

MOISTURE METERS FOR USE ON THIN LUMBER AND VENEERS

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We at Moisture Register Company are honored to participate in this symposium. As we are located in southern California, we deem it a privilege to present our case to a meeting of West Coast Dry Kiln Clubs. While the particular subject assigned pertains to the use of moisture meters on thin lumber and veneers, the radio frequency type of moisture meters have also been expanded to such products as pulp and paper products, textiles, woodwaste, particle boards and many powdered and granular materials.

In order to better understand how the radio frequency meters operate, a brief explanation covering the principle of high frequency power absorption or power loss should be made. In semi-technical language, the radio frequency meter is a device which gives the measurement of the radio frequency dielectric properties of a condenser directly on a meter scale. The plates of the condenser are the electrode plates and the dielectric of the condenser is the sample material pressed against the electrode. This sample under test is penetrated by an electrostatic field which is radiated by the electrode. The dielectric loss of the sample is reflected through coupling coils into the circuit of a self-excited oscillator. This changes the conditions of oscillation so as to cause a shift in the grid circuit of the oscillator tube. A sensitive microammeter in the grid circuit is used to correlate these meter readings caused by varying amounts of moisture in the test sample.

In simple lay language, the radio frequency instrument tends to average out the moisture content in the sample directly beneath the electrode down to the penetration depth of the instrument. By varying the size of the electrode coverage, the penetration depth is varied. Thus, the RF instrument does not attempt to indicate the exact moisture content at any particular depth but tends

to give an average of the entire area covered by the electrode down to the penetration depth. By taking several quick spot checks across a board or sheet of veneer, etc., a good average moisture indication of the piece can be obtained. I am told that this ability to detect wet and dry streaks in a given sample is very important.

There has been some misunderstanding to the effect that the radio frequency meter is only a "surface tester." Since the radio frequency type electrode does not actually probe the sample beneath the surface of the sample, it is easy to see how such a misunderstanding can occur. But this is not the truth, I assure you. The reading obtained on the microammeter is affected by the average of the moisture contained in the entire area covered by the electrode down to the penetration depth. As a matter of interest, try taking a reading with a radio frequency instrument on the surface of a telephone book. Then place a wet blotter between the pages of the book down from the surface, the distance of the instrument penetration. Watch the needle increase from the original reading.

Next, what are the general characteristics of the radio frequency type moisture meters?

1. Portability. Can be carried from station to station easily.
2. Rugged construction. Designed for field use as well as laboratory.
3. Fast operation. Can make average tests within few seconds time.
4. Easy and convenient operation. Non-technical personnel can use instruments with confidence.
5. Does not mar sample under test. This is not so important when testing rough lumber but becomes very important when testing surfaced boards, veneer, etc.
6. Calibrated for common species. Calibrations start at 0% moisture content and are carried up to the saturation point. As you probably know, the RF meters are affected by the density of the wood under test. It is for this reason that separate calibration charts are required for each species. This prevents a direct reading scale on the microammeter for all woods. However, our calibration charts are all based upon check points made from many samplings which are compared to careful oven determinations as specified by the Forest Products Laboratory at Madison, Wisconsin. In addition, parallel dielectric curves have been prepared to

check the accuracy of our data. Therefore, in most cases we feel that a reading taken with a radio frequency type meter which is based on an average of many check points is more accurate than a single oven determination. I might say that if an operator is testing one or even two woods more than any other, the instrument can be equipped with a combination dial, including direct moisture percentage scale for those woods.

What instruments of the radio frequency type are available for the various applications in the lumber field today?

A RF type meter with 1" penetration, range 0 to 35%, spring loaded button type electrode, is designed for use on irregular surfaces and curved surfaces of lumber. It can be used on 2" stock by testing both sides of the board and averaging results and also used on particle board and various paper and textile applications. A meter with 2" penetration, range 0 to 25%, with oversized electrode allows greater accuracy in the low moisture ranges and deeper penetration, and can be used on 4" stock by testing both sides and averaging results. A RF type moisture meter with 1" penetration has been designed for use on dressed lumber, stacks of veneer and plywood.

A RF type meter with 1/8" penetration is adequate for thin lumber and veneer. Here the electrode is smooth surfaced, consisting of brass concentric rings cast into a plastic nosepiece. The penetration is governed by the spacing of the rings. An instrument ranging from 0 to 25% can be supplied in three more sensitive oscillators, cutting the range down to 0-18%, 0-12%, and 0-10% respectively. As long as the sample tested is 1/8", only one calibration curve per species is required. When testing beneath 1/8", a separate calibration curve may be required at various thickness levels, such as 1/10", 1/16", 1/24", 1/32", 1/64", etc. A plastic plate is furnished with the instrument. As long as the sample is placed on the plastic plate, the beam will not protrude through the sample and pick up the moisture in the backing material.

A radio frequency type of moisture meter is now being widely used in the manufacture of veneer. Tests are made on single sheets of veneer before passing into the driers as well as after the drying operation. The instrument is also used on thin stacks of veneer in storage before shipping.

In the manufacture of plywood, the radio frequency meter is used in two ways. After the glue has been applied and allowed to set, the instrument is used on the finished panel. As long as the sheets making up the panel are of the same species, the regular calibration charts can be used. We generally allow one dial division correction to take care of the glue line. If the sheets of the panel are of different species, the meter is used strictly as a comparator by comparing the instrument readings from one batch to another of the same type. In so doing, minimum and maximum points on the dial can be established representing the lowest and highest moisture content which can be tolerated.

The meter is also being used to help determine when the glue in the panel is dry enough for satisfactory use. For example, readings are taken on the veneer sheets before gluing. Readings are also taken on the panel after gluing. Naturally, the readings are then much higher due to the moisture content of the glue. As the glue dries, the readings will gradually decrease until they approach the original readings obtained on the veneer sheets before gluing. When these original readings are reached, the operator knows that the glue is dry enough.

As mentioned before, the radio frequency type moisture meter is also being actively used in the veneer and plywood industry. Here, the instrument must be used on stacks of veneer. It will not give the moisture content of the individual sheet due to the increased penetration depth. However, it will give a good average indication of the moisture content of the stack. In addition, the instrument can be used on plywood panels over 1/8" thick, as well as on dressed lumber. Therefore, it is more versatile and can be used in more spots, provided samples approximately 1/2" can be tested.

For use on wood waste materials a portable instrument has been designed for use on fibers as well as sawdust, wood flour, and small shavings. This meter has a maximum penetration of 3 inches and can be supplied in various oscillator

sensitivities for testing various materials in different moisture ranges. By means of a micro-switch arrangement in the instrument gun, we can control the amount of pressure on any given sample. When the correct amount of pressure is applied (18 lbs.) a red light flashes on the black instrument case.

When more than 18 pounds are required to obtain a uniform sample, we suggest a granular model which is designed for use on powdered and granular materials, which is now being used satisfactorily for these as well as for larger shavings, wood chips, ground wood pulp, various fibrous materials, etc. This same instrument is also being widely used on such materials as chemicals, food materials, feeds, fertilizers, resins and many others.

In closing, I would emphasize that no electric moisture tester can take the place of carefully conducted oven tests or other laboratory determinations. However, we would seriously emphasize the need of good ovens and laboratory gear to work with. A poor oven will cost more money than it will save. Please bear in mind that your moisture meter, no matter what type, is a production tool and should be used as such. Treat it as you would a valued tool, and it will give you good service for a long time.