

ISO 4359:2013-02 (E)

Flow measurement structures - Rectangular, trapezoidal and U-shaped flumes

Contents		Page
Foreword		v
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Symbols	2
5	Flume types and principles of operation	3
6	Installation	6
6.1	Selection of site	6
6.2	Installation conditions	8
7	Maintenance	10
8	Measurement of head	11
8.1	General	11
8.2	Location of head measurement(s)	11
8.3	Gauge wells	11
8.4	Zero setting	12
9	General equations for discharge	12
9.1	Discharge based on critical flow in the flume throat	12
9.2	Discharge based on observed upstream head	13
9.3	Calculation of stage-discharge relationships	27
9.4	Approach velocity and coefficient of velocity	27
9.5	Selection of flume size and shape	28
10	Rectangular-throated flume	30
10.1	Description	30
10.2	Location of head measurement section	30
10.3	Provision for modular flow	30
10.4	Evaluation of discharge for a given observed upstream head	31
10.5	Computation of stage-discharge relationship	35
10.6	Limits of application	35
11	Trapezoidal-throated flumes	36
11.1	Description	36
11.2	Location of head measurement section	36
11.3	Provision for modular flow	37
11.4	Evaluation of discharge -- Coefficient method	37
11.5	Computation of stage-discharge relationship	40
11.6	Limits of application	42
12	U-throated (round-bottomed) flumes	43
12.1	Description	43
12.2	Location of head measurement section	44
12.3	Provision for modular flow	44
12.4	Evaluation of discharge -- Coefficient method	44

12.5	Computation of stage-discharge relationship	48
12.6	Limits of application	50
13	Uncertainties of flow measurement	51
13.1	General	51
13.2	Combining measurement uncertainties	52
13.3	Percentage uncertainty of discharge coefficient $u^*(C)$ for critical-depth flumes	54
13.4	Uncertainty budget	54
14	Example of uncertainty calculations	55
14.1	General	55
14.2	Characteristics -- Gauging structure	55
14.3	Characteristics -- Discharge calculation	55
14.4	Characteristics -- Discharge coefficient	55
14.5	Characteristics -- Gauged head instrumentation	56
14.6	Characteristics -- Throat width	56
14.7	Overall uncertainty in discharge	57
Annex A (informative) Simplified head-discharge relationships for flume		58
Annex B (informative) Introduction to measurement uncertainty		63
Annex C (informative) Sample measurement performance for use in hydrometric worked examples		72
Annex D (informative) Spreadsheets for use with this International Standard		75
Bibliography		77