RWANDA STANDARD

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Second edition

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Water quality — Swimming pool — Tolerance limits

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

RS189 was prepared by Technical Committee RSB/TC 13, *Water and sanitation*.

In the preparation of this standard, reference was made to the following standard:

IS 3328: 1993, Quality tolerances for Water for swimming pools

The assistance derived from the above source is hereby acknowledged with thanks.

This second edition cancels and replaces the first edition (RS 189:2013) which has been technically revised.

Committee membership

The following organizations were represented on the Technical Committee on Water and Sanitation (RSB/TC 13) in the preparation of this standard.

Ruliba Clays Ltd

Rwanda Environmental Management Authority (REMA)

Rwanda Fish Sector (RFS)

Rwanda Mines, Petroleum and Gas Board (RMB)

Rwanda Polytechnic/ IPRC-Kigali

Standards for Sustainability (SFS)

SULFO Rwanda Ltd

University of Rwanda/College of Sciences and Technology (UR/CST)

World Vision Rwanda

Rwanda Standards Board (RSB) – Secretariat

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Water quality — Swimming pool — Tolerance limits

1 Scope

This Draft Rwanda Standard specifies the tolerances limits for the water used in swimming pools of continuous circulation type.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

RS ISO 10523, *Water quality — Determination of pH*

ISO 10566, *Water quality — Determination of aluminium — Spectrometric method using pyrocatechol violet Water quality -- Determination of suspended solids by filtration through glass-fibre filters*

RS ISO 11923, *Water quality — Determination of suspended solids by filtration through glass-fibre filters*

RS ISO 12020, *Water quality — Determination of aluminium — Atomic absorption spectrometric methods*

ISO 5813, *Water quality — Determination of dissolved oxygen — Iodometric method*

ISO 5814, *Water quality — Determination of dissolved oxygen — Electrochemical probe method*

RS ISO 6332: *Water a quality — Determination of iron*

ISO 9963 *Water quality — Determination of alkalinity*

RS ISO 7027, *Water quality — Determination of turbidity*

RS ISO 7887, Water quality — *Examination and determination of colour*

ISO 8288, Water quality — *Determination of cobalt, nickel, copper, zinc, cadmium and lead -- Flame atomic absorption spectrometric methods*

ISO 9297, *Water quality — Determination of chloride — Silver nitrate titration with chromate indicator (Mohr's method)*

ISO 9308 *Water quality — Detection and enumeration of Escherichia coli and coliform bacteria — Part 3: Miniaturized method (Most Probable Number) for the detection and enumeration of E. coli in surface and waste water*

ISO 7393, *Water quality — Determination of free chlorine and total chlorine*

3 Terms and definitions

No terms and definitions are listed in this document.

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4 Requirements

4.1 Physical requirements

The water shall be clear, odourless and colourless and shall be sufficiently clear at all times when the pool is in use to pass the test in annex B.

4.2 Chemical requirements

The water shall comply with the chemical tolerances specified in Table 1.

Table 1 — Chemical tolerances for swimming pools water

S/N	Characteristic	Tolerance	Test method
i	Total alkalinity (as $CaCO_3$), mg/l, max.	50 – 500 [a]	ISO 9963
ii	pH,	7.2 – 8.0 [a]	RS ISO 10523
iii	Aluminium (as Al), mg/l, max.	0.1	ISO 10566/ ISO 12020
iv	Total residual Chlorine, mg/l, range	1.5 – 3.0	ISO 7393
v	Oxygen absorbed in 4 hrs at 27 ˚C, mg/l, max	1.0	ISO 5813/5814
vi	Total dissolved solids, mg/l, max.	1500	RS ISO 11923
vii	Chloride (as Cl), mg/l, max.	500	RS ISO 9297
viii	Iron, mg/l, max.	0.1	ISO 6232
ix	Heavy metals (as Pb), mg/l, max.	0.1	ISO 8288
x	Colour, Hazen units, max.	10	RS ISO 7887
xi	Turbidity, NTU, max.	10	RS ISO 7027

[a] NOTE Too low alkalinity and low pH are the most common causes of complaints of taste, odour and eye irritation. At pH lower than 7.2, there is an increased tendency for formation of di-chloramine and nitrogen chlorides or similar compounds which cause eye irritation.

4.3 Bacteriological requirements

Table 2 — Limits of microbial contaminants for swimming pool water

S/N	Characteristic	Limit	Test method
i	Standard plate count, CFU/ml, max.	100	Annex A
ii	Coliform organisms, MPN/100ml, max.	10	ISO 9308 – 3

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Annex A
(normative)

Determination of standard plate count

A.1 Apparatus

A.1.1 Dilution bottles and tubes

Bottles or tubes of resistant glass, preferably Pyrex, closed with glass stoppers, rubber stoppers, or screw caps equipped with liners that do not produce toxic or bacteriostatic compounds on sterilization shall be used. Cotton plugs shall not be used as closures. Graduation levels shall be indelibly marked on the side of dilution bottle.

A.1.2 Autoclaves

Of sufficient size and shall keep uniform temperature within the chamber up to and including the sterilizing temperature of 121 °C. They shall be equipped with an accurate thermometer located so as to register the minimum temperature within the sterilizing chamber, a pressure gauge and properly adjusted safety valves.

A.1.3 Pipettes

1 ml, straight-sided delivery pipettes. The tips shall be unbroken.

A.1.4 Petri dishes

Of 100 mm diameter and 15 mm depth. The bottom of the dishes shall be free from bubbles and scratches and shall be flat so that the medium shall be of uniform thickness throughout the plate.

A.1.5 Incubator

Maintaining a uniform and constant temperature of 35 ± 0.5 °C at all times in all parts. The use of water-jacketed or anhydric type with thermostatically controlled low temperature electric heating units and equipped with mechanical means of circulating air shall be preferred.

The incubators shall have sufficient space to accommodate the culture racks and plates, with at least 2.5 cm space between adjacent stacks and between walls and stacks.

They shall be provided with accurate thermometers and a daily record of the temperature shall be maintained.

A.1.6 Colony Counter

An approved counting aid, such as Quebee colony counter. If such a counter is not available, then counting may be done with a lens giving a magnification of 1.5 diameters. In order to ensure uniformity of conditions during counting, illumination equivalent to that produced by Quebee colony counter shall be employed.

A.2 Reagents

A.2.1 Buffered dilution water

Dissolve 34.0 g of potassium dihydrogen phosphate (KH_2PO_4) in 500 ml of distilled water, adjust to pH 7.2 with 1 m sodium hydroxide solution and make up to 1 l with distilled water. Add 1.25 ml of the above solution to 1l of distilled water. Dispense in amounts that provide 99 ± 2 ml, or 9.0 ± 0.2 ml, after autoclaving for 20 min.

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A.2.2 Tryptone glucose extract agar medium

Add 3 g beef extract, 5 g of glucose, and 15 g of agar of each litre of distilled water. Heat to boiling until all ingredients are dissolved. Make up lost weight with hot distilled water. Adjust the reaction so that the pH reading after sterilization will be between 6.8 and 7.0. Bring to a boiling temperature, stirring vigorously. Make up lost weight with hot distilled water and clarify. Distribute to the desired containers and sterilize in the autoclave at 121 °C.

When the pressure reaches zero, remove the medium from the autoclave and cool quickly to avoid decomposition to sugars. Store in a container which provides for maintenance of a temperature of 43 °C - 45 °C.

A.3 Sterilization of apparatus

A.3.1 Dilution bottles or tubes

Sterilize the bottles or tubes in the autoclave at 121 °C for 15 min after the temperature reaches 121 °C.

A.3.2 Petri dishes

Wrap the petri dishes in Kraft paper and sterilize in the hot air oven at 160 °C for one hour.

A.3.3 Pipettes

Place the pipettes in copper, stainless steel or aluminium cylinders with cover or individually wrapped in paper and sterilize in the hot-air oven at 160 °C for one hour.

A.4 Procedure

A.4.1 Dilution

Fill the dilution bottles or tubes with proper amount of buffered dilution water so that after sterilization they contain the desired quantity with a tolerance of 2 %. The exact amount of water to be placed in the bottle may be determined only by experiment with the particular autoclave in use. Only buffered dilution water is to be used for dilution. Tap water or distilled water shall not be used.

A.4.1.1 Shake the sample bottle vigorously 25 times. Transfer with a sterile pipette 10 ml, 1 ml or 0.1 ml of the sample to the proper dilution bottle, tube or petri dish as required. Shake each dilution bottle or tube vigorously 25 times after the addition of portion of the sample and before a second dilution or sample is removed.

A.4.2 Plating

The amount of the sample taken should be such as will give 30 to 300 colonies on a plate.

Ordinarily, it is not desirable to plate more than 1 ml of water in a plate; therefore, when the total number of colonies developing from 1 ml is less than 30, it is obviously necessary to record the result as observed, disregarding the rule given above. Take 1 ml, 0.1 ml or other appropriate volume of the sample dilution for plating in petri dish. Add not less than 10 ml of liquefied tryptone glucose extract agar medium at a temperature of 43 °C - 45 °C to water in the petri dish.

Flame the lips of all test tubes or flasks used for pouring the medium. Lift the cover of the petri dish just enough for the introduction of either pipette or the culture medium. Mix thoroughly the medium and sample and uniformly spread over the bottom of the petri dish by tilting and rotating the dish. Solidify all plates as rapidly as possible after pouring and place them immediately in the incubator. Not more than 20 min shall elapse between pouring and plating.

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A.4.3 Incubation

Incubation shall be done at 35 ± 0.5 °C. Incubate for 24 ± 2 h. Invert the glass covered petri dishes in the incubator. Place the dishes in the incubator as prescribed in A.1.5.

A.4.4 Counting

In determining the standard plate count, only such plates should be considered which saw 30 - 300 colonies except as provided in A.4.2.

Counting shall be done with an approved counting aid. (A.1.6)

A.4.4.1 If the same amount of water has been planted in 2 or more replicate plates and of these, one shows colonies within the limits mentioned in A.4.4, while others show less than 30 or more than 300 colonies, the results recorded shall be average of all the plates planted with this volume of sample.

A.4.4.2 In order to avoid fictitious accuracy and yet expense the numerical results by a method consistent with the precision of the technique employed, the recorded number of bacterial per millilitre shall be reported as follows:

Up to 100 to the nearest unit

More than 100 to the nearest 5 units

Counts shall be designated as the standard plate count at 35 °C.

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Annex B
(normative)

Clarity test method

Place a black disc, 150 mm in diameter and fixed to a white background, on the bottom of the pool at the deepest point.

The disc shall be clearly visible from the sidewalks of the pool at all distances up to 9 m in a line drawn across the pool through the said disc.

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