

## Indian Standard

METHODS OF SAMPLING AND TEST ( PHYSICAL AND  
CHEMICAL ) FOR WATER AND WASTE WATER

## PART 12 DENSITY

## ( First Revision )

**1. Scope** — Prescribes a method for determination of density, using density bottle. This is applicable for all types of waters.

**2. Principle** — Determination of density is based on determination of the mass of a known volume of sample at a given temperature. Density should be determined at the same temperature at which glassware in use is calibrated ( 27°C ).

**3. Interferences** — Suspended matter interferes and is removed by filtration or centrifugation. Evaporation losses should be kept to the minimum during the operation.

#### 4. Apparatus

**4.1 Density Bottle** — 50 ml capacity.

**4.2 Balance** — Capable of weighing the density bottle to the nearest 0.1 mg.

**4.3 Water-Bath** — Constant temperature  $27 \pm 0.5^\circ\text{C}$ .

**5. Procedure** — Adjust the temperature of the sample to  $27 \pm 0.5^\circ\text{C}$ . Fill the tared bottle with sample. Stopper and wipe it. Weigh the bottle to the nearest 0.1 mg. If a constant temperature bath is not available, record the temperature with an accurate thermometer and obtain value of relative density for that temperature from Table 1.

**6. Calculations** — Calculate the density of the sample as follows :

$$D = \frac{MC}{V}$$

where

$D$  = density of the sample at 27°C, g/ml;

$M$  = mass of sample in the density bottle, g;

$V$  = volume of density bottle, ml; and

$C$  = correction factor for temperature.

**Note** — When measurements are made at 27°C,  $C = 1$ .

For other temperatures.

$$C = \frac{\text{Relative density at } 27^\circ\text{C}}{\text{Relative density at test temperature}}$$

**7. Report** — Report density to three decimal places in terms of grams per millilitre at specified temperature.

**8. Precision and Accuracy** — Precision and accuracy depend, to a large extent, on the density bottle and the balance.

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TABLE 1 DENSITY OF WATER AT DIFFERENT TEMPERATURE

( Clause 5 )

Temperature	Density	Temperature	Density
°C	g/ml	°C	g/ml
0	0.999 87	65	0.980 59
3.98	1.000 00	70	0.977 81
5	0.999 99	75	0.974 89
10	0.999 73	80	0.971 83
15	0.999 17	85	0.968 65
18	0.998 62	90	0.965 34
20	0.998 23	95	0.961 92
30	0.995 67	100	0.958 38
35	0.994 06		
38	0.992 99		
40	0.992 24		
45	0.990 25		
50	0.985 73		
55	0.985 73		
60	0.983 24		

Note — The temperature of maximum density for pure water, free from air = 3.98°C ( 277.13 K ).

## EXPLANATORY NOTE

Density is the mass of substance per unit volume at a specific temperature and relative density is the mass of a volume of the substance compared to that of an equal volume of water. Density is used in computation where results are expressed in terms of parts per million ( ppm ).

Concentration in terms of parts per million ( ppm ) =  $\frac{\text{Concentration in terms of mg/l}}{\text{Density}}$