Bureau of Indian Standards Specification for Drinking Water (BIS 10500: 1991)

1. Scope

The standard prescribes the requirements for the essential and desirable characteristics required to be tested for ascertaining the suitability of water for drinking purpose.

2. References

The Indian Standard listed in Annex A are necessary adjuncts to this standard.

3. Characteristics

3.1 The test characteristics are given in Table 1.

Table 1: Test Characteristics for Drinking Water

S. No.	Substance or Characteristic	Requirement (Desirable Limit)	Permissible Limit in the absence of Alternate source
Essential characteristics			
1.	Colour, (Hazen units), Max	5	25
2.	Odour	Unobjectionable	--
3.	Taste	Agreeable	--
4.	Turbidity (NTU), Max	5	10
5.	pH Value	6.5 to 8.5	No Relaxation
6.	Total Hardness (as $CaCo_3$) mg/L, Max	300	600
7.	Iron (as Fe) mg/L, Max	0.3	1.0
8.	Chlorides (as Cl) mg/L, Max.	250	1000
9.	Residual, free chlorine, mg/L, Min	0.2	--
10.	Fluoride (as F) mg/L, Max	1.0	1.5
Desirable Characteristics			
11.	Dissolved solids mg/L, Max	500	2000
12.	Calcium (as Ca) mg/L, Max	75	200
13.	Magnesium (as mg) mg/L, Max	30	100
14.	Copper (as Cu) mg/L, Max	0.05	1.5
15.	Manganese (as Mn)mg/L, Max	0.10	0.3
16.	Sulfate (as SO_4) mg/L, Max	200	400
17.	Nitrate (as NO_3) mg/L, Max	45	No Relaxation
18.	Phenolic Compounds (as C_6H_5OH) mg/L, Max	0.001	0.002
19.	Mercury (as Hg) mg/L, Max	0.001	No relaxation
20.	Cadmium (as Cd) mg/L, Max	0.01	No relaxation
21.	Selenium (as Se) mg/L,Max	0.01	No relaxation
22.	Arsenic (as As) mg/L, Max	0.01	No relaxation
23.	Cyanide (as CN) mg/L, Max	0.05	No relaxation
24.	Lead (as Pb) mg/L, Max	0.05	No relaxation
25.	Zinc (as Zn) mg/L, Max	5	15
26.	Anionic detergents (as MBAS)	0.2	1.0

	mg/L, Max		
27.	Chromium (as Cr^{6+}) mg/L, Max	0.05	No relaxation
28.	Poly nuclear aromatic hydrocarbons (as PAH) g/L, Max	--	--
29.	Mineral Oil mg/L, Max	0.01	0.03
30.	Pesticides mg/L, Max	Absent	0.001
31.	Radioactive Materials		
	i. Alpha emitters Bq/L, max	--	0.1
	ii. Beta emitters pci/L, Max	--	1.0
32.	Alkalinity mg/L, Max	200	600
33.	Aluminium (as AI) mg/L, Max	0.03	0.2
34.	Boron mg/L, Max	1	5

3.2 Bacteriological

3.2.1 Water in Distribution System

Ideally, all samples taken from the distribution system including consumers' premises, should be free from coliform organisms. In practice, this is not always attainable, and the following standard for water collected in the distribution system is therefore recommended when tested in accordance with IS 1622: 1981.

a) Throughout any year, 95 percent of samples should not contain any coliform organisms in 100 ml;

b) No sample should contain E. Coli in 100 ml;

c) No sample should contain more than 10 coliform organisms per 100 ml; and

d) Coliform organisms should not be detectable in 100 ml of any two consecutive samples.

3.2.1.1 If any coliform organisms are found the minimum action required is immediate re-sampling. The repeated finding of 1 to 10 coliform organisms in 100 ml or the appearance of higher numbers in individual samples suggests that undesirable material is gaining access to the water and measures should at once be taken to discover and remove the source of the pollution.

3.2.2 Unpiped Water Supplies

Where it is impracticable to supply water to consumers through a piped distribution network and where untreated sources, such as wells, boreholes and springs which may not be naturally pure, have to be used, the requirements for piped supplies may not be attainable. In such circumstances, disinfection although desirable is not always practicable, and considerable reliance has to be placed on sanitary inspection and not exclusively on the results of bacteriological examination. Everything possible should be done to prevent pollution of the water. Obvious sources of contamination should be removed from the immediate catchment area, special attention being given to the safe disposal of excrement. Wells and storage tanks should be protected by lining and covering, surface drainage should be diverted, erosion prevented and the surrounding area paved.

Access of man and animals should be restricted by fencing, and should be so designed that fouling is prevented when drawing water. Although not supplied through pipes, water from such sources is likely to undergo further deterioration in quality during transport or storage before drinking. Containers used for water should be kept clean, covered and clear of the floor. The most important factor in achieving these objectives is to ensure the cooperation of the local community, and the importance of education in simple sanitary hygiene should be strongly stressed. In hospitals or medical clinics with such supplies, the value of some form of treatment is stressed.

3.2.2.1 Bacteriologically, the objective should be to reduce the coliform count to less than 10 per 100 ml, but more importantly, to ensure the absence of faecal coliform organisms. If these organisms are repeatedly found, or if sanitary inspection reveals obvious sources of pollution which cannot be avoided, then an alternative source of drinking water would be sought, whenever possible. Greater use should be made of protected groundwater sources and rainwater catchment which are more likely to meet requirements for potable water quality.

3.2.2.2 Although private sources of drinking water may be outside the jurisdiction of public health and water supply authorities, such supplies should still be of potable quality. The results of bacteriological tests and those of sanitary surveys should therefore be used to encourage improvement. Partial treatment may be necessary to remove turbidity even when coliform counts are low; and other quality criteria may dictate the need for treatment processes.

3.3 Virological Examination

3.3.1 It is theoretically possible that virus disease can be transmitted by water free from coliform organisms, but conclusive evidence, that this has occurred, is lacking.

3.2.2 None of the generally accepted sewage treatment methods yield virus-free effluent. Although a number of investigators have found activated sludge treatment to be superior to trickling filters from this point of view, it seems possible that chemical precipitation methods will prove to be the most effective.

3.3.3 Virus can be isolated from raw water and from springs. Enterovirus, reovirus, and adenovirus have been found in water, the first named being the most resistant to chlorination. If enterovirus are absent from chlorinated water, it can be assumed that the water is safe to drink. Some uncertainty still remains about the virus of infectious hepatitis, since it has not so far been isolated but in view of the morphology and resistance of enterovirus it is likely that, if they have been inactivated hepatitis virus will have been inactivated also.

3.3.4 An exponential relationship exists between the rate of virus inactivation and the redox potential. A redox potential of 650 mV (measured between platinum and calomel electrodes) will cause almost instantaneous inactivation of even high concentrations of virus. Such a potential can be obtained with even a low concentration of free chlorine, but only with an extremely high concentration of combined chlorine. This oxidative inactivation may be achieved with a number of other oxidants also, for example, iodine, ozone, and potassium permanganate, but the effect of the oxidants will always be counteracted if reducing components, which are mainly organic, are present. As a consequence, the sensitivity of virus towards disinfectants will depend on the *milieu* just as much as on the particular disinfectant used.

3.3.5 Thus, in a water in which free chlorine is present, active virus will generally be absent if coliform organisms are absent. In contrast, because the difference between the resistance of coliform organisms and of virus to disinfection by oxidants increases with increasing concentration of reducing components, for example, organic matter, it cannot be assumed that the absence of viable coliform organisms implies freedom from active virus under circumstances where a free chlorine residual cannot be maintained. Sedimentation and slow sand filtration in themselves may contribute to the removal of virus from water.

3.3.6 In practice, 0.5 mg/1 of free chlorine for one hour is sufficient to inactivate virus, even in water that was originally polluted.

3.4 Biological Examination

3.4.1 Biological examination is of value in determining the causes of objectionable tastes and odours in water and controlling remedial treatments, in helping to interpret the results of various chemical analysis and in explaining the causes of clogging in distribution pipes and filters. In some instances, it may be of use in demonstrating that water from one source has been mixed with that from another.

3.4.2 The biological qualities of water are of greater importance when the supply has not undergone the conventional flocculation and filtration processes, since increased growth of methane-utilizing bacteria on biological slimes in pipes may then be expected, and the development of bryozoal growths such as *Plumatella* may cause operational difficulties.

3.4.3 Some of the animalcules found in water mains may be free-living in the water, but others such as *Dreissena* and *Asellus* are more or less firmly attached to the inside of the mains. Although these animalcules are not themselves pathogenic, they may harbour pathogenic organisms or virus in their intestines, thus protecting these pathogens from destruction by chlorine.

3.4.4 Chlorination, at the dosages normally employed in waterworks, is ineffective against certain parasites, including amoebic cysts; they can be excluded only by effective filtration or by higher chlorine doses than can be tolerated without subsequent dechlorination. *Amoebiasis* can be conveyed by water completely free from enteric bacteria; microscopic examination after concentration is, therefore, the only safe methods of identification.

3.4.5 Strict precautions against back-syphonage and cross-connections are required if amoebic cysts are found in a distribution system containing tested water.

3.4.6 The *cercariae* of *schistosomiasis* can be detected by similar microscopic examination, but there is, in any case, no evidence to suggest that this disease is normally spread through piped water supplies.

3.4.7 The Cyclops vector of the embryos of *Dracunculus medinensis* which causes dracontiasis or Guinea-worm disease can be found in open wells in a number of tropical areas. They are identifiable by microscopic examination. Such well supplies are frequently used untreated, but the parasite can be relatively easily excluded by simple physical improvements in the form of curbs, drainage, and apron surrounds and other measures which prevent physical contact with the water source.

3.4.8 The drinking water shall be free from microscopic organisms such as algae, zooplanktons, flagellates, parasites and toxin-producing organisms. An illustrative (and not exhaustive) list is given in Annex B for guidance.

4. Sampling

Representative samples of water shall be drawn as prescribed in IS 1622: 1981 and IS 3025 (Part I) : 1987.

[Annexures are omitted]