Chapter 2

HYDROMETERS

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Introduction

1. The hydrometer is a device for measuring the specific gravity or relative density of a liquid, the specific gravity being expressed as a decimal in comparison with the specific gravity of pure water, which is taken as unity. It operates on the principle that when a body floats, partially submerged, in a liquid, it takes up a position of equilibrium in which the weight of the displaced liquid equals the total weight of the body. The volume of that part of the body which is submerged, therefore, is in inverse proportion to the density of the liquid in which it floats.

DESCRIPTION

2. In practice, a float is used which takes the form of a closed glass tube containing air and which is weighted at the lower end to enable it to float in an upright position. A scale, incorporating the desired range of specific gravity, is marked on the side of the float, and in order to obtain an open scale the lower portion of the tube is expanded into the form of a cylindrical bulb, the graduations being shown on the narrow upper portion of the float. This design results in a greater vertical movement for a given range of specific gravity.

3. The principal application of this instrument, in Service electrical practice, is to determine the specific gravity of the electrolytes used in lead-acid or alkaline batteries. This value is required when preparing the electrolyte by dilution of an acid or a solution of solid alkaline electrolyte; it is also required for the electrolyte present in cells whilst in use, as the specific gravity of the acid used in a lead-acid battery may be used to assess the degree to which the cell has been charged or discharged. Although the specific gravity of the electrolyte used in an alkaline cell does not vary with the state of charge, it may change due to other cause. A check of the electrolyte density in either type of cell is, therefore, desirable in order to prevent the consequent deterioration of the cell plates due to the action of electrolyte of the incorrect specific gravity.

4. The measurement of the density of the electrolyte present in cells requires the use of some form of syringe to withdraw the liquid to be assessed. In the Service hydrometer sets the hydrometer proper and a suitable syringe are incorporated to form one instrument. The hydrometer sets are supplied in different types, as described in A.P.4343S, Vol. 1, Sect. 14, depending upon whether they are to be used with acid or alkaline electrolytes; this is desirable, due to the different nature of the electrolytes and different range of specific gravity readings covered.

OPERATION

5. In order to use the apparatus, the nozzle of the syringe is inserted beneath the level of the electrolyte, which is drawn into the

body of the syringe by pressing and releasing the rubber bulb. Care must be taken to draw in sufficient liquid to ensure that the hydrometer is floating freely, but does not rise high enough to bring the upper part of the float in contact with the rubber stop. The specific gravity may then be read off directly from the scale on the hydrometer, the reading being taken on the hydrometer scale opposite the surface of the liquid.

Note . . .

It is important that hydrometers used for acid electrolyte should not be used for those of an alkaline nature, owing to the danger of contamination of the electrolyte.

6. The specific gravity of a liquid varies with the temperature of the liquid, decreasing with increasing temperature. It is important when measuring the specific gravity of an electrolyte not at normal temperature (15 deg. C. or 60 deg. F.) that this reading should be corrected, as described in the appropriate chapter of A.P.4343, Vol. 1, Sect. 3, to obtain the corresponding value at normal temperature.

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