
**Hydrometry — Measurement of
liquid flow in open channels —
Determination of the stage–discharge
relationship**

*Hydrométrie — Mesurage du débit des cours d'eau — Détermination
de la relation hauteur–débit*

iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO 18320:2020](https://standards.iteh.ai/catalog/standards/iso/681cb2c1-69dc-4a4c-81d8-880dd563b08f/iso-18320-2020)

<https://standards.iteh.ai/catalog/standards/iso/681cb2c1-69dc-4a4c-81d8-880dd563b08f/iso-18320-2020>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

[ISO 18320:2020](https://standards.iteh.ai/catalog/standards/iso/681cb2c1-69dc-4a4c-81d8-880dd563b08f/iso-18320-2020)

<https://standards.iteh.ai/catalog/standards/iso/681cb2c1-69dc-4a4c-81d8-880dd563b08f/iso-18320-2020>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	v
1 Scope	1
2 Normative references	1
3 Terms, definitions and symbols	1
3.1 Terms and definitions.....	1
3.2 Symbols.....	1
4 Principle of the stage–discharge relationship	2
4.1 General.....	2
4.2 Controls.....	3
4.3 Governing hydraulic formulae.....	3
5 Stage–discharge calibration of a gauging station	5
5.1 General.....	5
5.2 Preparation of a stage–discharge relationship.....	5
5.2.1 General.....	5
5.2.2 List of discharge measurements.....	5
5.2.3 Arithmetic plotting scales.....	7
5.2.4 Logarithmic plotting scales.....	8
5.2.5 Commercially available software.....	10
5.2.6 Rating-curve shape.....	11
5.3 Curve fitting.....	12
5.3.1 General.....	12
5.3.2 Hydraulic-formula curves.....	12
5.3.3 Mathematical rating curves.....	13
5.3.4 Software packages to aid the determination of the rating curve.....	13
5.4 Combination-control stage–discharge relationships.....	13
5.5 Stable stage–discharge relationships.....	13
5.6 Unstable stage–discharge relationships.....	14
5.7 Shifting controls.....	14
5.8 Variable-backwater effects.....	15
5.8.1 General.....	15
5.8.2 Downstream backwater influences.....	15
5.8.3 Hysteresis effects or loop rating curves.....	15
5.9 Extrapolation of the stage–discharge relationship.....	18
6 Methods of testing stage–discharge relationships	18
7 Uncertainty in the stage–discharge relationship	19
7.1 General.....	19
7.2 Definition of uncertainty.....	19
7.3 Statistical analysis of the stage–discharge relationship.....	20
7.3.1 General.....	20
7.3.2 Standard error of estimate.....	20
7.3.3 Standard uncertainty.....	21
7.4 Uncertainty of predicted discharge.....	22
Annex A (informative) Types of control	23
Annex B (informative) Complexities of stage–discharge relationships	24
Annex C (informative) Software packages available to evaluate the stage–discharge relationship	25
Annex D (informative) Examples of a hypothetical rating curve	29
Annex E (informative) Example of how hydraulic properties of a river channel properties vary with stage	31
Annex F (informative) Use of shift controls	37

Annex G (informative) Extrapolation of a stage–discharge relationship	39
Annex H (informative) Uncertainty in the stage–discharge relationship and in a continuous measurement of discharge	41
Bibliography	44

iTeh Standards
(<https://standards.itih.ai>)
Document Preview

[ISO 18320:2020](https://standards.itih.ai/catalog/standards/iso/681cb2c1-69dc-4a4c-81d8-880dd563b08f/iso-18320-2020)

<https://standards.itih.ai/catalog/standards/iso/681cb2c1-69dc-4a4c-81d8-880dd563b08f/iso-18320-2020>

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 113, *Hydrometry*, Subcommittee SC 1, *Velocity area methods*.

This first edition of ISO 18320 cancels and replaces ISO 1100-2:2010, which has been technically revised.

The main changes compared to the previous edition are as follows.

- Major revisions have been made to [Clause 5](#), including a new figure of a stage–discharge relationship and shift curves.
- [Clause 7](#) has been revised to be consistent with new standards on uncertainty.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Hydrometry — Measurement of liquid flow in open channels — Determination of the stage–discharge relationship

1 Scope

This document specifies methods of determining the stage–discharge relationship for gauging stations. It specifies an accuracy for defining the stage–discharge relationship based on a sufficient number of discharge measurements, complete with corresponding stage measurements.

This document considers stable and unstable channels and includes brief descriptions of the effects on the stage–discharge relationship of the transition from inbank to overbank flows, shifting controls, variable backwater and hysteresis. Methods of determining discharge for twin-gauge stations, ultrasonic velocity-measurement stations and other complex rating curves are not described in detail.

NOTE These types of rating curves are described separately in other International Standards, Technical Specifications and Technical Reports, which are listed in the Bibliography.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 748, *Hydrometry — Measurement of liquid flow in open channels using current-meters or floats*

ISO 772, *Hydrometry — Vocabulary and symbols*

ISO 18320:2020

<https://standards.iteh.ai/catalog/standards/iso/681cb2c1-69dc-4a4c-81d8-880dd563b08f/iso-18320-2020>

3 Terms, definitions and symbols

3.1 Terms and definitions

No terms and definitions are listed in this document.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.2 Symbols

For the purposes of this document, the symbols given in ISO 772 and the following apply.

Symbol	Definition
A	wet cross-sectional area
B	cross-sectional width
β	power-law exponent (slope on logarithmic plot) of the rating curve
C_D	coefficient of discharge

^a Some reference texts use a characteristic dimension of four times the hydraulic radius, because it gives the same value of Re for the onset of turbulence as in pipe flow^[16]. Other texts use the hydraulic radius as the characteristic length-scale, with consequently different values of Re for transition and turbulent flow.