

# ISO 5168:2005-06 (E)

## Measurement of fluid flow - Procedures for the evaluation of uncertainties

---

| <b>Contents</b>   |  | <b>Page</b> |
|---|--|-------------|
| Foreword .....  |  | iv          |
| Introduction .....  |  | v           |
| 1   | Scope .....  | 1           |
| 2   | Normative references .....                                   | 1           |
| 3   | Terms and definitions .....                                  | 1           |
| 4   | Symbols and abbreviated terms .....                          | 3           |
| 4.1   | Symbols .....  | 3           |
| 4.2   | Subscripts .....   | 7           |
| 5   | Evaluation of the uncertainty in a measurement process ..... | 8           |
| 6   | Type A evaluations of uncertainty .....                      | 9           |
| 6.1   | General considerations .....                                 | 9           |
| 6.2   | Calculation procedure .....                                  | 9           |
| 7   | Type B evaluation of uncertainties .....                     | 10          |
| 7.1   | General considerations .....                                 | 10          |
| 7.2   | Calculation procedure .....                                  | 10          |
| 7.3   | Rectangular probability distribution .....                   | 10          |
| 7.4   | Normal probability distribution .....                        | 11          |
| 7.5   | Triangular probability distribution .....                    | 11          |
| 7.6   | Bimodal probability distribution .....                       | 11          |
| 7.7   | Assigning a probability distribution .....                   | 11          |
| 7.8   | Asymmetric probability distributions .....                   | 11          |
| 8   | Sensitivity coefficients .....                               | 12          |
| 8.1   | General .....  | 12          |
| 8.2   | Analytical solution .....                                    | 12          |
| 8.3   | Numerical solution .....                                     | 12          |
| 9   | Combination of uncertainties .....                           | 13          |
| 10  | Expression of results .....                                  | 14          |
| 10.1  | Expanded uncertainty .....                                   | 14          |
| 10.2  | Uncertainty budget .....                                     | 15          |
| Annex A (normative) Step-by-step procedure for calculating uncertainty .....                        |  | 17          |
| Annex B (normative) Probability distributions .....   |  | 20          |
| Annex C (normative) Coverage factors .....  |  | 22          |
| Annex D (informative) Basic statistical concepts for use in Type A assessments of uncertainty ..... |  | 24          |
| Annex E (informative) Measurement uncertainty sources .....   |  | 36          |
| Annex F (informative) Correlated input variables .....  |  | 38          |

|  |           |
|--|-----------|
| <b>Annex G (informative) Examples .....</b>  | <b>40</b> |
| <b>Annex H (informative) The calibration of a flow meter on a calibration rig .....</b>  | <b>58</b> |
| <b>Annex I (informative) Type A and Type B uncertainties in relation to contributions to uncertainty<br/>from "random" and "systematic" sources of uncertainty .....</b> | <b>61</b> |
| <b>Annex J (informative) Special situations using two or more meters in parallel .....</b>   | <b>62</b> |
| <b>Annex K (informative) Alternative technique for uncertainty analysis .....</b>  | <b>64</b> |
| <b>Bibliography .....</b>  | <b>65</b> |