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