

Moisture Meters: Getting Accurate Results

Without question, moisture is one variable that has a profound influence on corrugated board quality. Yet, most operators will tell you they can manage combined board quality if they know the moisture of the liners and medium they are using. So it comes as no surprise that most converting plants outfit their corrugator crews with portable moisture meters. Moisture meters can be extremely helpful, but their results must be interpreted correctly to be of maximum benefit. In this edition of *Paperwise*, we will discuss the proper use of moisture meters.

How Portable Moisture Meters Work

To understand the results from portable moisture meters, we must first understand how they work. There are several moisture-measuring devices available to paper producers and paper converters. They may differ in appearance and construction, but the principle of operation is the same - electrical capacitance.

A moisture meter generates an electric field much like radio waves from an antenna (this is why the electric measuring field is referred to as “radio frequency or RF signal”). In the presence of dry paper, the electrical field weakens by a measurable amount. In the presence of water, the field weakens dramatically. How much the electric field weakens depends on a property of the material called the dielectric constant. The higher the dielectric constant, the more the electric field weakens. Water has a dielectric constant **20 to 40 times greater** than dry paper. So it is no wonder why these moisture meters are sensitive to the moisture content of paper. It is the measured loss in the electric field strength that tells the moisture meter whether there are small or large amounts of moisture present in the paper.

Steps to Accurate Results

1. Calibrate the instrument to the paper. Moisture meter manufacturers test hundreds of rolls to translate the

electric field strength losses into moisture readings. Even with this effort, the meter readings only approximate moisture to a range. To accurately measure the moisture content of paper, the meter must be calibrated to the paper you are using. Because a paper’s density will affect the electric field loss, the calibration factor is generally referred to as a “density factor.”

A denser paper will appear to be wetter than a bulky sheet. Here is why:

Figure 1

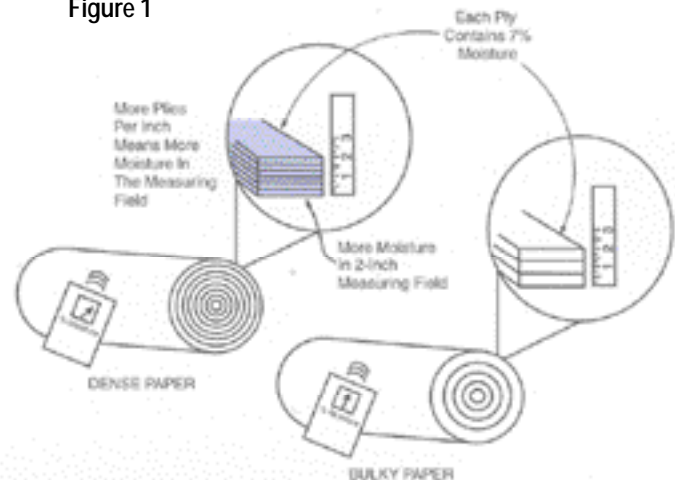


Figure 1. Effects of paper density on measured moisture.

The fact that the paper is more dense, will elevate the readings by itself; however, it is accepted that the instrument “sees or senses” more moisture in the “viewing area” (see Figure 1). Most moisture meters “view” an area approximately six inches by six inches across and two inches deep into a roll. As Figure 1 illustrates, even with papers having equal moisture contents, denser paper fills a larger amount (mass) of moisture in the same two-inch depth.

The larger quantity or mass, not percentage, of moisture in the viewing area lowers the field loss noticeably. Therefore the meter “sees” the paper as being wet when, in reality, it has acceptable moisture.

Moisture meter suppliers include a calibration procedure with the instrument to allow you to derive more accurate density factors for the paper grades your plant uses. Some factors will be very close depending on the liners and mediums you use, but if you choose not to calibrate - beware! Though the meter will correctly characterize the roll's moisture profile, the actual moisture can be in error by several percentages.

Liners with the same basis weight from different suppliers will probably require you to use separate density factors. This is mainly due to the actual density of the liner, but it can be affected by manufacturing processes and furnish types (i.e. recycled versus virgin fibers, bleached versus unbleached). Also, be sure the density factor you use is appropriate for the basis weight and paper grade you are testing. Typically, the density factor changes as basis weight changes.

It is also important to realize that apparent moisture streaks in rolls may actually be due to density or caliper variation. This may cause the corrugator operator to take an action that may give the opposite result. For instance, a low caliper spot on the roll would appear as a wet streak because the paper is more dense in that location. This may lead the operator to believe the roll truly has a wet streak. In turn, the operator may try to "dry out" the position, which may create a warp condition. It can be quickly determined if the streak is moisture or caliper-related by collecting a roll strip and measuring the caliper relative to the area around the streak.

2. Inspect your equipment. Make sure the surfaces of the meter contacting the rolls are level and are indeed contacting the roll. If the contact surfaces are not level and in good contact with the paper surface, the meter will read the air gap between the paper. Air has a low dielectric constant like dry paper, therefore the paper will appear drier.

Newer models of moisture have a low battery power indicator. If your meter does not have a low battery power indicator, check your batteries or routinely change them at the manufacturer's recommended frequency. Weak batteries will yield a weaker electric field, which yields questionable or erroneous measurements.

If you have any equipment malfunctions, do not hesitate to consult the manufacturer. The effort you invest may spare you headaches later.

3. Check the zero before use. The manufacturer advises on the zeroing frequency. Checking the zero helps ensure reliable moisture measurement. Remember, zero the instrument in the environment where the measurements will take place (i.e. the production floor). Hold the device in the air, away from any other materials, so that only air is in the instrument's field.

4. Roll temperature can be a factor. Hot rolls will read wetter than cold rolls. Traditionally, converters use rolls when they have cooled. But, rolls stored outside in very cold climates may reach temperatures close to the freezing mark. To eliminate temperature's influence on readings, we recommend making calibration readings on rolls at a temperature typically used at the time of conversion.

5. Ready to measure. Now you are ready to begin measuring roll moisture. One last pointer: Remember not to venture too close to the roll edge while scanning the roll.

If you would like more information on moisture meters or other technical topics, contact your Smurfit-Stone Sales Manager or call us toll free at 877-785-7835 or e-mail us at paperwise@smurfit.com.