

MOISTURE METERS AND THEIR EFFECTIVE USE

NEKDA/DANBURY CT.
KILN DRYING WORKSHOP
APRIL 19-20, 2012

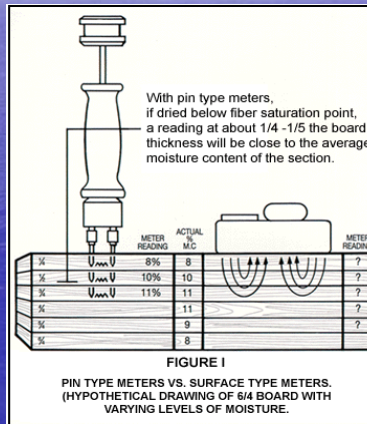


©Delmhorst Instrument Co.
2012

TOOLS TO MEASURE MOISTURE CONTENT

- PIN METERS
DC RESISTANCE
- PIN-LESS METERS
DIELECTRIC/ RF
- OVEN TEST
PRIMARY METHOD

PIN vs. PINLESS



WHY USE A MOISTURE METER?

- Results are immediate
- Less labor
- Larger sample
- Wet spots
- Easy to use

ABOUT THE PIN METER

Principle of operation

Electrical Resistance  MC

Range

30% to 6% - highly reliable

30% and higher – “free moisture” – use as qualitative readings only!

ABOUT THE METER

Accuracy

Electrical / Primary

+/- 0.2

Secondary

+/- 0.5.....6-12%

+/- 1.0....12-20%

+/-2.0....20-30%

ABOUT THE METER

Original Calibration

- Laboratory conditions
- Temperature and RH controlled
- Very thin, uniform samples
- 5/16th penetration – non-insulated pins

WHAT FACTORS AFFECT METER READINGS?

- Moisture Content!
- Moisture Gradient/Thickness
 - shell/core readings, insulated pins
 - 1/5 rule
- Temperature
 - as the wood temp rises, indicated MC also rises and vice versa

MORE FACTORS AFFECT METER READINGS?

- Species
 - different electrical characteristics
 - SPF "group"
- Electrode
 - 2 or 4 pins/ insulated or not
- Grain Direction
 - pins parallel to the grain

ADDITIONAL FACTORS THAT AFFECT METER READINGS?

- Basic Care
 - Calibration, batteries, pins
- You – The User
 - Input the proper settings
 - Watch for surface moisture
 - Drive pins to the proper depth

USE THE METER FOR DATA ACQUISITION

- Statistical Functions
 - Obtain data on entire population
 - Average, Std dev., Confidence int.
- Management Tools
 - Use with basic elements of the wood-moisture relationship in mind

STD DEV – describes variability

- Kiln 1 –
30 samples –11.5%-20%
Average – 15% SD= 3.08%
- Kiln 2 –
30 samples –14%-16%
Average 15% SD= 0.71%
- By definition.....68% will be within 1 std dev of the mean; 95% will be within 2 std dev.

STATISTICAL SUMMARIES

RDM3 US Job #1 Douglas Fir	
Number of Readings	51
First	7/22/05 8:04AM
Last	7/22/05 8:10AM
Minimum Value	7.1%
Maximum Value	20.0%
Average	11.4%
Standard Deviation	3.4
Coefficient of Variation	0.301
Confidence Interval	8.6%
Notes:	

RDM3 US Job #2 Douglas Fir	
Number of Readings	52
First	7/22/05 8:08AM
Last	7/22/05 8:09AM
Minimum Value	7.2%
Maximum Value	21.0%
Average	14.3%
Standard Deviation	4.0
Coefficient of Variation	0.282
Confidence Interval	7.1%
Notes:	

HOW MANY MEASUREMENTS?

- Number of Readings = $\left[\frac{(2 \times \text{Standard Deviation})}{\text{Degree of Accuracy Required}} \right]^2$

$$152 \text{ readings} = [2 \times .0308 / .005]^2$$

- Law of Large Numbers – minimum 30 samples
- Wood is not homogenous
- Non-uniform kiln conditions
- Variations within species and within a board

OTHER ISSUES.....

- Static Electricity – low RH and high resistance
- Using the meter inside the kiln – caution!
- Frozen Lumber
- Treated Lumber - OK < 15%
- Meters do not always agree – standards, correction factors, pins' penetration

RESISTANCE MOISTURE METERS RECAP

- Proven, indispensable tools
- Fast and accurate
- Follow manufacturer's procedures
- Know the meter's capabilities
- Apply your knowledge and experience

26-ES Electrode



Insulated pins, 1-1/8" penetration

J-2000 Moisture Meter

5/16" penetration,
non-insulated pins



Total readings, average,
highest

Species - Temperature
corrections

RDM3 DATA ACQUISITION METER

Use with integral or
external electrodes

Data storage,
statistics

Generate reports

