



Dry and Wet Rub Testing of Printed Materials

In our daily life, we are surrounded by printed materials. Paper, textiles, plastics, and packaging materials are just a part of the vast and complex world of inks and printing. The ink on the printed materials doesn't always stay where it's supposed to be. For instance, when liquid spills onto a page of notes, the ink on the notes runs due to the water reconstituting some of the dyes in the ink mixture. Then, adhesive and cohesive forces enable the ink to travel around/through/by the already saturated fibers and onto dry fibers, therefore causing feathering, bleeding, and ghosting phenomena. Besides, printed ink can become smeared due to repetitive wear against another object. One quick and yet established way to predict whether or not printed materials will transfer or will last as designed is with rub testing.

Rub testing measures the amount of ink transferred from one printed sheet onto a blank receptor sheet of paper. ASTM Standard D5264, a testing standard for rub testing, provides detailed recommendation and guidance on how the rub testing normally should be conducted. In summary, a rub tester consists of a receptor that is attached to a moveable two- or four-pound weight and a printed material sample that is secured beneath it. During a rub test, the receptor is moved many times rubbing against the printed material to simulate wear and abrasion that occurs during actual usage. The applied weight, number of cycles, and rubbing speed can be varied to simulate different applications. After the test, the receptor sheet is examined for transferred ink, while the tested sample is examined for print degradation. Ink transfer can be accelerated in the presence of a liquid. Exposing printed materials to a liquid often makes the ink run, bleed, feather, or to be completely removed. Wet rub testing is thus selected to characterize the printed material's resistance to transfer ink with presence of a liquid.

In this application note, the rub resistance, or dry ink transfer, of a paper calendar was tested at 106 cycles/minute with a 2-pound weight. Figure 1 shows the results of the tests. As can be seen from Figure 1, no ink transfer was observed after 500 cycles of rubbing. After 1000 cycles of rubbing, minor transfer was seen at the edges of the receptor sheet.

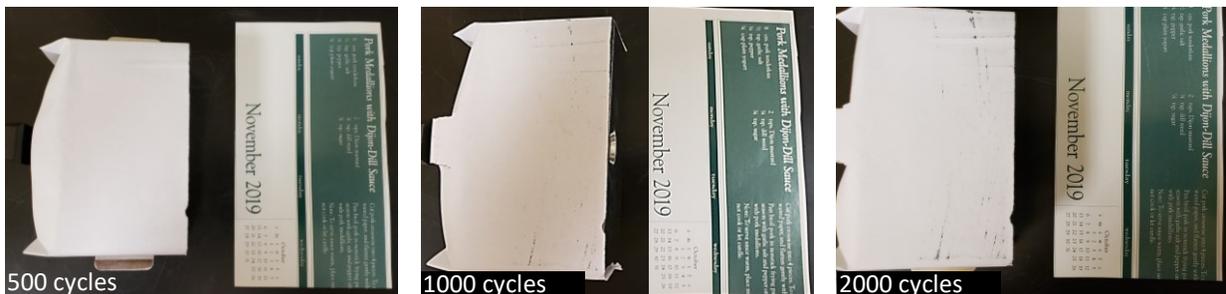


Figure 1. Images of rub test receptors (left side of each image) and test calendar samples (right side of each image) after 500 cycles, 1000 cycles, and 2000 cycles of rubbing.



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After 2000 cycles of rubbing, significant ink transfer was observed from the edge into the middle of the receptor. Faint streaks of ink removal in the upper center portion of the calendar sample have also been observed after 2000 cycles of rubbing.

The following presents testing results on three samples of the same printed material that underwent three different rub tests: dry rub, wet rub with oil, and wet rub with ethanol. In the dry rub test, the receptor and sample were tested dry. In the wet rub tests, three drops of oil or three drops of ethanol were deposited onto the receptor prior to the rubbing.



Figure 2. Images of rub test receptors (left side of each image) and test samples with orange-colored prints (right side of each image) after 800 cycles of rubbing under dry, wet with oil, wet with alcohol conditions.

As can be seen from Figure 2, after 800 cycles of dry rubbing, only a small streak of orange ink at the bottom edge of the receptor is found. After 800 cycles of wet rubbing with oil though, large streaks of orange ink were observed on the receptor. After 800 cycles of wet rubbing with alcohol, significant transfer of orange ink onto the receptor was detected. Further, both of the receptor and print sample have shown obvious degradations and damages after wet rub test with ethanol. Clearly, prints that are resistant to dry transfer may still be susceptible to wet transfer.

In this modern world of commerce, how well a product can weather the everyday comings and goings is important. Rub testing under dry and wet rub conditions can be useful in assisting designers and product quality engineers to determine whether or not your printed materials are great for the intended applications such as in printed papers, textiles, advertisements, packaging materials, etc.