EMD 2 (73), *Water quality -Determination* of *dissolved solids*

3 Definition

For: the purposes of this Botswana Standard, the following definition shall apply:

short term consumption: Usual and continuous daily consumption for periods not exceeding one year.

4 Requirements

4.1 Suitability

The assessment of the suitability of water for drinking purposes shall be based on the consideration of its physical, chemical and microbiological properties.

4.2 Physical, inorganic, organic, chemical and microbiological requirements

The water shall comply with the requirements of class I or class II for lifetime consumption or with the requirements for class III for short-term consumption in relation to the physical, organoleptic and chemical requirements specified in Tables 1, 2 and 3. All classes of water shall comply with the microbiological requirements specified in Table 4.

NOTE Users of this standard should notice that while waters that comply with classes I and II can be consumed for a whole lifetime without adversely affecting the human heCj.lth, any determined that falls within class III, is a potential problem that poses a health risk to consumers. Therefore, class III should only be used as an interim measure while efforts are being made to arrest the situation.

5 Methods of test

Any method that will guarantee the required accuracy shall be used. For purposes of enforcement of the requirements in Tables 1,2,3 and 4, the reference test methods outlined in clause 2 shall be used.

NOTE 1 A list of other available test methods that give the required accuracy are listed in Annex A.

NOTE 2 As technology advances, more accurate, precise and cost-effective methods are becoming available and can be used, provided they guarantee the required accuracy.

6 Sampling

The recommendations provided in BOS ISO 5667-1 shall be used as the basis for the establishment of a sampling programme and those recommendations provided in parts 2 to 6 of BOS ISO 5667 and in BOSISO ?667-11 shall be used as the basis for implementing the sampling programme.

NOTE 1 It is not practicable to describe a standard frequency of sampling without taking into consideration all the variables associated with a water supply. These include effects on the water from climatic, human and industrial activities, the volume !of water processed, the population served, the area of reticulation and the capabilities of the analytical facility (both in terms of capacity and in terms of analytical performance). For this reason, it is necessary to establish a sampling programme that !takes into consideration appropriate recommendations.

NOTE 2 In the absence of a formally established sampling programme, the minimum sampling frequency given in Table B.1 could be used as an interim measure.

Table 1 – Physical and organoleptic requirements

Determinands .	Units	Upper limit and ranges		
		Class I (Ideal)	Class II (Acceptable)	Class III (Max. allowable)
Physical and organoleptic (aesthetic) requirements				
Colour	TCU	15	20	50
Conductivity at 25°C	µS/cm	700	1500	3100
Dissolved solids	mg/l	450	1000	2000
Odour	n/a	Not objectionable	Not objectionable	Not objectionable
pH value at 25°C	-	6.5~8.5	5.5-9.5	5.0 -10.0
Taste	n/a	Not objectionable	Not objectionable	Not objectionable
Turbidity	NTU	0.5	5	10

Table 2A – Chemical requirements: Inorganic macro –determinands

Determinands	Upper limit and ranges		
	Class I (Ideal) mg/l	Class II (Acceptable) mg/l	Class III (Max. allowable) mg/l
Chemical requirements:			
lnorganic			
Macro-determinands			
Ammonia as N	0.2	1.0	2.0
Calcium as Ca	80	150	200
Chloride as CI	100	200	600
Chlorine residual	0.3-0.6	0.6 -1.0	1.0
Fluoride as F	0.7	1.0	1.5
Hardness as $CaC0_3$	20	200	500
Magnesium as Mg	30	70	100
Nitrate as NO_3	45	45	45
Nitrite as $N0_2$	3.0	3.0	3.0
Potassium as K	25	50	100
Sodium as Na	100	200	400
Sulfate as SO_4	200	250	400
Zinc as Zn	3.0	5.0	10.0

Table 2B - Chemical requirements: Inorganic micro – determinands

Determinands	Upper limit and ranges		
	Class I (Ideal) µg/l	**Class II (Acceptable)** µg/l	**Class III (Max. allowable)** µg/l
Chemical requirements, Inorganic -Micro-determinands			
Aluminium as Al	100	*200*	*200*
Antimony as Sb	*5.0*	*5.0*	*5.0*
Arsenic as As	10	10	10
Cadmium as Cd	3.0	*3.0*	*3.0·*
Chromium as Cr (total)	50	50	50 .
Cobalt as Co	*250*	*500*	1000
Copper as Cu	1 000	1000	*1000*
Cyanide (free) as CN	70	70	70
Cyanide (recoverable) as CN	70	70	70
lron as Fe	30	300	2000
Lead as Pb	10	10	10'
Manganese as Mn	50	106	500
Mercury as Hg (total)	1.0	1.0	1.0
Nickel as Ni	20	20	20
Selenium as Se	10	10	10

Table 3 - Chemical requirements: Organic determinands

Determinands	Upper limit and ranges		
	Class I (Ideal)	**Class II (Acceptable)**	**Class III (Max. allowable)**
	µg/l	µg/l	µg/l
Chemical requirements - Organic determinands			
Total organic carbon	8000	8000	8000
Total trihalomethanes	1000	1000	1000
Phenols	10	10	10
Chloroform	30	30	30
Total pesticides[a]	5.0	5.0	5.0
Pesticide[b]	1.0	1.0	1.0
Poly-aromatic hydrocarbons	100	100	100
Benzene	10	10	10
Toluene	700	700	700
Xylene	500	500	500
Ethyl benzene	300	300	300

[a] The limit given is for pesticides that make up a certain group together. Therefore. the "total pesticides" refers to all the pesticides in that one group of pesticides. such as, carbamates pesticides. chlorinated pesticides, organo-phosphates pesticides. pyrethroids pesticides and atriazines pesticides.

[b] Pesticide refers to anyone given pesticide, such as. methoxychlor, DDT. etc.

Table 4 - Microbiological requirements

Determinands	Units	Allowable compliance contribution[1)]		
		95 % min	4% max	1 % max
		Upper limits		
Total coliform	Count/100 ml	Not detected	10	100
Faecal coliform	Count/100 ml	Not detected	1	10
Faecal streptococci	Count/100 ml	Not detected	10	100

NOTE 1 If any coliform bacteria are found in a sample. take a second sample immediately after the tests on the first sample have been completed. This shall be free from coliform 15acteria; and

NOTE 2 not more than 5 % of the total number of water samples (from anyone reticulation system) tested per year may contain coliform bacteria

[1)] The allowable compliance contribution shall be at least 95 % to the limits indicated in column 3. with a maximum of 4 % and 1 % respectively. to the limits indicated in columns 4 and 5. The objective of disinfection should. I nevertheless. be to attain 100 % compliance to the limits 1n00catea In column 3.

ANNEX A
(informative)

Other test methods

A.1 Alternate BOS and BOS ISO test methods

The following BOS and BOS ISO test methods can offer the required accuracy:

BOS ISO 6058:1984, *Water quality - determination of calcium content -EDTA titrimetric method*[a]

BOS ISO 6059:1984, *Water quality - determination of calcium and magnesium -EDTA titrimetric method*[a]

BOS ISO 9297:1989, *Water quality - Determination of chloride -Silver nitrate titration with chromate indicator (Mohr's method)*[a]

EMD 2 (72) D20, *Water quality - Determination of Manganese - Persulphate methods*[a]

BOS ISO 5666:1999, *Water quality -Determination of mercury*[a]

BOS ISO 7890-1:1986, *Water quality -Determination of nitrate* -2,6 *Dimethylphenol spectrometric methods*[a]

BOS ISO 7890-2:1986, *Water quality -Determination of nitrate -4-Fluoropheno[spectrometric method after distiffation*[a]

BOS ISO 7890-3:1988, *Water quality -Determination of nitrate -Spectrometric method using salicylic acid*[a]

BOS ISO 6777:1984, *Water quality -Determination of nitrite -Molecular absorption spectrometric method*[a]

BOS ISO 9964-1:1993, *Water quality -Determination of sodium and potassiumTJ -Part* 1: *Determination of sodium by atomic absorption spectrometry*[a]

BOS ISO 9964-2:1993, *Water quality -Determination* of *sodium and potassium -Part* 2: *Determination of potassium by atomic absorption spectrometry*[a]

BOS ISO 9280:1990,*Water quality -Determination of Sulphate -Gravimetric method using barium chloride*[a]

BOS ISO 7393-1:1985, *Water quality -Determination of free chlorine and total chlorine -Part* 1: *Titrimetric method N, N-diethyl-1,4-phenylenediamine*[a]

BOS ISO 7393-3:1985, *Water quality -Determination of free chlorine and total chlorine -Part* 3: *lodometric method for the determination of totalchlorine*[a]

BOS ISO 6222:1999, *Water quality -Enumeration of cufturable micro-organisms -Colony count by inoculation in* a *nutrient agar culture medium*

BOS ISO 8199, *Water quality -General guide to the enumeration of micro-organisms by culture*[a]

BOS ISO 9308-2, *Water quality -Detection and enumeration of Escherichia coli and coliform bacteria -Part 2: Liquid enrichment method*[a]

BOS ISO 9308-3:1998, *Water quality -Detection and enumeration of Escherichia coli and coliform bacteria Part* 3: *A4iniaturized method (Most Probable Number) of E. coli in surface and waste water*[a]

BOS ISO 7150-2:1984 Water quality -Determination of ammonium -Part 2: Automated spectrometric method[a]

A.2 ASTM standard test methods

All of the determinants for which the requirements are listed in Tables 1, 2, 3 and 4 can be evaluated with the required accuracy, using the test methods given in:

*Annual book of **ASTM** standards -Water and environmental technology, Volumes 11.01 and 11.02, American Society for Testing and Materials (ASTM).*

[a] Still under preparation

A.3 APHA-AWWA-WPCF test methods

All the determinands for which the requirements are listed in Tables 1, 2, 3 and 4 can be evaluated with the required accuracy, using the test methods given in:

Standard methods for the examination of water and wastewater, American Public Health Association, American Water Books Association and Water Environment Federation, 20th ed. 1998.

ANNEX B
(informative)

Minimum frequency of sampling

The minimum frequency of sampling shall be as shown in Table B.1 below:

Table B.1 - Minimum frequency of sampling

Population served	**Frequency** [1)] min
More than 100 000	10 every month per 100 000 of population served
25 000 - 100 000	10 every month
10000 - 25 000	3 every month
2500 -10 000	2 every month
Less than 2 500	1 every month
[1)] During the rainy season or during the outbreak of water borne diseases, sampling should be carried out more frequently.	

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