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Reverse Osmosis (RO) Based Point-of-Use (PoU) Water Treatment System — Specification

ICS No. 130.060.01

भारतीय मानक ब्यूरो
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Water Purification System Sectional Committee, MHD 22

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Water Purification System Sectional Committee had been approved by the Medical Equipment and Hospital Planning Division Council.

The quality of water available for human consumption is a direct measure of the health of the population/community and indirectly to that of the country. In populated countries like India, the quality of drinking water has deteriorated due to contamination of soil and water by biological and industrial wastes and over exploitation of ground water. Tapping of ground water for drinking purpose has also increased in urban and semi-urban areas to meet the growing demand. Ground water is generally characterized by high dissolved solids; mineral contents and may contain harmful heavy metals and natural elements like excess fluoride.

Reverse Osmosis technology combined with sediment filter and carbon filter has proven to be an effective water treatment method for removing various inorganic, organic and microbiological contaminants from the water. Realizing the fact, many organized and un-organized sectors have entered RO technology based water treatment market. This trend necessitates the importance and urgency of drawing a standard for RO based water treatment system. This standard also covers the testing of materials that come in contact with water for their safety.

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 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

REVERSE OSMOSIS (RO) BASED POINT-OF-USE (POU) WATER TREATMENT SYSTEM — SPECIFICATION

1 SCOPE

1.1 This standard covers Reverse Osmosis (RO) based Point-of-Use (POU) water treatment system with a capacity of up to 25 litres per hour that reduces TDS of water, reduces chemical contamination to safe level and removes physical particles including microbiological impurities.

1.2 The standard does not cover consumables such as filters and media.

2 REFERENCES

The following standards 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 below:

IS No.	*Title*
302 (Part 1) : 1979	Safety of household and similar electrical appliances: Part 1 General requirement (*fifth revision*)
3025	Method of sampling and test (physical and chemical) for water and waste water:
(Part 16) : 1984	Filterable residue (total dissolved solids) (*first revision*)
(Part 34) : 1988	Nitrogen (*first revision*)
(Part 37) : 1988	Arsenic (*first revision*)
(Part 41) : 1992	Cadmium (*first revision*)
(Part 42) : 1992	Copper (*first revision*)
(Part 47) : 1994	Lead
(Part 48) : 1994	Mercury
(Part 52) : 2003	Chromium
(Part 53) : 2003	Iron
(Part 60) : 2008	Fluoride
9845 : 1998	Determination of overall migration of constituents of plastics material and articles intended to come in contact with foodstuffs — Method of analysis
10500 : 2012	Drinking water — Specification (*second revision*)

3 TERMINOLOGY

For the purpose of this standard the following definitions shall apply.

3.1 Reverse Osmosis — Reverse Osmosis is a pressure driven membrane separation technique to reduce dissolved solutes such as minerals, salts, organic species from water.

NOTE — Reverse Osmosis is often used in commercial and residential water treatment. It is also one of the methods used for desalination of brackish water and seawater. In Reverse Osmosis based water system, normally a spiral wound membrane element is used along with pretreatment filters consisting of sediment filters, activated carbon filters etc.

3.2 Membrane — A semi-permeable barrier that allows preferential passage of water. Commonly used Reverse Osmosis membranes include cellulose triacetate and aromatic polyamide polymers popularly known as TFC (thin film composites).

3.3 Drinking Water — Water intended for human consumption for drinking and cooking purposes from any source (*see* IS 10500).

3.4 Production Rate — The volume of water produced by a system in litres per hour.

3.5 Point of Use Drinking Water Treatment System — A plumbed-in or faucet-mounted system used to treat the feed water for direct consumption or use.

NOTE — POU RO system is not intended for distribution.

3.6 Recovery Rating — The ratio of product water to feed water.

3.7 Feed Water — Water entering the system.

3.8 Product Water — Water that has been treated by a system.

3.9 Influent Challenge Level — The standard test water with specified contaminants entering a system for evaluation.

3.10 Chemical Reduction — A reduction in the quantity of one or more specified organic or inorganic chemical contaminants by a system from feed water.

3.11 Contaminant — An undesirable physical, chemical, or microbiological substance or parameter in water that may have adverse effects on health and aesthetics or both.

4 CONSTRUCTION

4.1 Inlet Port — Their inlet port shall be so designed that it can be connected to the tap.

4.2 Method of Mounting — The units shall facilitate wall-mounting or counter top placement or under the sink installation etc.

4.3 Main Components and Installation — RO system shall have the following components:

a) *Sediment filter —* An effective filter required to remove the suspended solids like fine particles from feed water.
b) *Media —* Required for the removal of Chlorine and organic matter from water.
c) Reverse Osmosis membrane element.
d) *Taste enhancer media or/and carbon —* Required to improve the taste of RO treated water.
e) Booster pump
f) *Reject water control mechanism —* Required to control the water flow or/and pressure.
g) Power supply
h) *Auto shut-off mechanism —* Required to avoid overflow and protect the dry running of pump.
j) Flushing mechanism (optional).

5 MATERIALS

5.1 Materials in contact with water shall not impart extractable contaminants exceeding the permissible level for various plastic materials when tested as per IS 9845.

5.2 Materials of Construction

5.2.1 Those surfaces of the components of the RO system, which are expected to get wetted by the flow of water through the RO system, shall be made of corrosion–resistant materials or shall have corrosion–resistant treatment or coating of food grade quality. The manufacturer shall provide an evidence of the same.

5.2.2 All components installed after the booster pump shall be pressure resistant to the extent of maximum pressure exerted by the booster pump as declared by the manufacturer.

5.3 Membrane Preservatives

5.3.1 The chemical preservatives used in the membrane shall be of food grade quality and shall be declared by the manufacturer in the user guide for consumer.

5.3.2 The manufacturer shall also declare the flushing requirement etc in the user guide for consumer.

6 PERFORMANCE REQUIREMENTS

6.1 General

6.1.1 RO system shall be so designed and constructed that its intended purpose is accomplished when installed and operated in accordance with the manufacturer's instructions.

6.2 Reject Water Control Mechanism

6.2.1 A reject water control mechanism shall be provided as an integral part of the system to regulate the flow of the reject water. The performance of the system depends on the specified reject water flow rate.

6.3 Performance

6.3.1 *TDS Reduction*

RO system shall reduce the TDS level of feed water to less than or equal to 500 mg/l as per the maximum desirable concentration specified in IS 10500 when tested as per IS 3025 (Part 16).

6.3.2 For testing, the influent challenge level water shall have minimum 1 500 mg/l of TDS or the operating maximum TDS level as declared by the manufacturer.

6.3.3 *Chemical Reduction*

The manufacturer shall meet the maximum allowable product water level as given in Table 1.

6.3.4 *Microbiological Reduction*

The RO system shall meet the requirements of Table 1 to deliver microbiologically safe drinking water.

6.4 Percent Recovery of Product Water and Hourly Production Rate

6.4.1 The minimum recovery shall be equal to or more than 20 percent.

6.4.2 Recovery of product water shall be tested at TDS level specified in **5.3.1** for 10 continuous minutes. The tests shall be conducted when the system and the feed water have been conditioned at 27 ± 2°C.

NOTE — The test shall be done with a fresh RO system.

6.4.3 Production rate shall not be less than 5 litres in an hour.

6.4.4 The manufacture shall declare

a) the recovery rating;
b) maximum operatable feed water TDS;
c) production rate in litres per hour; and
d) operating pressure range, in MPa.

6.5 Electrical Safety

6.5.1 The entire electrical circuit shall be insulated from the RO system, such that leakage current shall not be more than 210 μA when tested in accordance with IS 302.

6.5.2 The electrical circuit shall also be capable of withstanding for 1 min, a high voltage test at 1 500 V

Table 1 Chemicals and Microbiological Reduction

(*Clauses* 6.3.3 *and* 6.3.4)

Sl No.	Contaminant	Influent Challenge Level	Maximum Allowable Product Water Level	Method of Testing
(1)	(2)	(3)	(4)	(5)
i)	Arsenic (as Ag), mg/l, *Max*	0.10 ± 10%	0.01	IS 3025 (Part 37)
ii)	Cadmium (as Cd), mg/l, *Max*	0.03 ± 10%	0.003	IS 3025 (Part 41)
iii)	Chromium (as Cr), mg/l, *Max*	0.30 ±10%	0.05	IS 3025 (Part 52)
iv)	Copper (as Cu), mg/l, *Max*	3.00 ±10%	0.05	IS 3025 (Part 42)
v)	Fluoride (as F), mg/l, *Max*	8.00 ±10%	1.0	IS 3025 (Part 60)
vi)	Lead (as Pb), mg/l, *Max*	0.15 ±10%	0.01	IS 3025 (Part 47)
vii)	Mercury (as Hg), mg/l, *Max*	0.006 ±10%	0.001	IS 3025 (Part 48)
viii)	Nitrate (as NO_3), mg/l, *Max*	150.00 ±10%	45	IS 3025 (Part 34)
ix)	Iron (as Fe), mg/l, *Max*	0.9 ±10%	0.3	IS 3025 (Part 53)
x)	Pesticides total µg/l, *Max*	0.03 of each pesticide	0.01 (of each pesticide) 0.05 (total pesticides)	IS 10500
xi)	*E.coli*	10^7/100 ml	99.999 9 % reduction	IS 10500
xii)	MS2 (Viruses)	10^7/100 ml	99.99 % reduction	IS 10500
xiii)	Cryptosporidium	5×10^3/100 ml	99.9 % reduction	IS 10500
xiv)	Giardia lamblia	5×10^3/100 ml	99.9 % reduction	IS 10500

NOTE — Claims for inorganic, organic chemicals and microbiological reduction shall be made for the specific contaminants shown in this table. To qualify for a specific contaminant reduction claim, the system shall reduce the level of the contaminant from the influent challenge to the specified limits.

rms between body and live parts, when tested in accordance with IS 302.

6.5.3 All parts of metallic construction shall be permanently and reliably connected to an earthing termination within the RO system and shall be free of rough or sharp edges or other hazards that may cause injury to persons adjusting, servicing, or using the system.

6.6 Power Supply

6.6.1 The RO system requiring power up to 1 kW, as of those for domestic use shall be capable of working with a single-phase, 230 ± 10 V, 50 Hz, a.c. supply.

6.6.2 The RO system requiring power above 1 kW shall be capable of working with a three-phase, 415 ± 20 V, 50 Hz, a.c. supply.

6.7 Type Pressure Test (Hydrostatic Test)

6.7.1 All the components of the RO system through which the water passes shall be checked by hydrostatic test at pressure of 0.294 MPa. The membrane cartridge and other accessories connected to the system from the booster pump discharge like pipes, fittings, instruments etc, up to the product discharge valve and reject discharge point to the booster shall be tested at least 1.5 times exerted by the maximum pressure exerted by the booster pump.

6.7.2 Leakage of the unit to be tested by closing the outlet of the RO system. There shall not be any leakage from any of the joints, filter housing, connectors etc when the pressurized unit is held for 15 min. The hydrostatic pressure shall be slowly increased so that the required pressure is reached within 5 min.

6.7.3 The pressurization shall be done only on the filters after the booster pump which is subject to clogging. Pressurization of the unit shall be done in following manner:

a) From the inlet port till the outlet port of the filter prior to the pump at 0.196 MPa pressure.

b) From the inlet port of the pump till the outlet port of the Product water (from where product water falls into the storage tank).

7 ROUTINE PRESSURE TEST (PNEUMATIC TEST)

7.1 Minimum 5 percent of the units of RO system produced per batch shall be tested for routine pneumatic test.

7.2 Full device leakage testing: Compressed air (with pressure 0.2 MPa) is fed through the inlet point of the device keeping all the outlets shut. After the pressure is reached to the maximum, the air line is isolated by a manual valve and checked for the drop in pressure in 3 min. If the pressure is sustained, then this is found to be free from any leak.

8 TEST REQUIREMENTS

8.1 Take samples as per the sampling plan given in Annex A.

8.2 Test as per the sequence given in Annex A.

8.3 Both the samples should pass in all the requirements. In case of any failure discontinue further testing.

9 MAINTENANCE OF THE PRODUCT

9.1 RO system contains a replaceable treatment component critical for effective reduction of total dissolved solids. The product water shall be tested periodically by the maintenance service provider to

verify the system performance after replacement of consumables as specified by the manufacturer.

9.2 For all filtration components like sediment filter, activated carbon filter and RO membrane filter, manufacturer shall declare the maximum possible life in terms of litres of water, which can be processed through each filter. Factors affecting the performance of the filters shall be mentioned. All these information shall be provided in the user manual.

9.3 The manufacturer shall give explicit instructions in the user manual and also on the product for cleaning and disinfecting of the storage tank by halogenated solutions (usually chlorine) or any other equivalent disinfectant. The recommended frequency shall also be mentioned in the user manual.

10 CAUTION

10.1 The manufacturer shall explicitly state the following caution on the label of the RO system:

> "RO system is not recommended for arsenic level above 0.1 mg/l and fluoride level above 8.0 mg/l"

11 MARKING

11.1 A name plate shall be fixed on the body of the RO system, at a prominent location. The nameplate shall be marked with the following details:

a) Name of the manufacturer;
b) Brand name;
c) Production serial number;
d) Model name or code;
e) Production rate in l/h;
f) Recovery rating ;
g) Maximum operating TDS level;
h) Supply voltage whether single or three-phase, frequency, volts and wattage.

12 USER MANUAL

12.1 An user manual for the proper method of operation and use of the RO system shall be supplied along with the RO system. It shall also include the life and specification of all the filters/consumables.

13 WARRANTY

13.1 The manufacturer shall provide a suitable warranty for the RO system.

14 CERTIFICATION MARKING

14.1 The product may also be marked with the BIS Standard Mark

The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act,* 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufactures or producers may be obtained from the Bureau of Indian Standards.

15 PACKING

15.1 The RO system shall be suitably packed in order to avoid damage during transit and storage.

ANNEX A

(*Clauses* 8.1 *and* 8.2)

SAMPLING PLAN FOR RO SYSTEM

A-1 Randomly select the two samples of RO system from the same batch.

A-2 Install and condition the selected RO systems as per the instruction manual provided by the manufacturer.

A-3 Allow at least 10 litres of product water (in line) or 1 volume equivalent of storage tank to flow.

A-4 Conduct the test as per the sequence and frequency given below:

a) Microbiological,
b) Pesticides,
c) Salts and heavy metals, and
d) Iron.

	Week 1	*Week 2*	*Week 3*	*Week 4*
Microbiological	✓	✓	✓	✓
Pesticides	✓	✓	✓	✓
Salt and heavy metals	✓	✓	✓	✓
Iron	✓	✓	✓	✓

A-5 Allow at least 40 litres of product water after every sequence to wash out the previous set of contaminants.

A-6 Sampling shall be done after running the RO system with the influent challenge water for 15 min.

A-7 All product water samples shall be collected in duplicates and tested accordingly.

Bureau of Indian Standards

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Review of Indian Standards

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