U'RSS (C) = (0.752$

$0.0342) \ 1/2\% = 0.75\%$;

o) C.6.6 in. $U'RSS(C) \ 0.0352 = 0.15 \ () \ 21/2\% = 0.15\%$ for the modified $U'RSS(C) \ 0.0342 = 0.15 \ () \ 21/2\% = 0.15\%$;

p) C.7.1 in. Equation (C.11) by the $u_A(X) = u_{A2} \ () \ \sqrt{v/4} \ u_{A2} \ () \ \sqrt{H' / \{ \}} \ 8 \ 1/2$ amended as $u_A(X) = u_{A2} \ () \ \sqrt{v/4} \ u_{A2} \ () \ \sqrt{H' / \{ \}} \ 16 \ 1/2$;

q) C.7.4 in. $X_k = 0.00112$ amended as $X_k = 1.12$, $u_{Arel}(X) = 0.5/81/2\% = 0.18\%$ revised to $u_{Arel}(X) = (0.5) \ 2/16\% = 0.125\%$; $u_{Brel}(X) = (0.25 \ 0.125) \ 1/2\% = 0.61\%$ for the modified $u_{Brel}(X) = (0.25 \ 0.0625)\% = 0.56\%$; $URSS(C) = (0.5919 \times 0.0016) = 9.4704 \times 10^{-4}$ repair Instead $URSS(C) = (0.5919 \times 0.0015) = 8.8785 \times 10^{-4}$;

$U'RSS(C) = 9.4704 \times 10 \ () \ -4 \ 2 \ 5.88 \times 10 \ () \ \sqrt{-5 \ 2 \ 1/2/0.5919} = 0.16\%$ for the modified $U'RSS(C) = 8.8785 \times 10 \ () \ -4 \ 2 \ 5.299 \times 10 \ () \ \sqrt{-5 \ 2 \ 1/2/0.5919} = 0.13\%$;

Formula $URSS(C0) = 8.26 \ 0.00112 \times 0. \ () \ 0018 \ 2 \ 0.00112 \times 0. \ () \ 0061 \ \sqrt{2 \ 1/2} = 5.88 \times 10^{-5}$ in number it is a mistake to amend $URSS(C0) = 8.26 \times 10^{-3} \ 1.12 \times 0. \ () \ 00125 \ 2 \ 1.12 \times 0. \ () \ 0056 \ \sqrt{2 \ 1/2} = 5.299 \times 10^{-5}$.

This section also made the following editorial changes.

--- Canceled Chapter 1, section numbers, "range" within;

--- Change the number of formulas in the Appendix.

This part is proposed by China Machinery Industry Federation.

This part of the measurement and control of Standardization Technical Committee (SAC/TC124) is administered by the National industrial processes.

This section is drafted. Shanghai Industrial Automation Instrument Research Institute, Shanghai Automation Instrumentation system verification tests, China Metrology Research Institute, Beijing Institute of Metrology detection, Shanghai Institute of Measurement and Testing, Shanghai Polytechnic University, Shanghai Weier Tai Industrial Automation Copper Co., Ltd., Yuyao Yinhuang Traffic Instrument Co., Ltd., Central-day instrument Co., Ltd., Dandong Beit Automation Instrumentation has Limited.

1 Scope

GB/T 29820 in this section describes the access to a variety of tube closure or open channel flow measurement calibration charts and evaluate such calibration is not the process of determining the degree. The use of calibration charts to evaluate the measurement uncertainty of the process of this part are also given, as well as the same point repeatedly measuring the average flow rate Uncertainty value calculation program.

This section only considers uncertainty estimate a linear relationship. Uncertainty nonlinear relationship discussed by the GB/T 29820.2. therefore, this section only applies to the