AUSTRALIAN STANDARD
Prepared by the Appita Testing Committee. Endorsed as part of AS 1301 by the Standards Association of Australia—September 1978. Endorsed as suitable for use in New Zealand by the Standards Council of New Zealand.

Appita P401s—78

Tentative Standard—July 1956
Standard—1959
Revised—April 1963
Revised—October 1970
Revised—September 1978

THE SAMPLING AND TESTING OF PAPER FOR MOISTURE CONTENT

The moisture content of many materials, including paper*, is commonly determined by oven-drying, the change in mass of the material being assumed to be due solely to the removal of water. In the case of paper, this assumption is not always justified. Apart from the possibility of the presence of volatile constituents other than water, which would be lost in oven drying, there is also the possibility of mass change by oxidation or decomposition of such constituents of the paper as fillers, dyes, sizing materials, etc, and of the cellulose itself, if the temperature is sufficiently high and drying is prolonged.

Practical experience has shown that the quantity of water removable from paper depends on the method of drying adopted. In oven-drying the moisture values obtained are to some extent dependent on the temperature used, the humidity in the oven and also on the time of drying, the final stage of drying being very slow and with no clearly defined end-point. When other methods of water removal are used—for example, vacuum desiccation, or distillation or extraction with solvents—experience has shown that the moisture content values do not always agree closely with those obtained by a standardized oven-drying method.

In view of these facts and of the complexity of the cellulose/water relationship, it is not possible to define the moisture content of paper in fundamental terms. The moisture content must therefore be defined arbitrarily in terms of a particular method. This is done in the present test method by defining two procedures. The first, based on oven-drying, is suitable for the majority of papers; the second, based on distillation with a solvent, is intended for papers (such as waxed papers) containing volatile or fusible constituents other than water, which cannot be tested by the oven-drying method.

The choice of oven-drying as the main method is based on its widespread use and on the fact that, with suitable standardization of the testing conditions, it gives more consistent results than are possible by other methods.

Particular attention is paid in this test method to the matter of sampling. Whatever method of testing may be employed, care must be taken that the sample does not change appreciably in moisture content between the time of sampling and commencement of the test through exposure to an atmosphere with which the paper is not in equilibrium. Although few exact data are available on the rate of change in the moisture content with exposure under various conditions, it is known that these changes can occur very rapidly and, for this reason, the accuracy of the moisture test as a whole will often be limited to the accuracy with which the sampling can be carried out.

1. METHODS

The methods specify means of testing paper to determine its moisture content at the time of sampling.

1.1 Oven-drying method. This method applies to papers that do not contain any appreciable quantity of materials, other than water, which will escape from the paper at the temperature specified for the test.

1.2 Distillation method. This method is suitable for materials such as waxed papers, varnished papers, laminates, etc, which cannot be tested by the oven-drying method owing to the probable loss of volatile or fusible constituents. It cannot be used if there is possibility of water being produced by decomposition of any material with which the paper has been treated.

*In this standard the term paper is used in the generic sense and includes pulp, paperboard and corrugated and solid fibreboard.

2. DEFINITIONS

2.1 Mositure content. A measure of the quantity of water in paper. This is regarded either as the loss in mass of a test piece when dried to constant mass under standard conditions or the mass of water removed from a test piece by distillation. In either case it is reported as a percentage of the mass of the test piece taken.

2.2 Moisture content on an oven-dry basis. The loss in mass of a test piece after drying to constant mass under standard conditions, expressed as a percentage of the constant mass so obtained.

2.3 Constant mass. The mass reached by a test piece after drying at the specified temperature until the difference between successive weighings does not exceed 0.1 per cent of the initial moist mass of the sample.

3. OVEN-DRYING METHOD

3.1 Apparatus.

(a) A balance having an accuracy of at least 0.05 per cent of the original mass of the test piece.

(b) Containers, for the transporting and weighing of test pieces, having airtight lids and made from a lightweight material not subject to change under the conditions of the test.

(c) A drying oven, capable of being maintained at an air temperature of 105 ± 2°C, and having forced ventilation. A suitable oven is one which conforms to Type IIB of ASTM Designation E145-65T—Gravity Convection and Forced Ventilation Ovens. Ideally the air for ventilation of the oven should be taken from a test room whose conditions conform to Appita P415. Otherwise the oven should be sited to avoid intake of air which is either very moist or very dry (Reference 7.1).

3.2 Preliminaries. Before commencing to take samples, number and weigh sufficient clean and dry containers. Keep the containers closed until the sample is about to be taken. Before weighing, each container should have been allowed to attain temperature equilibrium with the atmosphere.

If the atmosphere at the place of sampling is warm and damp, precautions must be taken to prevent errors from condensation either in or on the container.

Special precautions should be taken in handling the sheets in order to avoid contamination and any pick up or loss of moisture. In particular it is recommended that clean rubber gloves be worn. Moreover, to avoid moisture changes, which can be extremely rapid with any paper, it is very important to enclose all test pieces in their containers within a few seconds of sampling or, when longer times are unavoidable, to protect the test pieces from exposure by means of additional layers of the same paper at top and bottom, which are discarded immediately before putting the test piece into a container.

3.3 Sampling. Select units for sampling as in Table 1 and conduct a separate moisture test on each unit as described below.

TABLE 1

Size of lot *(n)*	Number of units selected	Method of selection
1-5 units	All	—
6-99 units	5	At random
100-399 units	*n*/20*	At random
400 or more units	20	At random

*Ignore any remainder

(a) When the unit is a ream or parcel take a sufficient number of consecutive sheets from the centre of each ream or parcel selected to provide a test piece of at least 50 g (Note 6.1) and comprising preferably four consecutive complete sheets to be enclosed in one of the containers after folding or cutting. The test piece may comprise less than four sheets if their combined mass is so large as to be unmanageable. If cutting is necessary discard the top and bottom layers of each cut portion immediately before enclosing the remainder in the container. Weigh the container and contents and from the mass of the container calculate the mass of the test piece (Note 6.2).

(b) When the unit is composed of reams or parcels packaged together, select as follows:

If there are 20 or more reams or parcels in each unit, select units according to Table 1, then treat this selected quantity as a lot and the reams or parcels as units, select reams or parcels according to Table 1, and proceed as in (a). If there are less than 20 reams or parcels in each unit, select one ream or parcel at random from each unit and proceed as in (a).

(c) When the unit is the reel remove and discard all damaged layers from the exterior of the reel. Discard also at least 3 undamaged layers if the grammage is less than or equal to 224 g/m² or at least one undamaged layer if the grammage is greater than 224 g/m². (The number of layers discarded may need to be increased according to the efficiency of wrapping and influence of storage conditions.) Take, by cutting in the cross direction, a layer at least 5 mm thick and lay it out flat. Take sets of strips, 50 to 75 mm wide in the machine direction, from the selected layer; cut one set of strips from near each reel edge and another set from the region of the midpoint between the edges, or cut a set of strips from the complete width of the reel. Take care not to separate either the sheet comprising the layer or the strips comprising a set.

Discard the top and bottom strip from each set of strips; the remainder together constitutes a test piece and shall have a mass of at least 50 g. Quickly fold or cut the strips comprising the test piece and enclose them together in a container. Weigh the container with its contents and calculate the mass of the test piece (Note 6.2).

3.4 Drying procedure. Dry the test piece in the oven, either in its container (with the lid removed)