Indian Standard (Reaffirmed 1996)

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

PART 9 TEMPERATURE

(First Revision)

Water Sectional Committee, CDC 26; Panel for Methods of Test for Water and Effluents, CDC 26 : P1 [Ref: Doc: CDC 26 (8855)]

1. Scope — Prescribes methods for the measurement of temperature of water and waste water.

2. Principle

2.1 Temperature measurements may be made with any mercury-in-glass thermometer, provided it is checked occasionally against a precision thermometer certified by a competent agency.

2.2 Depth temperature may be obtained with a protected reversing thermometer or a thermistor. Measurements of temperature are, usually, more conveniently done using thermistors.

3. Procedure

3.1 Make measurement with the thermometer immersed directly in the water body, after a period of time sufficient to permit constant reading. If the measurement of water temperature can not be carried out directly, carry it out in a sampling bottle. The bottle should have a volume of at least one litre. Adjust its temperature to that of the sample water before the measurement. Do not expose it to heat or direct solar radiation. Measure temperature of tap water in a bottle through the water flows until a constant reading is obtained.

3.2 Make measurement of the temperature of a water body at a particular depth with the thermometer or thermistor immersed directly in the water body. After sufficient time has elapsed to allow the thermometer or thermistor to come to the exact temperature of the water, take a reading. In the case of the thermistor make a direct measurement of its resistance and obtain the temperature of the water body from the calibration curve supplied with the thermistor.

3.3 In the case of reversing thermometer, obtain the reading by dropping a messenger weight along the wire to which is attached the reversing thermometer in a reversing frame on a water sampling bottle. This weight normally drops at a speed of about 150 metres per minute except when the wire is extremely inclined to the vertical. After sufficient time has passed for the messenger weight to trip the thermometer, haul up the wire and keep the water bottle with the thermometer carefully in a vertical position away from direct sunlight in order to prevent accidental reversing before reading the temperature to be measured. Allow about 10 to 15 minutes for the thermometers to reach the air temperature, after they are brought up from the water. At this stage the auxiliary thermometer records the atmospheric temperature and the main thermometer, the approximate temperature of the water body.

4. Calculations — Calculate the exact temperature of the water body, in the case of the reversing thermometer, from the following formula:

$$T_w = T' + C + I$$

and

$$C = \frac{(T' - V_o)\ \ (T' - T_1)}{K - 100}$$

where

T_w = the corrected value, that is, the true value of the water temperature, °C;

T' = the reading of the main thermometer, °C;

I = the index correction given on a calibration sheet supplied with the thermometer;

C = correction for thermal expansion;

V_o = volume of mercury below 0°C mark given on the calibration graph;

K = reciprocal thermal expansion coefficient given on the calibration graph; and

T_1 = temperature reading of the auxiliary thermometer, °C.

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4.1 If an unprotected reversing thermometer is used along with the protected thermometer the corrected temperature T_u can be similarly obtained. The actual depth of reversal of the thermometers can be obtained using the following equation:

$$Z = \frac{T_u - T_w}{P_m - Q}$$

where

Z = depth in metres;
T_u = corrected reading of the protected thermometer, °C;
T_w = corrected reading of the protected thermometer, °C;
P_m = mean density of the water column; and
Q = pressure coefficient of the unprotected thermometer given on the calibration graph.

5. Report — Report the temperature of water to the nearest 0·01, 0·1 or 0·5°C, depending on the accuracy required and the thermometer used.

EXPLANATORY NOTE

Measurements of temperature are required in studies of self-purification of rivers and reservoirs and is one of the parameters for suitability of an effluent waste discharge and for the control of waste treatment plants. Temperature of water is important in relation to aquatic biota, bathing and irrigation use. It also affects taste of water.

Accurate measurements of temperature of natural waters are essential for calculation of degrees of saturation with respect to various minerals and in study of mineral 'equilibria'. Temperature readings are used in calculation of various forms of alkalinity. In limnologic studies, temperature readings at different depths are required. In industrial plants, for process use or heat transfer calculations, temperature values are required.

This method supersedes clause 10 of IS : 2488 (Part I)-1966 'Method of sampling and test for industrial effluents, Part I'.