INTERNATIONAL STANDARD

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Water quality — Sampling —

Part 5: Guidance on sampling of drinking water from treatment works and piped distribution systems

Qualité de l'eau — Échantillonnage —

Partie 5: Lignes directrices pour l'échantillonnage de l'eau potable des usines de traitement et du réseau de distribution

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Contents

Page

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 5667-5 was prepared by Technical Committee ISO/TC 147, *Water quality*, Subcommittee SC 6, *Sampling (general methods)*.

This second edition cancels and replaces the first edition (ISO 5667-5:1991), which has been technically revised.

ISO 5667 consists of the following parts, under the general title *Water quality — Sampling*:

— *Part 1: Guidance on the design of sampling programmes and sampling techniques* [1)]

— *Part 3: Guidance on the preservation and handling of water samples*

— *Part 4: Guidance on sampling from lakes, natural and man-made*

— *Part 5: Guidance on sampling of drinking water from treatment works and piped distribution systems*

— *Part 6: Guidance on sampling of rivers and streams*

— *Part 7: Guidance on sampling of water and steam in boiler plants*

— *Part 8: Guidance on the sampling of wet deposition*

— *Part 9: Guidance on sampling from marine waters*

— *Part 10: Guidance on sampling of waste waters*

— *Part 11: Guidance on sampling of groundwaters*

— *Part 12: Guidance on sampling of bottom sediments*

— *Part 13: Guidance on sampling of sludges from sewage and water-treatment works*

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1) ISO 5667-1:1980 and ISO 5667-2:1981 are currently undergoing joint revision, which will be published as ISO 5667-1.

— *Part 14: Guidance on quality assurance of environmental water sampling and handling*

— *Part 15: Guidance on preservation and handling of sludge and sediment samples*

— *Part 16: Guidance on biotesting of samples*

— *Part 17: Guidance on sampling of suspended sediments*

— *Part 18: Guidance on sampling of groundwater at contaminated sites*

— *Part 19: Guidance on sampling of marine sediments*

The following part is under preparation:

— *Part 20: Guidance on the use of sampling data for decision making — Compliance with limits and classification*

Introduction

ISO 5667 is a group of standards dealing with the general aspects of sampling (Parts 1 to 3) and with the sampling of specific types of water (from Part 4 onwards). ISO 5667-5 covers the sampling of drinking water within a piped distribution system and should be read in conjunction with ISO 5667-1 and ISO 5667-3.

Effective monitoring of drinking water requires collaboration between sampling programme designers, water treatment plant and distribution system operators, sample collectors, laboratory analysts and data users. ISO 5667-5 gives guidance on the selection of sampling locations and the collection of samples when monitoring drinking water from treatment plants and from piped distribution systems.

Understanding of the purposes for monitoring drinking water and of the principles behind the methods of analysis is important, since specific sampling protocols can vary widely in accordance with different purposes and different analytical methods.

Examples of sampling purposes include:

a) checking of drinking water to ensure compliance with national and/or international regulations (e.g. WHO *Guidelines for Drinking Water Quality* [1] and the EU Drinking Water Directive [2]);

b) determination of the efficiency of a drinking water treatment plant or components thereof (for example, disinfection);

c) quality monitoring of the water leaving the treatment plant;

d) quality monitoring of the water within the distribution system (including distribution within large buildings);

e) search for the cause of contamination of the distribution system (for example, in response to customer complaints);

f) monitoring of the corrosive potential of drinking water to plumbing;

g) assessment of the effects of materials in contact with water on the water quality (chemical and biological);

h) monitoring of the influent water and the various processing stages in a food or beverage processing plant, including necessary treatment steps.

Water quality — Sampling —

Part 5: Guidance on sampling of drinking water from treatment works and piped distribution systems

1 Scope

This part of ISO 5667 establishes principles to be applied to the techniques of sampling water intended for human consumption.

For the purposes of this part of ISO 5667, water intended for human consumption comprises:

a) all water either in its original state or after treatment, intended for drinking, cooking, food preparation, or other domestic purposes, regardless of its origin, plus

b) all water used in any production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption unless the competent national authorities are satisfied that the quality of the water cannot affect the wholesomeness of the foodstuff in its finished form.

The guidance given in this part of ISO 5667 is confined to those circumstances where water is drawn from municipal or similar distribution systems (including individual systems) where prior treatment and/or quality assessment has resulted in the water being classified as suitable for drinking or potable process purposes. Specifically, this part of ISO 5667 is applicable to water that is in continuous supply relative to any stage of use up to and including the point of consumption in a distribution system. This includes distribution within large buildings in which additional water quality management might be applicable.

This part of ISO 5667 is also applicable to sampling situations that can arise relative to the investigation of system defects or emergency situations where the safety of sampling operatives is not compromised.

This part of ISO 5667 does not provide guidance for water sources or for products generated by using drinking water. The followings items are examples of cases not addressed by the present document:

— the sampling of source water, for example groundwater and surface water impoundments;

— sampling of drinking water supplies derived from non-continuous sources (for example, from road tankers);

— sampling of bulk storage of water on airplanes, trains and ships;

— the sampling of beverage products (including bottled waters) or food containing potable water used in its preparation;

— sampling of drink vending machines that dispense unsealed cups of drinks.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
water intended for human consumption
drinking water or potable process water

2.2
drinking water
all water either in its original state or after treatment, intended for drinking, cooking, food preparation, or other domestic purposes, regardless of its origin

2.3
potable process water
all water used in any food-production undertaking for the manufacture, processing, preservation or marketing of products or substances intended for human consumption.

3 Design of sampling programmes

Programmes for the sampling of drinking water, including statistical considerations, should be designed in accordance with ISO 5667-1.

Microbiological investigations of drinking water should be designed and implemented in accordance with ISO 19458.

4 Sampling equipment

The general recommendations for sampling equipment given in ISO 5667-1 should be followed and sample containers should be prepared in accordance with ISO 5667-3.

On-line sensors/analysing equipment for water should conform to ISO 15839.

Equipment and bottles for sampling for microbiological analysis should conform to ISO 19458.

5 Sample collection locations

5.1 General

Sample collection locations should be selected according to the following criteria.

a) The chosen collection locations should yield samples that are representative of the system as a whole, or representative of its main components.

b) For each treatment plant, there should be at least one sample collection location on the water intake and at least one sample collection location immediately after the processed water outlet.

c) In systems with more than one water source, sample collection locations should reflect the output of each source, the demand on each source and the relative population using each source.

d) Sample collection locations should be widely distributed throughout a piped distribution system, the number being proportional to the number of links or branches in the system.

e) Sample collection locations should include locations representative of the most unfavourable sources and locations considered vulnerable to contamination such as loops, low-pressure zones and ends of systems.

f) Where waters from different sources mix within a complex piping system, sample collection locations should permit identification of relative proportions from each source through the system.

g) Where a distribution system connects to large buildings such as hotels or office blocks, there should be sample collection locations at the intake and throughout each building consistent with the principles in d) and e) above.

5.2 Service reservoirs (including water towers)

Samples should be collected from the inlet and outlet pipes as close as possible to the service reservoir. The outlet sample location should be upstream of the first customer.

If a service reservoir has a common inlet and outlet main, samples should, where possible, be collected when the main is acting as an outlet and the water quality is therefore representative of water that has been stored in the service reservoir. If this cannot be achieved, a sample collection pumping system should be installed and utilized.

If a service reservoir has more than one compartment but the compartments are hydraulically connected, the compartments may be regarded as a single reservoir. If a service reservoir has more than one compartment and these compartments are not hydraulically connected, each compartment should be considered as a separate service reservoir and should be assigned individual sampling points, except if the individual outlets from the compartments combine into a common outlet, in which case a single sample location on the common outlet might be adequate.

Sometimes (for example, when a reservoir has been out of service or cleaned, when there is no sampling valve on the outlet pipe, or when the surface layer of the reservoir is to be analysed), it might be necessary to take dip samples, as described in 6.5 from the service reservoirs, although this means of sampling should be avoided wherever possible. If it is essential to take dip samples, special care should be taken to ensure that the sampling operation does not introduce debris into the water and that equipment is sterilized before sampling to avoid a microbiological compromise of the water in the reservoir.

5.3 Water treatment plants

Samples should be collected from the inlet and outlet pipes as close as possible to the treatment plant. For monitoring of the different stages (for example, sedimentation and filtration) of water treatment, sampling should take place before and after the respective stage being monitored. If there is disinfection and/or an oxidation plant, sampling should be carried out as described in 5.4.

There usually is an expectation that water is better after treatment. Equipment that is inappropriate, or equipment that was poorly installed or inadequately maintained can, however, introduce contaminants and compromise microbiological quality. Additionally, some materials used to coat pipes can introduce low concentrations of contaminants such as ethylbenzene or xylenes.

5.4 Disinfection/oxidation plants

Samples from the influent to the disinfection/oxidation plant should be collected as close as possible to the point of entry to the plant. Samples of the treated water should be collected after allowing for the appropriate contact period between water and disinfectant/oxidant. In some installations, this contact period can depend upon utilization of part of the distribution systems. In these situations, samples required to test the efficiency of the disinfection/oxidation stage should be taken at an appropriate point within the distribution system. One alternative, a sample line with an appropriate residence time, may be used for sampling within the treatment plant although this is not recommended.

5.5 Distribution system

5.5.1 General

Sampling points in the distribution system should include locations representative of the typical water quality plus those locations considered vulnerable to contamination such as loops, low-pressure zones and ends of system. Where waters from different sources mix within the distribution system, sample locations should permit identification of relative proportions from each source through the system. If treatment works exist within the distribution system, sample collection points should be located before and after such works to allow assessment of the efficacy of the treatment.

Samples from the distribution system are typically collected from domestic faucets, installed sampling faucets, or fire hydrants. Where domestic faucets are utilized to characterize the water quality through a water distribution system, a computer should be used to generate a random selection of a sufficient number of locations. Domestic faucets are discussed in 5.5.2.2.

If sampling is carried out from hydrants, it should be ensured that the hydrants are suitable for drinking water sampling purposes (see 6.3).

When sampling on domestic premises, it is particularly important to ensure that equipment and chemical reagents are kept securely out of reach of children and pets. Also, flaming should be avoided if there is any fire hazard.

5.5.2 Sampling faucets

5.5.2.1 General

If a sampling faucet is to be installed or utilized specifically for sample collection:

a) the sampling line should be as short as possible, in good condition and capable of being flushed at full flow rate;

b) the sampling line should not protrude inside the pipe wall of the water main;

c) the sampling line should preferably connect to the main piping immediately downstream from a valve, elbow or fitting that causes turbulent flow;

d) water from a mains spur should not be considered to be representative of water in the main;

e) the sampling line should be of materials suitable for the conveyance of drinking water;

f) the sampling line should not include T-junctions, which might result in stagnation;

g) the sampling line and faucet should be adequately protected from frost;

h) the faucet location should be protected from vandalism and contamination;

i) if the faucet is to be flame-disinfected, it is important that there are no flammable materials or fumes nearby;

j) there should be adequate space to fill a variety of bottle sizes;

k) there should be an adequate supply of water to the faucet at all times;

l) the site should have adequate drainage, i.e., water discharged by flushing should be able to run off freely;

m) for each fixed location, the sampler should have a location plan, details of access, and any special flushing or collection instructions.

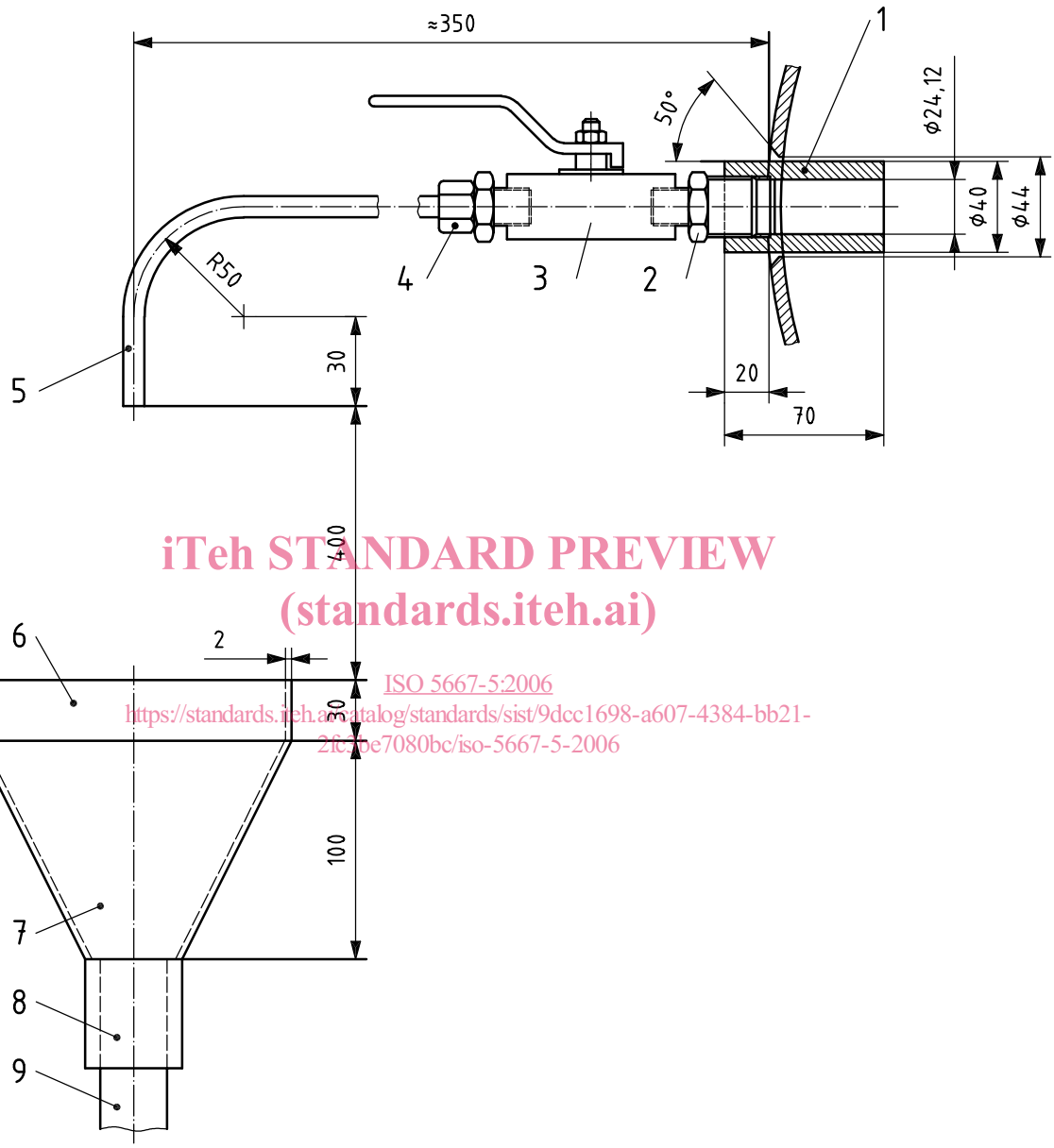
It is recommended that a sample point chosen for frequent sampling (e.g. monitoring the working of a process in a treatment plant or food producing company) should have a faucet suitable for easy sampling for microbiological, physical and chemical analysis. An example is given in Figure 1.

Irrespective of absolute dimensions of the device illustrated in Figure 1, it is important that the neck of the receiving vessel allows adequate passage of the water into the container. In addition, there should be sufficient space between the head of the waste funnel and the faucet outlet to allow unhindered manipulation of each sample container.

When samples are collected for microbiological analysis, the sampled faucets should, where necessary, be sterilized in accordance with ISO 19458.

A need might arise to sample water where there is a very low flow. When taking the sample, care should be taken that disturbance of sedimentary material does not occur. If this cannot be avoided, a sufficient volume of water should be flushed or a sufficient time allowed for a steady state to occur after the sampling valve has been opened or the flow disturbed.

Dimensions in millimetres except where stated otherwise



Key

1 pipe plug
2 nipple
3 ball valve (full flow design)
4 coupling ∅ 10 mm
5 stainless steel pipe
6 PVC pipe ∅ 140 mm
7 funnel
8 PVC plug ∅ 32 mm
9 to drain/waste

Figure 1 — Example of a faucet suitable for frequent sampling