

Measurement of liquid flow in open channels — Stream flow measurement —

**Part 3Q: Guidelines for safe working
practice in river flow measurement**

ICS 17.120.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee CPI/113, upon which the following bodies were represented:

- British Hydrological Society
- British Waterways Board
- Chartered Institution of Water and Environmental Management
- Department of the Environment, Transport and the Regions — Water and Land Directorate
- Environment Agency
- Institution of Civil Engineers

The following bodies were also represented in the drafting of the standard, through a subcommittee:

- Co-opted members
- Cranfield University
- Gambica (Beama Ltd)
- Scottish Environmental Protection Agency

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Foreword

This British Standard has been prepared by Technical Committee CPI/113 with the assistance of subcommittee CPI/113/1.

It forms a revision of BS 3680:Part 3Q:1993, incorporating improvements in line with changes in practice, particularly to the requirements of the Health and Safety at Work etc. Act 1974. No other British Standard is affected by its publication.

The following currently available parts of BS 3680 cover stream flow measurement:

- *Part 3A: Measurement of liquid flow in open channels — Stream flow measurement — Velocity-area methods;*
- *Part 3B: Guide for the establishment and operation of a gauging station;*
- *Part 3D: Moving-boat method;*
- *Part 3E: Measurement of discharge by the ultrasonic (acoustic) method;*
- *Part 3F: Collection and processing of data for determination of errors in measurement;*
- *Part 3H: Electromagnetic method using a full-channel-width coil;*
- *Part 3J: Guide to the measurement of discharge using three verticals;*
- *Part 3M: Guide to the methods of measuring high discharges in rivers;*
- *Part 4A: Methods of measurement of liquid flow in open channels — Weirs and flumes — Method using thin-plate weirs;*
- *Part 4B: Methods of measurement of liquid flow in open channels — Weirs and flumes — Triangular profile weirs;*
- *Part 4C: Methods of measurement of liquid flow in open channels — Weirs and flumes — Flumes;*
- *Part 4E: Methods of measurement of liquid flow in open channels — Weirs and flumes — Rectangular broad-crested weirs;*
- *Part 4F: Methods of measurement of liquid flow in open channels — Weirs and flumes — Round nose horizontal broad-crested weirs;*
- *Part 4G: Methods of measurement of liquid flow in open channels — Weirs and flumes — Flat-V weirs;*
- *Part 4H: Methods of measurement of liquid flow in open channels — Stream flow measurement — Electromagnetic method using a full-channel-width coil;*
- *Part 4I: Methods of measurement of liquid flow in open channels — Weirs and flumes — V-shaped broad crested weirs.*

As a Code of Practice, this British Standard takes the form of guidance and recommendations. It should not be quoted as though it were a specification and particular care should be taken to ensure that claims of compliance are not misleading.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 18, inside back cover and a back cover.

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0 Introduction

0.1 The Health and Safety at Work etc. Act 1974

0.1.1 This code of practice has been prepared with particular regard to the Health and Safety at Work etc. Act 1974 [1] which makes provision for securing the health, safety and welfare of persons at work and for protecting other persons against risks arising from the activities of those at work. Since publication of the original standard considerable new Health and Safety legislation has come into force which has been taken into consideration during preparation of this revision.

0.1.2 The Health and Safety at Work etc. Act 1974 [1] is clear on the general duty of employers to ensure “so far as is reasonably practicable” the health, safety and welfare of employees and Section 2 of the Act specifies the extent of this duty. It includes the following:

- a) provision and maintenance of plant and systems that are, as far as is reasonably practicable, safe and without risk to health;
- b) provision of relevant information, instruction, training and supervision;
- c) maintenance of the workplace and working environment in a safe working condition and without risk to health.

0.1.3 Section 7 of the Health and Safety at Work etc. Act 1974 [1] deals with the duty of employees themselves with respect to health and safety and this provision is relevant to much of the work covered by this standard. Two aspects are highlighted:

- a) the duty to take reasonable care for the health and safety of oneself and other persons likely to be affected; and
- b) the need to cooperate with one's employer in carrying out any requirements of the Act.

0.1.4 Several sets of Regulations have been introduced in recent years under the Health and Safety at Work etc. Act 1974 [1]. Of particular relevance to this standard are the Manual Handling Operations Regulations 1992 [2], the Workplace (Health Safety and Welfare) Regulations 1992 [3], the Provision and Use of Work Equipment Regulations 1992 [4], the Personal Protective Equipment at Work Regulations 1992 [5] (as amended by the Control of Substance Hazardous to Health Regulations 1994 [6]) and the Management of Health and Safety at Work Regulations 1992 [7]. The last of these is particularly relevant to this revision as it requires risk assessments to be undertaken of the workplace and the task being undertaken.

0.2 Relevance of the Health and Safety at Work etc. Act to river flow measurement

Hydrometric field work encompasses a variety of tasks which often need to be carried out in potentially hazardous conditions and locations. Often the field worker will be unaccompanied and the guiding principle in these circumstances should be to exercise proper care and to avoid risks. The single-handed field worker should at all times approach his or her work bearing in mind common-sense rules of safety, and local operating procedures.

0.3 Personal responsibility

The aim of this standard is to provide a template against which hydrometric staff may assess the risk associated with the task of flow measurement at specific sites in order to enable themselves and their colleagues to undertake that task in a safe and responsible manner. Line managers should normally undertake the risk assessments at sites that are routinely visited, but it is inevitable that field workers will have to be trained to undertake assessments for themselves, or update previous assessments, at sites which are visited infrequently or for ad hoc gaugings. No guidelines or instructions, however comprehensive, can entirely replace the element of personal responsibility or the need to exercise mature judgement. One should always be satisfied that the programme of work can be undertaken without unreasonable risk to oneself, or to others, and precautions should always be adopted with this in mind. At all times, field workers should be at liberty to withdraw from the site, without prejudice, if they feel that to continue operations might cause harm to themselves or to others: the manager/supervisor should be informed of the circumstances.

1 Scope

This part of BS 3680 gives recommendations on the factors which should be included in any assessment of the risks associated with the various tasks involved in the operation and maintenance of sites used for the measurement of level and flow in open channels.

Much of the work covered by this standard is, of necessity, carried out in close proximity to deep and/or fast-flowing water and frequently requires operating from floating vessels or entry into watercourses. Consideration is given to the potential additional hazards imposed by lone working, often in remote areas where assistance may not be readily available in the event of an emergency.

Risk assessments undertaken using this standard procedure should not stand alone but be incorporated into the safe working practices operating locally at any time.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS EN 361:1993, *Personal protective equipment against falls from a height — Full body harness*.

BS EN 471:1994, *Specification for high-visibility warning clothing*.

BS 3367:1980, *Specification for fire brigade and industrial ropes and rescue lines*.

3 Terms and definitions

3.1 stilling well

well connected with the main stream in a way that permits measurement in relatively still liquid

3.2 double manning

staffing level at which two people are necessary for the work to be carried out competently and safely

3.3 triple manning

staffing level at which three people are necessary for the work to be carried out competently and safely

4 General considerations

4.1 Planning and preparation

4.1.1 Work schedules and logs

River gauging, in common with many other hydrometric tasks, often involves, of necessity, working alone at remote locations and possibly outside of normal working hours. Continuous contact with base office may not always be possible and there is always a risk that even a minor accident or incapacity may develop into a serious situation if loss of mobility prevents aid being summoned. It is important therefore to ensure, before leaving the base office, that a schedule covering the period of intended absence is filed or displayed at the base, or as required by local procedures, for reference by colleagues or supervisory staff.

The schedule should, as far as possible, itemize all locations to be visited together with the anticipated time of arrival and duration of each visit.

4.1.2 Reporting in

A routine should be followed of reporting in at prearranged times during the working day. It should of course be sufficiently flexible to suit the nature of the workload and conditions. If radio equipment or car telephone equipment is not available, or the proposed working area is known to be one of poor reception for such devices, the routine should allow for at least one telephone message to base around midday and again before the end of normal office hours, or as required by local procedures. Any significant departure from the schedule should also be communicated back as soon as possible. Whatever arrangement is operated it should ensure that any unexpected or unexplained failure to return to the base office or to the field worker's home is noted within a reasonable period of time by the base office. This should ensure that effective action is taken should any search or recovery procedure prove necessary. For this purpose, members of the field

worker's family or household or other nominee should hold the names of key supervisory personnel. Local procedures should be devised for staff to report their safety outside normal working hours.

4.1.3 Working alone at remote locations

The following additional points should be considered;

- a) a detailed route plan, filed with the schedule;
- b) a reliable weather forecast covering the duration of the schedule;
- c) tide tables, in cases where stations are situated on estuaries or tidal channels;
- d) any special survival equipment (see also 4.2);
- e) any requirements for notifying other organizations (for example, army, police, rescue bodies) of the person's schedule;
- f) any local procedures for lone workers.

4.1.4 Working at night or under adverse weather conditions

Work involving entry into watercourses should never be attempted single-handed during the hours of darkness or in conditions of poor visibility. Personal equipment should include a powerful and serviceable hand-torch and spare batteries. Field work should never be undertaken alone in situations where reduced visibility coupled with waterlogged ground, snow, ice or heavy rainstorms renders conditions unusually hazardous. At such times the decision to continue is at the discretion of the person in the field. Special care should always be exercised at times of electrical storms.

One should be aware of the additional hazard of fatigue attending long periods of work at night, in poor weather, or in intense sunshine. Working in water of low temperatures can also prove hazardous.

4.1.5 Entry onto private land

The operation and maintenance of permanent gauging stations are usually subject to established procedures and formal agreements with relevant landholders, but contact should be maintained to ensure that arrangements are up to date and to assist the parties concerned in fulfilling their obligations under the Health and Safety at Work etc. Act 1974 [1]. Special care should of course be exercised in the case of sites which might be visited only once or at very infrequent intervals at best. On such occasions the field worker should follow local procedures or have recourse to a comprehensive check-list of points to consider before undertaking the visit. The check-list should cover the following.

- a) Providing the owner/occupant with adequate notice of the visit.
- b) Reporting to the occupant or responsible person on arrival at and departure from the site.
- c) Adhering fully to any advice or instructions with respect to excluded or restricted areas and any safety or security procedures, or requirements for protective equipment.

NOTE Special requirements will often apply in the case of agricultural (for example, in cases of outbreaks of notifiable animal diseases), industrial and commercial property and there will be strict procedures to be observed concerning entry to military establishments.

- d) Always keeping to agreed routes of access to the working area. Gates and stiles should always be used to negotiate fences and hedges. Gates should not be climbed if they can be opened and if access is needed on a regular basis arrangements should be made with the occupant to have gates opened in advance of or at the time of each visit.
- e) Avoiding areas of ground or vegetation which are known to have been recently treated with a potentially harmful or unknown chemical substance.
- f) Avoiding areas which are known to contain potentially dangerous animals, unless the animal is visible and is extremely unlikely to interfere with a relatively quick and routine task.
- g) Avoiding parking vehicles, or operating and/or storing equipment, in a position likely to cause a hazard or a nuisance to the owner/occupant or other persons on site.

4.1.6 Work in public places

Whenever planning gauging work in any location accessible to the public, it should be kept in mind that the unusual nature of an activity such as current-metering makes it an object of particular interest to passers-by and at such times the field team will need to have regard to the safety of other persons as well as their own.

River gauging frequently involves operating from or occupying bridges, footpaths, bridleways and road-side verges as well as the variety of public recreation or amenity areas often established on or close to the riverbank. Special attention should be given to the following.

- a) Whenever possible, vehicles should be parked off the highway and in such a manner as to cause no unreasonable obstruction to other vehicles or pedestrians.
- b) If parking on the highway is possible and legally permissible, the vehicle should be located with due thought for the safety of other road users. Hazard warning lights should be switched on and warning signs and traffic cones should be available for use if required. Staff should wear a high-visibility jacket.
- c) Pedestrian thoroughfares should not be obstructed. Vehicles and/or equipment should be marked by hazard warning signs and cones. If adequate working space is not available, it will be necessary to withdraw from the site and make alternative arrangements.
- d) When working during the hours of darkness, the presence of vehicles and/or equipment should be well advertised to traffic and pedestrians by adequate lighting.

Should there be doubt at any time over the extent of any particular traffic hazard, advice should be sought from the police or the local highway authority.

4.2 Equipment

4.2.1 *Personal equipment and protective clothing*

Personnel should ensure that they are at all times equipped with those items necessary for safe completion of the task to be undertaken. The list should include the following, to be used as conditions or the task dictate, or as otherwise defined in local procedures.

4.2.1.1 *Over-jacket*, all-weather, with hood (and leggings if waders are not suitable).

4.2.1.2 *Change of warm clothing*

4.2.1.3 *Boiler suit*

4.2.1.4 *Over-jacket or tabard*, reflective.

4.2.1.5 *Boots*, whether rubber or leather, fitted with protective toe-caps and soles.

4.2.1.6 *Hard hat*

4.2.1.7 *Gloves*, protective/thermal.

4.2.1.8 *Goggles*

4.2.1.9 *Waders*, (thigh- or chest-) with or without steel studded soles, steel toe-cap and mid-sole; and/or dry-suits.

4.2.1.10 *Life-jacket*

NOTE Ensure that this fits correctly and has been regularly checked and maintained.

4.2.1.11 *Hand-torch*

4.2.1.12 *Loud-hailer*

4.2.2 *General safety equipment*

In addition to the equipment identified in **4.2.1** members of the field team should have ready access to the following equipment, each item being selected according to the nature, location, and circumstances of the work to be undertaken, or the requirements of local procedures as stated in the site-specific risk assessment. All items should be checked prior to use to ensure that they are in a satisfactory condition and in good working order. Equipment that is suspect or beyond its recommended safe working life should be replaced immediately.

4.2.2.1 *Handline and pegs*

4.2.2.2 *Gas detector*

4.2.2.3 *Traffic-warning signs and beacons*

4.2.2.4 *Spare batteries for hand-torch*