

DRAFT FOR COMMENTS ONLY	Doc No.: FAD 14(10417)P
<b>Draft Indian Standard</b> <b>QUALITY TOLERANCES FOR WATER FOR PROCESSED FOOD INDUSTRY</b> <i>(First Revision of IS 4251)</i>	
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## FOREWORD

(Adoption Clause would be added later)

The food and beverage industry is of prime importance to the economy. With a high concern for consumer safety, it is one of the most stringent areas of quality control. The food industry has a high demand for clean and fresh water. Access to an abundant source of high quality water is one of the essential factors in designing a food plant.

The principal concerns in the food and beverage industry are:

- Microbiological control and product safety;
- Reducing the formation of scale and deposits;
- Maintaining product integrity;
- Lowering overall production costs.

Due to the importance of consumer health, microbiological control and product safety has an especially high precedence. Reducing the formation of scale and deposits and in general protecting machinery and pipelines is a well-documented issue. The main parameters in water which indicate its effect on the equipment are mainly recognized and can be seen as general parameters (on scaling, fouling, corrosion).

Within the food industry several sectors can be distinguished. The most important water consuming sectors within the food industry are:

- Vegetables and fruit processing industry;
- Dairy industry;
- Meat industry;
- Fish processing industry;
- Beverage industry and Breweries;
- Sugar and starch industry;
- Oil and fat industry.

For all the above mentioned sectors water is more or less used for the same main functions. In food processing plants the water use starts with conditioning raw materials, such as soaking, cleaning, blanching and chilling. It continues with cooling, sanitizing, steam generation for sterilization, power and process heating, and, finally, direct 'in-process' use. The main functions of water in industrial processes are:

- Washing/cleaning of (raw) products;
- Transport of products;
- Dissolving of ingredients;
- Treatment of the product (e.g. alteration, separation);
- Provision of appropriate water contents in the final product/as an ingredient in the product;
- Cooling processes;
- Steam generation;
- Cleaning/rinsing of equipment;
- Abnormal incidents (e.g. fire protection);
- Sanitation.

This standard is intended to guide food process industry in judging the suitability of a particular supply of water for that industry and in planning the type of treatment required for available supplies of water. The requirements of water for boiler feed purposes are covered in IS 1680.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2: 1960. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

## 1. SCOPE

**1.1** The Standard prescribes the quality tolerances of water for use in the processed food and beverage industry with respect to general operations such as washing flushing, boiler feed and indirect cooling as well as an ingredient in the food. Special requirements for the individual food industries are also specified.

## 2 REFERENCES

The standards listed in Annex B contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex B.

## 3. MICROBIOLOGICAL REQUIREMENTS

**3.1 General Requirements:** The water shall comply with the requirements given below:

**3.1.1** *Coliform* bacteria and *Escherichia coli* (or thermotolerant bacteria) shall be absent in any 100 ml sample when tested in accordance with the method given in IS 15185.

**3.1.2** Sulphate Reducing Bacteria shall not exceed 5/ml when tested in accordance with the method given in 3.7 of IS 1622: 1981.

**3.2 Requirements for water in contact with food/as an ingredient in the product:** In addition to the general requirements, the water shall also comply with the requirements given below:

**3.3.1** *Faecal Streptococci* and *Staphylococcus aureus*, shall be absent in any 100 ml sample when tested in accordance with the method given in IS 5887 (Part 2)

**3.3.2** *Listeria monocytogenes*, shall be absent in any 100 ml sample when tested in accordance with the method given in IS 14988 (Part 1).

**3.3.3** The total viable colony count shall not exceed 50/ml when tested in accordance with the method given in IS 5402.

**3.3.4** The combined count of Proteolytic and Lypolytic organisms shall not exceed 5/ml when tested as per the method given in Annex B of this standard.

## 4. ORGANOLEPTIC AND PHYSICAL PARAMETERS

**4.1** Water shall be clear without any sediments, suspended particles and extraneous matter. It shall also comply with the requirements given in Tables 1

## 5. CHEMICAL PARAMETERS

**5.1 General Requirements:** The water shall comply with the requirements given in Table 2

**5.2 Requirements for water in contact with food/as an ingredient in the product:** The water shall also comply with the requirements given in Table 3

**5.3 Tolerance for Radioactivity** - The level of radioactivity in the water shall be as prescribed in Table 4 of IS 10500: 2012, when tested according to the method prescribed in them.

**5.4 Tolerance for Pesticide Residues:** water shall comply with the requirements of pesticide residues given in Table 5 of IS 10500: 2012 which shall be conducted by a recognized laboratory using internationally established test method meeting the residue limits as given in Table 6 of IS 10500: 2012.

**Table I**  
(Clause 3.1)

Sl No. (1)	Characteristic (2)	Requirement				Method of Test, Ref to IS (7)
		(3) <sup>1)</sup>	(4) <sup>2)</sup>	(5) <sup>3)</sup>	(6) <sup>4)</sup>	
i)	Colour, true colour units, <i>Max</i>	5	2	2	2	3025 (Part 4)
ii)	Odour	Agreeable				3025 (Part 5)
iii)	Taste rating as per hedonic scale, <i>Max</i>	e	c	d	c	3025 (Part 8)
iv)	Turbidity, Nephelometric turbidity unit (NTU), <i>Max</i>	5	2	2	2	3025 (Part 10)
v)	Total dissolved solids, mg/l, <i>Max</i>	1000	500	500	500	3025 (Part 16)
vi)	pH	6.0 to 9.0	6.0 to 8.5	5.5 to 8.5	6.7 to 7.0	3025 (Part 11)

<sup>1)</sup> For general non-contact operations requirements

<sup>2)</sup> For use in contact with food/as an ingredient in the product including for cleaning of equipments and utensils

<sup>3)</sup> For use as ingredient in alcoholic drink industry

<sup>4)</sup> For use as ingredient in dairy industry

**Table 2**  
(Clause 4.1)

Sl No. (1)	Characteristic (2)	Requirement						Method of Test, Ref to IS (4)
		A <sup>5)</sup>	B <sup>6)</sup>	C <sup>7)</sup>	D <sup>8)</sup>	E <sup>9)</sup>	F <sup>10)</sup>	
1.	Aluminium (as Al), mg/l, <i>Max</i>	---			0.03			IS 3025 (Part 55)
2.	Ammonia (as total ammonia-N), mg/l, <i>Max</i>	--			0.5			IS 3025 (Part 34)
3.	Anionic surface active agents (as MBAS), mg/l, <i>Max</i>	1.0			0.2			Annex K of IS 13428
4.	Barium (as Ba), mg/l,	--			0.7			Annex F of IS

	<i>Max</i>							13428* or IS 15302
5.	Copper (as Cu), mg/1, <i>Max</i>	1.0			0.05			IS 3025 (Part 42)
6.	Iron (as Fe), mg/1, <i>Max</i>	1.0	0.2	0.3	0.3	0.2	0.2	IS 3025 (Part 53)
7.	Manganese (as Mn), mg/1, <i>Max</i>	0.2			0.1			IS 3025 (Part 59)
8.	Magnesium (as Mg), mg/1, <i>Max</i>	75.0	30.0	5.0	5.0	5.0	5.0	IS 3025 (Part 46)
9.	Nitrate (as NO <sub>3</sub> ) mg/1, <i>Max</i>				45			IS 3025 (Part 34)
10.	Fluoride (as F), mg/1, <i>Max</i>	1.5			1.0			IS 3025 (Part 60)
11.	Zinc (as Zn), mg/1, <i>Max</i>	15.0			5.0			IS 3025 (Part 49)
12.	Silver (as Ag), mg/1, <i>Max</i>	---			0.01			Annex J of IS 13428
13.	Chloramines (as Cl <sub>2</sub> ), mg/1, <i>Max</i>	---			4.0			IS 3025 (Part 26)
14.	Chloride (as Cl), mg/1, <i>Max</i>	250			200			IS 3025 (Part 32)
15.	Free Residual Chlorine, mg/1, <i>Max</i>	1.0			0.2			IS 3025 (Part 26)
16.	Selenium (as Se), mg/1, <i>Max</i>	0.05			0.01			IS 3025 (Part 56) or IS 15303*
17.	Sulphate (as SO <sub>4</sub> ), mg/1, <i>Max</i>				200			IS 3025 (Part 24)
18.	Total Alkalinity (as Calcium Carbonate), mg/1, <i>Max</i>	200	200	200	50	200	50	IS 3025 (Part 23)
19.	Total Hardness (as CaCO <sub>3</sub> ), mg/1, <i>Max</i>	600	200	30	30	30	30	IS 3025 (Part 21)
20.	Calcium (as Ca), mg/1, <i>Max</i>	150	75	75	30	75	30	IS 3025 (Part 40)
21.	Sodium (as Na), mg/1, <i>Max</i>				200			IS 3025 (Part 45)
22.	Phenolic compounds (as C <sub>6</sub> H <sub>5</sub> OH), mg/1, <i>Max</i>				0.001			IS 3025 (Part 43)
23.	Mineral oil	---			0.5			Clause 6 of IS 3025 (Part 39) Infrared partition method
24.	Molybdenum (as Mo), mg/1, <i>Max</i>	---			0.07			IS 3025 (Part 2)
25.	Sulphide (as H <sub>2</sub> S), mg/1, <i>Max</i>				0.05			IS 3025 (Part 29)
26.	Borates (as B), mg/1, <i>Max</i>				5			Annex H of IS 13428
27.	Mercury (as Hg), mg/1, <i>Max</i>				0.001			IS 3025 (Part 48)
28.	Cadmium (as Cd),				0.003			IS 3025 (Part 41)

	mg/l, <i>Max</i>			
29.	Total Arsenic (as As), mg/l, <i>Max</i>		0.01	IS 3025 (Part 37)
30.	Cyanide (as CN)		0.05	IS 3025 (Part 27)
31.	Lead (as Pb), mg/l, <i>Max</i>		0.01	IS 3025 (Part 47)
32.	Total Chromium (as Cr), mg/l, <i>Max</i>		0.05	IS 3025 (Part 52)
33.	Nickel (as Ni), mg/l, <i>Max</i>		0.02	Annex L of IS 13428
34.	Polychlorinated biphenyle (PCB)	---	0.0005	Annex M of IS 13428
35.	Polynuclear aromatic hydrocarbons	---	0.0001	APHA6440
36.	Trihalomethanes:	---		
	a) Bromoform, mg/l, Max	---	0.1	ASTM D 3973- 85* or APHA 6232
	b) Dibromochloro methane, mg/l, Max	---	0.1	ASTM D 3973- 85* or APHA 6232
	c) Bromodichloro methane, mg/l, Max	---	0.06	ASTM D 3973- 85* or APHA 6232
	d) Chloroform, mg/l, Max	---	0.2	ASTM D 3973- 85* or APHA 6232

<sup>5)</sup> For general non-contact operations requirements

<sup>6)</sup> For use in contact with food/as an ingredient in the product including cleaning of equipments and utensils

<sup>7)</sup> For use in citrus fruit industry

<sup>8)</sup> For use as ingredient in dairy industry

<sup>9)</sup> For use in bakery and confectionery industry

<sup>10)</sup> For use in canning and meat industry

## ANNEX A

### METHOD FOR PROTEOLYTIC BACTERIA COUNT AND LIPOLYTIC BACTERIA COUNT AND PROTEOLYTIC BACTERIA COUNT

(Cl 3.2.4)

#### A – 1 PROTEOLYTIC BACTERIA COUNT

**A – 1.1 Outline of the method** -- The method consists in plating a known volume of the water 01' suitable decimal dilution of it with nutrient agar to which skimmed milk is added and then incubating at 37°0 for 48 hours. The photolytic colonies will show clear zones of proteolysis around the colony; these are counted. In order to differentiate a weak acid clearing by .the acid-producing organisms from proteolysis, the plates are flooded with dilute hydrochloric acid. If clear zone remains, it confirms proteolysis.

**A -1.2 Apparatus** - The apparatus prescribed for standard plate count in 3.1 of IS 1622: 1981 shall be used.

**A – 1.3 Media and Reagents** - In addition to the reagents prescribed for standard plate count in 3.2 of IS 1622: 1981, the following reagents shall be required:

a) *Skimmed Milk* - Take skimmed milk in suitable plugged tubes, Basks, or bottles, sterilize and keep.

b) *Dilute Hydrochloric Acid* - (1: 9).

**A.1.4 Procedure** - Prepare dilutions and plates as described under standard plate count in 5.4.1 and 5.4.2 of IS 1622: 1981. Add

1 ml of sterile skimmed milk to the agar tube and mix just before pouring on into the petri dish containing the sample. Incubate at 37°0 for 48 ± 3 hours. Remove the plate from the incubator and count colonies with adjacent zones of proteolysis. Flood the plate with dilute hydrochloric acid. Confirm the proteolysis by persistence of the clear zones.

**A.1.4.1** After determining the colony count, report the result as proteolytic count per ml.

## **A – 2. LIPOLYTIC BACTERIA COUNT**

**A – 2.1 Outline of the Method** – The method consists of plating a known volume of the water or a suitable dilution of it, with tributyrin agar (nutrient agar containing tributyrin) and incubating at 30°C for 3 days. The colonies of lipolytic organisms show clear zones around themselves.

**A-2.2 Apparatus** - The apparatus prescribed for standard plate count in 3.1 of IS 1622.1981 shall be required.

**A-2.2 Media and Reagents** - In addition to the reagents prescribed for Standard plate count in 5.2 of IS 1622 : 1981, the following reagent is required:

Tributyrin Agar – Dissolve 3 g of yeastrel (or meat extract) and 5 g of peptone in 1 000 ml of distilled water by passing steam. Take 25 g of shredded or powdered agar (if required, chop it up), wash in running water for 15 minutes, squeeze out the excess water and add to the yeastrel-peptone mixture. Add 2 g of tributyrin and emulsify in an efficient emulsifying machine at a temperature of 45° to 50°C. The emulsion shall show no microscopic globules and shall be stable. Adjust the pH value to 7.5 by addition of hydrochloric acid or sodium hydroxide after predetermination in a small portion, using phenol red as indicator. Place in tubes in 10 ml quantities and sterilize by steaming at 100°C for 30 minutes on each of three successive days.

**A-2.3 Procedure** – Prepare dilutions and plates as described under standard plate count in 3.4.1 and 3.4.2 of IS 1622: 1981, pour 10 ml of tributyrin agar and proceed as in 5.4 of IS : 1622-1964-, but incubating the plates at 30°C for 72 ± 3 hours. Remove the plates from the incubator and count the colonies with well-defined clear zones extending at least 1 mm from the edge of the colony.

A-2.3.1 Determine the colony count and report as lipolytic bacteria count per ml.

## **ANNEX B**

(Clause 2)

### **LIST OF REFERRED INDIAN STANDARDS**

<i>IS No.</i>	<i>Title</i>
1622 : 1981	Methods of sampling and microbiological examination of water ( <i>first revision</i> )
3025	Methods of sampling and test (physical and chemical) for water and waste water:
(Part 1) : 1987	Sampling ( <i>first revision</i> )
(Part 2) : 2002	Determination of 33 elements by inductively coupled plasma atomic emission spectroscopy
(Part 4) : 1983	Colour ( <i>first revision</i> )
(Part 5) : 1983	Odour ( <i>first revision</i> )
(Part 7) : 1984	Taste threshold ( <i>first revision</i> )
(Part 8) : 1984	Tasting rate ( <i>first revision</i> )
(Part 10) : 1984	Turbidity ( <i>first revision</i> )
(Part 11) : 1983	pH value ( <i>first revision</i> )
(Part 16) : 1984	Filterable residue (total dissolved solids) ( <i>first revision</i> )
(Part 21) : 1983	Total hardness ( <i>first revision</i> )
(Part 23) : 1983	Alkalinity ( <i>first revision</i> )

(Part 24) : 1986 Sulphates (*first revision*)  
(Part 26) : 1986 Chlorine residual (*first revision*)  
(Part 27) : 1986 Cyanide (*first revision*)  
(Part 29) : 1986 Sulphide (*first revision*)  
(Part 32) : 1988 Chloride (*first revision*)  
(Part 34) : 1988 Nitrogen (*first revision*)  
(Part 37) : 1988 Arsenic (*first revision*)  
(Part 39) : 1989 Oil and grease  
(Part 40) : 1991 Calcium  
(Part 41) : 1992 Cadmium (*first revision*)  
(Part 42) : 1992 Copper (*first revision*)  
(Part 43) : 1992 Phenols (*first revision*)  
(Part 46) : 1994 Magnesium  
(Part 47) : 1994 Lead  
(Part 48) : 1994 Mercury  
(Part 49) : 1994 Zinc  
(Part 52) : 2003 Chromium  
(Part 53) : 2003 Iron  
(Part 54) : 2003 Nickel  
(Part 55) : 2003 Aluminium  
(Part 56) : 2003 Selenium  
(Part 57) : 2005 Boron  
(Part 59) : 2006 Manganese  
(Part 60) : 2008 Fluoride  
5402 : 2002 Microbiology - General guidance for enumeration of micro-organisms - Colony count technique at 30°C (*first revision*)  
5887 (Part 2) : 1976 Isolation, identification and enumeration of *Staphylococcus aureus* and *faecal streptococci* (*first revision*)  
10500 : 2012 Drinking Water — Specification ( *Second Revision* )  
13428 : 2003 Packaged natural mineral water —Specification (*first revision*)  
IS 14988 (Part 1) : 2001 Microbiology of Food and Feeding Stuffs - Horizontal method for Detection and Enumeration of *Listeria Monocytogenes* : Part 1 Detection Method  
15185 : 2002 Water quality - Detection and enumeration of *Escherichia coli* and coliform bacteria — Membrane filtration method  
15302 : 2002 Determination of aluminium and barium in water by direct nitrous oxide-acetylene flame atomic absorption spectrometry  
15303 : 2002 Determination of antimony, iron and selenium in water by electro thermal atomic absorption spectrometry