

Central drinking water supplyBasic principles relating to the requirements on drinking water
Planning, construction and operation of the installations**DIN**
2000Zentrale Trinkwasserversorgung; Leitsätze für Anforderungen an Trinkwasser;
Planung, Bau und Betrieb der Anlagen*As it is current practice in standards published by the International Organization for Standardization (ISO),
the comma has been used throughout as a decimal marker.***Contents**

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1 Scope and purpose

This Standard applies to central drinking water supply systems through which drinking water is supplied to a large number of consumers via a network of pipes.

This Standard provides recommendations for the ways of constructing and operating installations for the central drinking water supply in a manner which meets hygienic requirements and is at the same time technically and economically satisfactory. It must in no way be regarded as an inflexible and rigid directive, and this would in any event be excluded by virtue of the great diversity of local circumstances. On the other hand, this Standard shall give a synopsis of the fundamental aspects of present-day technical and hygienic conceptions, and serve as a guide for the planning, construction, operation and supervision of the installations. It is also intended to emphasize that the present-day water supply engineering practice demands a high degree of responsibility and know-how from all concerned.

2 General

2.1 Drinking water is the most vital and important means of foodstuffs. It is irreplaceable.

2.2 In the interests of public health, certain specific requirements have to be stipulated in respect of the quality, quantity and pressure of the drinking water.

2.2.1 Everyone concerned must ensure that these requirements are fulfilled by every means available, even if this entails, if necessary, the deferment of other interests of less vital concern to the community.

2.3 The quality requirements in respect of the drinking water supply are, as a general rule to be related to the characteristics of a groundwater of impeccable quality won from an adequate depth and from sufficiently filtering strata, which has been extracted from the natural water cycle and has in no way been adversely affected.

Continued on pages 2 to 35
Explanations on pages 35No guarantee can be given in respect of this translation.
In all cases the latest German-language version of this
Standard shall be taken as authoritative

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A water which satisfies all the quality requirements without having to undergo any preliminary purification or treatment is to be preferred, if available, to a water which requires a preliminary treatment. However, in all cases where the water procured only exhibits the required quality either subject to certain reservations or not at all times with the necessary certainty, a suitable treatment must not be dispensed with; suitable, that is both from the process technology and the operational technique aspects.

It will not suffice, however, to win or to produce by treatment water of impeccable quality. It shall, in addition, be ensured that this water is available to the consumer at the point of consumption in adequate quantity and of a sufficiently high quality and pressure.

2.4 The installation of a central drinking water supply system without the simultaneous provision of a local sewerage system will cause nothing but trouble; consequently the necessary steps for the disposal and purification of the sewage shall be undertaken simultaneously.

3 Requirements relating to drinking water

The basic principles relating to the analysis and assessment are the „Deutsche Einheitsverfahren zur Wasser-, Abwasser- und Schlamm-Untersuchung. Physikalische, chemische und bakteriologische Verfahren“¹⁾ (German Standard Methods pertaining to the Analysis of Water, Sewage and Sludge. Physical, Chemical and Bacteriological Processes)¹⁾.

The process selected must be specified.

3.1 Drinking water must be free of pathogenic agents and must not exhibit any characteristics injurious to health

3.1.1 The prescriptions of the Lebensmittelgesetz²⁾ (Food Act²⁾) and of the Bundes-Seuchengesetz³⁾ (Federal Epidemics Law³⁾) apply to the condition of drinking water from the point of view of public health. According to these two Acts, the following actions are prohibited and liable to prosecution: "The winning, preparation and treatment of drinking water for others in such a way . . . that its consumption is liable to damage human health"; "Drinking water . . . must be of such condition that human health cannot be impaired or injured as a result of its consumption or use, in particular by pathogenic agents".

3.1.2 Infectious diseases, in particular typhoid fever, paratyphoid fever A and B and other salmonellosis, cholera, enteritis infectiosa (diarrhoea with vomiting), leptospirosis (e. g. Weil's disease), hepatitis infectiosa and intestinal worms can be transmitted by contaminated drinking water. The viruses of infectious diseases can find their way into the water with the excreta or sick or healthy persons or animals (excretors) and of persons with a suspected disease. In the context of drinking water hygiene, all human and animal excreta must be regarded as containing pathogenic agents. If such excreta are able to penetrate into the drinking water, the danger of infection exists.

3.1.3 Water is capable of picking up substances injurious to health in dissolved or undissolved form from the air, from the soil strata through which it flows, from solid waste materials or from sewage. Particular attention must be paid e. g. to compounds of arsenic, lead, cadmium, cyanogen, fluorine, mercury and selenium, and also to other heterogeneous substances such as phenols, pesticides, carcinogenic and radioactive substances, detergents and mineral oils. Drinking water must not contain any such substances, at least not in any amounts likely to endanger health⁴⁾. In the case of all these substances, the possibility of consequences injurious to health resulting from the consumption of anyone of them over a period of years, even in minimal concentrations, cannot be completely excluded, even if such substances are not detectable either by smell or taste.

3.2 Drinking water shall be relatively free from germs

3.2.1 Microbiological investigations give the best indication in respect of the assessment of water from a hygienic aspect. The proof of the presence of pathogenic agents is often difficult to obtain, and, in addition, it would come too late in most cases to prevent infections. Therefore, as a general rule, the number of colonies in the drinking water and the incidence of colonic bacteria (escherichia coli) which are usually harmless and inhabit the intestine are resorted to for the purpose of microbiological characterization of the drinking water. As regards the hygienics of epidemics, the incidence of colonic bacteria is somewhat dubious,

- 1) Published by the Fachgruppe Wasserchemie (Water Chemistry Study Group) of the Gesellschaft Deutscher Chemiker e. V. (German Chemists' Society), 3rd edition, 1960 onwards, Verlag Chemie, 694 Weinheim.
- 2) Law relating to trading in foodstuffs and commodities (Lebensmittelgesetz (Food Act)) in the version dated 17th January 1936 (Empire Gazette I p. 17 = Federal Gazette III No. 2125-4); latest amendment by virtue of the Law of 8th September 1969 (Federal Gazette I p. 1590).
- 3) Law relating to the prevention and combating of contagious diseases affecting human beings (Bundes-Seuchengesetz (Federal Epidemics Law)) dated 18th July 1961 (Federal Gazette I, p. 1012; amended p. 1300 = Federal Gazette III No. 2126-1).
- 4) See also the proposals of a Study Group named "Standardized Requirements relating to the Quality, Analysis and Assessment of Drinking Water in Europe" set up by the European Office of the World Health Organization; German translation by G. Müller in "Schriftenreihe des Vereins für Wasser-, Boden- und Lufthygiene" (Series of Publications of the Association for Water, Soil and Air Hygiene), Vol. 14 b, 3rd revised edition, Stuttgart 1971. In the case of radioactive substances, the prescriptions of the First Decree on the Protection against Damage by Radiation emitted by Radioactive Substances (Erste Strahlenschutzverordnung (First Radiation Protection Decree)) also apply in addition, in the version dated 15th October 1965 (Federal Gazette I p. 1654 = Federal Gazette III No. 751-2).

because it leads to the assumption that viruses of contagious diseases may perhaps be present. Special microbiological methods are required to differentiate reliably between the true faecal type of colonic bacteria (faecal indicator) and similar so-called coliform bacteria.

Escherichia coli must not be detectable in the drinking water in 100 millilitres. Coliform bacteria may point to contamination and, therefore, provide the reason for further tests to establish the cause of the contamination.

There are no generally valid limiting values applicable to numbers of colonies, however, the number of colonies in the drinking water shall not exceed a maximum of 100 per millilitre. If a degermination of the water is undertaken (see Section 4.9.13), the number of colonies after completion of the treatment shall not exceed a maximum of 20 per millilitre.

3.3 Drinking water shall be appetizing and shall stimulate the consumption. It shall be colourless, transparent, cool, odourless and have an unobjectionable taste.

3.3.1 A water is judged appetizing if its external condition and its physical, chemical, microbiological and biological characteristics do not give any indications of contamination, and if its drinking does not provoke any feelings of disgust or revulsion.

3.3.2 Any organisms, animal or vegetable remnants visible to the naked eye or any undissolved organic substances must not be present in the drinking water.

The presence of such remnants in surface water is of course a natural occurrence. Their presence in groundwater, including spring water, leads to the suspicion of contamination. In wells, reservoirs and the like, they may promote the development of algae and other organisms, especially in the presence of daylight.

3.3.3 Coloration and turbidity of the water arouse the suspicion of contamination, even if they only occur after a long period of stagnation in a vessel, e.g. as a result of the precipitation of iron (III) hydroxide or of calcium carbonate. They may also be caused by substances in the soil (humus substances, clay). Even if these substances are completely harmless from a health point of view, they should be removed by treatment.

Turbidity occurring in the groundwater after heavy precipitations or floods is a sign that insufficiently filtered surface water has penetrated into the groundwater. In such cases the water must always be deemed to be suspect from a hygienic point of view.

The nature and origin of any turbidity or coloration must be determined.

A milky turbidity of the water which is observed when the water is dispensed from the tap, and which gradually disappears from bottom to top when the water is left standing, is caused by supersaturation of the water with air. It is entirely harmless.

3.3.4 The temperature of the drinking water shall, if possible, be situated between 5 and 15 °C and shall not exhibit any short-duration fluctuations. In cases where surface water is used, higher or lower temperatures can-

not be avoided at times. Pronounced temperature fluctuations in the context of the assessment of groundwater including spring water point to the probability of surface water flowing into the groundwater in considerable quantities.

3.3.5 Objectionable odour and a strange taste impair the quality and appetizing taste of a drinking water and may, in addition, be injurious to health.

Substances which promote odour or taste may have either natural causes (e.g. iron salts, hydrogen sulphide, humic matter, products of metabolism of micro-organisms and small animals) or they may be conditioned by the influences of civilization (e.g. sewage, refuse tips, air pollution, mineral oil products) and by unsuitable coating materials, piping materials and installation materials.

Phenols and other organic substances are capable of imparting an objectionable taste to the water, even in low concentrations, particularly in conjunction with chlorine.

These substances must be eliminated. The necessary steps in this respect will depend on the nature of the substances concerned.

3.4 The content of dissolved substances shall be kept within acceptable limits

3.4.1 Limiting values for the permissible or desirable content of dissolved substances in the drinking water cannot be specified in a general manner for all mineral substances. A certain content of salts in the water is desired. This content shall, however, not be too high, because, apart from affecting the taste adversely, it may also have adverse effects on health.

3.4.2 Chlorides are commonly present in the water, but in widely differing amounts. A high chloride content in the groundwater may be due to natural causes, e.g. the dissolution of salt from salt deposits, or the infiltration of sea water. In the case of a hydraulic connection between fresh water and salt water, an excessive demand on the fresh water resources may result in an increase in the chloride content of the water by reason of the ascent or of the lateral admission of the salt water. An increase in the chloride content may also be a pointer to a contamination of the water by sewage, the leaching out of refuse or waste material, the scouring or washing away of soil treated with fertilizer, or the introduction of pit water.

3.4.3 Sulphates originate mainly from soils containing gypsum. The dissolved calcium sulphate may increase the hardness of the water to an undesirable extent. For example, water from mines and from moorlands is rich in sulphates. If they are geologically conditioned, sulphates are harmless from the health aspect; but if there is a simultaneous high sodium or magnesium ion concentration, health risks may result. Occasionally the leaching out of refuse is the cause of high or rising sulphate contents. In such cases, other contaminations which could endanger hygiene must also be looked for.

3.4.4 The hardness of the water (calcium and magnesium ion content) is of little significance to health on its own accord. However, it is difficult to cook