

ISO 6416:2004-07 (E)

Hydrometry - Measurement of discharge by the ultrasonic (acoustic) method

Contents		Page
Foreword		v
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Applications	1
4.1	Open channels	1
4.2	Multiple channels	2
4.3	Closed conduits	2
5	Method of measurement	3
5.1	Discharge	3
5.2	Calculation of discharge from the transit-time measurement	3
6	Flow velocity determination by the ultrasonic (transit time) method	3
6.1	Principle	3
6.2	Sound propagation in water	6
7	Gauge configuration	10
7.1	General	10
7.2	Single-path systems	11
7.3	Multi-path systems	12
7.4	Crossed path systems	12
7.5	Reflected-path systems	14
7.6	Systems using transponders	15
7.7	Systems using divided cross-sections	16
7.8	Sloping paths	17
8	Calculation of discharge	17
8.1	Single-path systems	17
8.2	Multi-path systems	17
8.3	Systems with transducers in the channel	21
9	System calibration	21
9.1	General	21
9.2	Single-path systems	22
10	Site selection	24
10.1	Practical constraints	24
10.2	Physical constraints of the measurement site	25
10.3	Physical constraints which are distant from the measurement site	25
11	Site survey -- Before design and construction	26
11.1	General	26
11.2	Visual survey	26
11.3	Survey of the cross-section	27
11.4	Survey of velocity distribution	27
11.5	Survey of signal propagation	28
11.6	Other survey activities	28

12	Operational measurement requirements	28
12.1	General	28
12.2	Basic components of flow determination	29
12.3	Water velocity determination	29
12.4	Determination of water stage or depth	29
12.5	Channel width	30
13	Gauging station equipment	30
13.1	General	30
13.2	Design and construction of equipment	31
13.3	Reflectors	32
13.4	Civil engineering works	35
13.5	Signal timing and processing	35
13.6	System self-checking	37
13.7	Site-specific data (or site parameters)	38
13.8	Clock and calendar	38
13.9	System performance criteria	38
13.10	System output	40
13.11	Installation	40
13.12	Commissioning	41
13.13	Operating manual	41
13.14	Maintenance	41
14	Measurement uncertainties	43
14.1	General	43
14.2	Definition of uncertainty	43
14.3	Uncertainty in discharge	44
	Bibliography	50