Determining the moisture content of paper and board (oven drying method)

These notes are intended as a brief introduction to the subject and are not a definitive procedure. Operators should always follow the procedures prescribed in the relevant national, international or industry standard methods.

Description of method
This method describes the procedure for determining the moisture content of paper and board samples. It applies to paper and board that contains water but no other material that may escape at the drying temperature.

Moisture content is the amount of water in the test piece of paper as the % ratio of the loss of mass of the sample when it is dried compared to the mass at the time it was sampled.

The test piece is weighed when it is first sampled and then dried at a specific temperature and weighed at intervals during the drying process until the difference between the last two weighings is less than 0.1% of the initial mass (constant mass).

Required Apparatus

1. A balance with accuracy of at least 0.05% of the mass to be weighed.
2. Lightweight closeable airtight containers for holding the test pieces during the weighing and drying process that will not absorb water vapour and will not be affected by the test conditions.
3. A ventilated drying oven of suitable size, that can maintain a constant temperature of 105 ± 2 ºC and free access of air to extract the water vapour being driven off the test pieces.
4. A suitable desiccator.

Containers preparation
The lightweight containers should be clean and dry. They should be numbered for identification and opened and allowed to acclimatize to the ambient atmospheric temperature. They should then be weighed and closed until the paper sampling is started. Identify and record the mass of each empty container.

Sampling
The sampling should be carried out strictly in accordance with the relevant national or international standard method. Precautions such as wearing rubber gloves should be taken to avoid contamination of the paper or board and to prevent any gain or loss of moisture during handling. The sampled test pieces should be placed in the containers immediately after sampling and the containers should at once be closed.

To select test pieces with grammage less than or equal to 224 g/m², discard the three outermost and any damaged sheets of the sample and place at least four test pieces (minimum 50 grams) into a container and close it immediately. The test pieces may be quickly cut or folded as necessary to fit them into the containers. Weigh the container and contents and calculate the mass of the test pieces.

For test pieces with grammage greater than 224 g/m² the sample should be cut into sufficient strips not less than 150 mm long and between 50 and 75 mm wide to give a total mass not less than 50 grams. Then close the containers and weigh as described above.
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To determine the variation in moisture content between the edges and center of a sheet. Select a layer of sample sheets and cut test pieces with a mass of at least 50 grams. Test pieces should be 150 mm long cut in the cross direction and 50 to 75 mm wide. The test pieces should be taken from both edges of the sheets and from the center region of the sheets. Strips should be from more than 150mm away from any adjacent edge of sheets. Edge strips and center region strips should be kept separate.

Drying

The test pieces are dried in the oven at a maintained air temperature of 105 ± 2 °C. They should be either in their opened containers or spread out to allow air circulation. The opened container should also be placed in the same oven. Record the start time of the drying process. The initial drying time for test pieces less than or equal to 224 g/m² shall be at least 30 minutes. For test pieces greater than 224 g/m² the initial drying time shall be at least 60 minutes. Do not place other test pieces into the oven while the first test pieces are being dried.

When the test pieces are considered to be completely dry, record the drying time; quickly enclose the test pieces in the container. Allow the container to cool in a desiccator. Re-weigh the test pieces in the container and calculate the mass of the dried test pieces. Place the container and test pieces in the oven as before, record the start time and continue the drying process for at least half the first drying time. Remove and reweigh the test pieces and container as before and calculate the mass of the test pieces. Repeat the process of dryings and weighings until constant mass is achieved. Repeated drying times must exceed half the total of all the preceding drying times. Constant mass is achieved when two consecutive weighings, at the required timings, do not differ by more than 0.1%.

The test report

The result is expressed, based on initial mass of the test pieces as sampled, as a percentage, rounded to nearest 0.1%

Percent moisture content = \( \frac{(m_1 - m_2)}{m_1} \times 100 \)

where 
- \( m_1 \) = initial mass of test pieces
- \( m_2 \) = dry mass of test pieces

For average value of moisture content in the lot.
1. mean value
2. maximum and minimum values
3. standard deviation
4. number of tests.

In each case for the total selected

For moisture content across the sheet
1. mean value
2. maximum and minimum values
3. standard deviation
4. number of tests
5. sampling positions

In each case for each selection taken according to the sampling procedure.

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Things that will affect precision

1. variations in moisture content throughout the lot
2. number of test values averaged
3. handling of test pieces
4. exposure of test pieces to atmospheric condition

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