



# GREENFIBER FRM<sup>®</sup> STABILIZED SPRAY-APPLIED INSULATION SANCTUARY TWO-HOUR FIREWALL, UL-U370 ASSEMBLY



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# FRM® STABILIZED SPRAY-APPLIED INSULATION

## Scope

The purpose of these instructions is to provide application requirements for the proper installation and testing of FRM® Stabilized Spray-Applied Insulation in fire-resistance rated assemblies, such as UL-U370. These are minimum requirements and in no way supersede local building code requirements.

## Requirements

1. The installing contractor has read and understood these FRM® Stabilized Spray-Applied Insulation installation instructions, and is proficient with the operation of the Wall Spray equipment, including post-application testing and documentation.
2. The installing contractor uses only FRM® Stabilized Spray-Applied Insulation, bearing the UL classification mark, for all UL fire-resistance rated assemblies (UL-U370, for example).
3. For breathing protection, use a NIOSH approved N95 or higher disposable or reusable particulate respirator (reference ASTM C 1015-06).
4. Greenfiber's Material Data Safety Sheet (MSDS) requires the use of safety eyewear when installing this product. The insulation contractor is responsible for managing housekeeping and engineering controls below nuisance dust levels. Follow all OSHA guidelines for safety requirements including 29 CFR 1926.501 Duty to Have Fall Protection. Various other local, state and federal rules and guidelines may apply.

## EQUIPMENT AND APPLICATION

The equipment and application methods used by the installing contractor will affect the installed density and moisture content. Careful spray technique and skill of the nozzle applicator are important. Dry Dense-Packed FRM® Stabilized Spray-Applied Insulation has not been tested in any fire-resistance rated assembly.

### Equipment Requirements

1. A two hopper system consisting of both a dry and recycle machine is required to effectively manage installed moisture and density. Contact your Greenfiber® Representative for equipment questions.
2. Core Sampling Kit as described in Appendix I.
3. Density Control Log, such as the Greenfiber® UL Fire Wall Field Test Log (PM-6.3-121)
4. Greenfiber® Wall Spray Manual (WI-6.19-18)
5. Wall Spray equipment required in the Wall Spray Manual (WI-6.19-18)

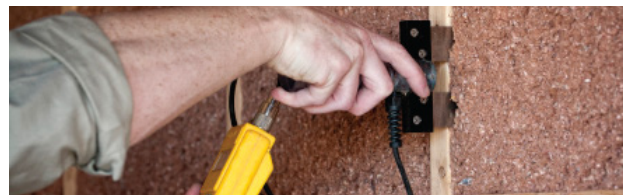
### Application Overview

FRM® Stabilized Spray-Applied Insulation is applied with basic Wall Spray techniques but with the knowledge that

the density characteristics will be different than that of typical thermal insulation applications. These instructions highlight the important details to keep in mind when installing FRM® Stabilized Spray-Applied Insulation. Greenfiber® cannot anticipate all of the individual and specific assembly details that the installing contractor will come across. These instructions can in no way be considered all inclusive to every assembly detail. If there is any doubt about installing FRM® Stabilized Spray-Applied Insulation in a particular assembly detail, consult the architect or engineer of record for advice on how to proceed.

### Application Requirements

1. Mesh netting or gypsum drywall must be attached to the outer face of one row of studs to provide a support for the sprayed fiber installation. Care should be taken to apply either the mesh netting or gypsum drywall to the opposing units in such a way that application can be achieved from the center unit, thereby increasing speed of application.
2. Begin installation at the bottom plate, spraying at a downward angle of approx 30-degrees, compressing the material and increasing the installed density.
3. Continue with the downward angle until the depth is 8-10 inches from the bottom plate. The position is approximately one foot closer to the wall relative to a normal Wall Spray application which helps to increase the installed density.
4. Angle the nozzle to the back of the cavity, moving the nozzle side to side as you fill the cavity in an upward motion. Care must be taken to fill the entire cavity, including behind the studs.
5. All fossil fuel heaters emit extreme amounts of moisture, causing increased relative humidity and drying time. Open windows and provide air circulation to remove evaporated moisture to the outside.



6. The installing contractor is responsible for performing density and moisture content field tests. The installing contractor must provide to the builder a copy of the field test results on the UL Fire Wall Field Test Log, or equivalent, for each unit installed.

### Moisture Testing (See Appendix I for details)

1. FRM® Stabilized Spray-Applied Insulation must be installed between 25% and 35% moisture content. Testing during installation is required to determine that this range is being maintained.
2. To predict dry density, the installing contractor must test the moisture content next to the area where the core samples are to be taken.

3. The primary control factor for FRM® Stabilized Spray-Applied Insulation for vertical wall assemblies is the material moisture content at the time of drywall installation. Do not cover the insulation until the insulation moisture levels, measured and documented after a minimum period of 24 hours from the time of installation, reach a reading of 25% or less. Several factors affect the drying rate for FRM® Stabilized Spray-Applied Insulation. Additional drying time may vary due to these conditions:

- Climate conditions: – The outside temperature is below freezing. – The humidity is above 80%.
- Depth of cavity is greater than standard (3.5 and 5.5 inches).
- Permeability of adjacent building products.

**WARNING:** Do not use kerosene or other fossil fuel heaters to try to accelerate the drying of FRM® Stabilized Spray-Applied Insulation. All fossil fuel heaters emit extreme amounts of moisture causing increased relative humidity and drying time; electric heaters, however, may be used open windows and provide air circulation in order to move moisture to the outside.

4. The only approved moisture meter for use in fire-resistance rated assemblies is the Delmhorst P-2000 with 19-E probe. **See Appendix III for proper calibration and use of this equipment.**



5. Moisture samples must be taken in the middle half of the cavity, keeping in mind that one must select an area where a full 8 inch sample depth can be taken.



**Table 1:**

U370 Minimum/Target Dry Density For Two-Hour and Three-Hour Fire-Rated Walls

ASSEMBLY	DRY DENSITY 2 HOUR	DRY DENSITY 3 HOUR
UL U370 FIRE RATING (MINIMUM DENSITY)	3.35 LBS/FT <sup>3</sup>	3.89 LBS/FT
(TARGET DENSITY)	4.0 LBS/FT <sup>3</sup>	4.5 LBS/FT

## Repairs

### Procedure For Repairing Low Density Areas

1. If test results show that the installed minimum dry density required in Table 1 has not been met, a repair must be made immediately. If an immediate repair is not possible, record the unit number, floor number and location of areas requiring repair in the notes section on the UL Fire Wall Field Test Log.
2. If the results of the core tests show the cavity will dry below the required minimum dry density, core sample tests must be taken in each cavity adjoining the failed cavity. The process should continue outward from the original failed cavity until the samples meet or exceed the minimum required dry density and the extent of the defect is known. Any additional cavities that do not meet the minimum dry density requirement must be repaired immediately. After repair, retest the cavities to make sure the repair meets the requirement. Replace the core sample material in the original hole and, if necessary, refinish these areas to create a consistent surface.

### Minor Repairs

1. If only a small amount of material is pulled or knocked from the wall before the gypsum drywall has been installed, cut a small portion of netting and face staple it to the studs over the spot where FRM® Stabilized Spray-Applied Insulation needs repair. Replace FRM® Stabilized Spray-Applied Insulation behind the net for a clean repair.
2. The installing contractor should be recalled for an on-site repair if a large portion of FRM® Stabilized Spray-Applied Insulation has been pulled from the cavity. Netting can be installed on both sides for added protection assurance.

**Appendix I:** Checking for Target / Dry Density:

**Appendix II:** Cavity Matrices (8", 9", 10", 11" & 12")

**Appendix III:** Delmhorst P-2000 Manual

### Reference InFormation

- **Greenfiber's UL Fire-Resistance Rated Assemblies.**  
GO TO: <https://iq.ulprospector.com/en/>  
TYPE IN U370 in the UL File Number box to see the assembly.
- **UL Fire Wall Field Test Log (PM-6.3-121)**  
Download at: <https://www.greenfiber.com/products/frm-100>

For additional information, please contact your Greenfiber® Representative, or call Greenfiber® at 800-228-0024.

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## 1.0 Checking For Target / Dry Density

The Core Sampling Kit includes a weight scale, coring tools, core plunger, sample holder, Delmhorst P-2000 with 19-E probe, and weight/density conversion matrices (Appendix II). The matrices in Appendix II were developed to predict the target dry density using the reading of the Delmhorst meter and the wet core weight of the sample at various sample/wall depths. The installing contractor is responsible for supplying a 14 to 18 volt battery operated drill with a fast/slow selector.

### 1.1 Checking For Moisture Content

The meter and probe can be used to determine the moisture in the wall. The meter is calibrated to ASTM D644 using the original weight method for calculating the moisture content. The meter reads the highest point of electrical conductance between the material and the electrode. This meter and electrode has been tested with Greenfiber® INS735 and FRM® Stabilized Spray-Applied Insulation products; its accuracy among other materials has not been tested using this method. Thus the meter is going to determine the highest moisture content of the sample that is in contact with the electrode, not the average of the sample in contact with the probe.

1. Follow Delmhorst's Guide for Calibration
2. Verify the meter is set to the third scale (\*); if it needs to be changed, hold down the button until (3) is displayed.
3. Insert the external probe into the cavity along the side of the stud until the back edge becomes flush with the stud.

**Note:** Be as careful as possible to keep the blades against the stud as the blades are inserted into the product, to prevent an air gap from forming between the blade and material.

4. Hit the read button (largest button with water drops).

### 1.2 Checking Sample Weight

To use the coring tool, the Operator will use a battery powered drill that is not included. A 14 to 18 volt drill with a fast/slow selector is required. The sample locations are best taken in the middle of the cavity, keeping in mind that one must select an area where a full sample can be taken.

Take a core sample as close to the moisture reading location as possible to produce the most accurate results. Switch the drill speed to the slowest setting. Load the coring tool into the drill. With the coring tool level, continue slowly into the cavity until the tool is in full contact with the drywall or the tool cuts through the netting. It is important that the speed of entry of the coring tool starts slowly and maintains a slow steady speed all the way to the back of the cavity.

Slowly slide the coring tool out of the wall, without the drill turning. Place the sample holder on the weight scale and press the "Zero" button. Disconnect the coring cylinder from its base by twisting the cylinder. Push the material out of the cylinder, with the core plunger, into the holder.

### 1.3 Determining Target Dry Density

Then, use the appropriate weight / density conversion matrix, Appendix II, to determine the dry density with the wet core weight and meter reading collected under section 1.1 and 1.2.

### 1.4 Sample Core Repair

To replace the product that has been taken for samples, pack the core cylinder full with the tested material and excess loose material. Slide the cylinder into the wall until it is fully inserted. Use the plunger and push the material inside the tube while removing the cylinder. Brush off the extra material that protrudes beyond the studs.

**Note:** Use a longer coring device with cavities larger than 9" in depth.

Please contact your Greenfiber® Representative for any questions regarding the use of this kit.

Greenfiber® does not provide architectural, inspection, engineering or building science services and disclaims any responsibility with respect thereto. Greenfiber® does not guarantee, warrant or attempt to determine whether a building structure, design or the use of material therein complies with any applicable Codes, standards, guidelines or standards of workmanship. Adding insulation to any part of a home's envelope will cause changes in air, heat and moisture flow. The user must understand how the use of insulation will change the performance of a dwelling prior to installation. The user maintains the full and complete responsibility to comply with all Codes, laws and regulations applicable to the safe and proper use, handling and installation of the product and should consult with an architect, engineer, building scientist, and/or a rater/energy specialist for all construction, design and performance related questions. The information contained herein is believed to be accurate as of the time of preparation. However, Greenfiber® makes no warranty concerning the accuracy of this information. Greenfiber® will not be liable for claims relating to the use of information contained herein, regardless of whether it is claimed that the information or recommendations are inaccurate, incomplete or incorrect.



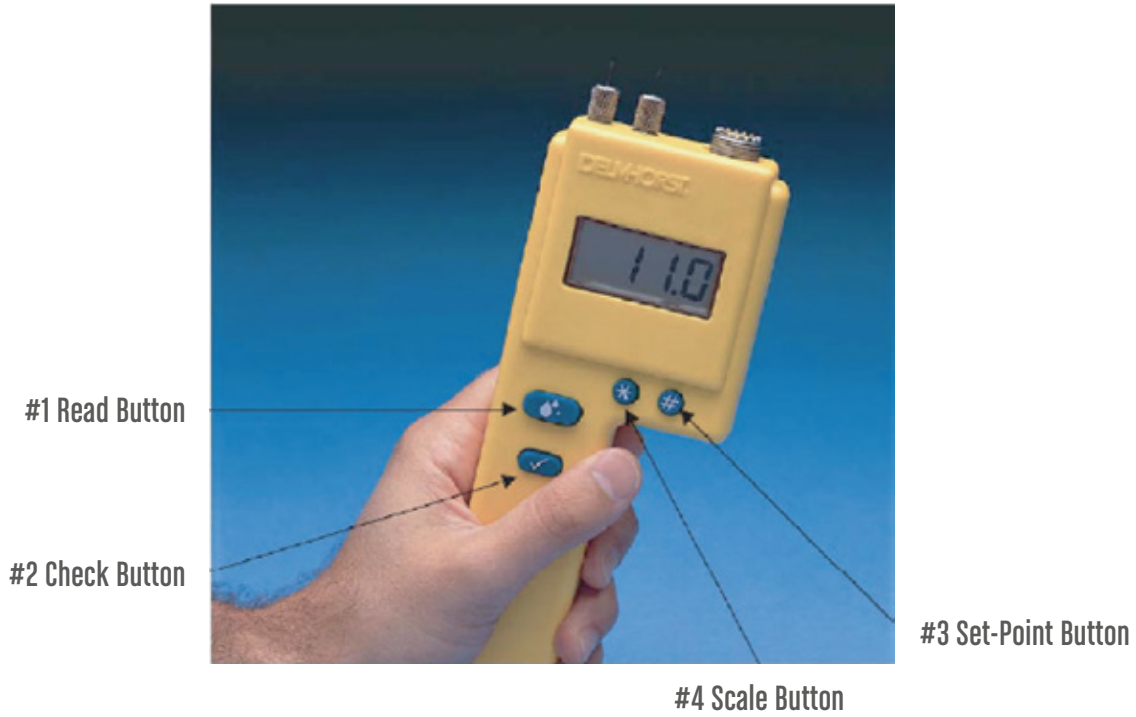












### P-2000 FEATURES

- Designed to check the moisture levels in paper products such as kraft stock, baled scrap paper, and other materials
- Resistance technology recognized around the world as the most accurate method for measuring moisture
- Averages up to 100 accumulated readings
- 4.3%-18% moisture range on paper
- 0-100 reference scale for relative moisture indications in various hygroscopic materials
- 5%-40% moisture range on baled scrap paper
- Digital readout
- Includes (1) 9-volt battery
- Proven microcontroller circuit
- One year warranty
- Over fifty years of proven quality, accuracy, and service

## BUTTON FUNCTIONS

### READ:



(#1)

Reads the % MC value.

### CHECK:



(#2)

Checks the meter calibration. Displays the average of up to 100 accumulated readings, displays the highest stored reading; erases the readings from memory.

### SET-POINT:



(#3)

Displays the current set-point. Also acts as an arrow (scroll) key to increase the set-point value in 1% increments. A buzzer will alert you if the meter reads higher than the selected %MC value.

### SCALE:



(#4)

Displays the meter scale as 41 (paper); #2 (0-100 reference): 43 (baled scrap paper). Also acts as a toggle to change among the three scales and as an arrow key to decrease the set-point value.

**When the battery is replaced, the meter displays its software version for one second and then turns itself off. After replacing the battery, you must reset the meter as described on page 6.**

## CHECK CALIBRATION

Set the meter to Scale #1 (Paper). Press the calibration check button (#2) and the read button (1) simultaneously. The meter is in calibration if it displays 11.1 % +/- 0.2.

When checking calibration, there is no need to disconnect the external electrode, if attached.

If you check the calibration and the display does not read 11.1%, it is likely an indication of a low battery. If this occurs, change the battery immediately.

Continued use with a low battery may cause the meter to go out of calibration. If you have a fresh battery and the instrument still does not indicate an acceptable calibration, return it to DELMHORST for service See "**Service for Your Meter**" section.

## TO SET THE SCALE

Set the scale to #1 for most paper and paper products, #2 for obtaining relative moisture indications on hygroscopic materials for which no established calibration is available, or #3 for baled scrap paper.

- **To change the scale**, press and hold the scale button (#4). The meter will display the current scale for one second then scroll forward through the scales.
- **Release the button** to stop at your desired scale

Changing the scale will automatically reset the set-point value to the default setting for that particular scale. Default settings are as follows:

**Scale #1 - 7%**

**Scale #2 - 50%**

**Scale #3 - 19%**

## TO CHANGE THE SET - POINT

- **To change the set-point value** press the set-point button (#3). The meter will display the current set-point value for the scale you have chosen for one second.
- **To scroll forward** to a higher value for that scale hold the set-point button (#3) while the current set-point is displayed and scroll to the set-point value desired.
- **To scroll backward** through the set-point values, press and release the set point button (#3). Within one second, press and hold the scale button (#4). Continue to hold the scale button (#4) and the set-point will decrease.
- **When scrolling in either direction**, release the button to stop at your desired set-point.
- **A buzzer sounds** if the meter reads a %MC higher than the set-point.

You can change the value between 5.0 and 18.0 for Scale #1, 2-99 for Scale #2 and between 6.0 and 39.0 for Scale #3.

## INFORMATION ABOUT YOUR READINGS

Readings below the nominal range of each scale will be displayed as a negative number. Readings above the nominal range will be displayed with a blinking number. All under-range and over-range readings should be disregarded. They are not added to the accumulated readings or used in calculation of the average or highest reading.

The meter can accumulate up to 100 readings. After all 100 readings are stored, it will not add new readings until the memory has been cleared. It will also continue to display the average of all 100 readings as a reminder that the memory is full.

- To add a reading to the sum of all the previously stored readings, release the read button (#1) within 2 seconds.

When taking and storing readings for a specific material, be sure to clear the meter before moving on to the next scale if you do not want to group all of the readings together.

## TO CHECK THE ACCUMULATED READINGS

This feature displays the total number of all accumulated readings for the given material you have chosen, the average of those readings, and the highest stored reading.

- **To view the readings**, press and release the calibration check button (#2). First, the meter displays the number of accumulated readings for one second, then the average of those readings for two seconds. Then it displays the highest stored reading for two seconds. The total cycle time is five seconds.
- **To keep the accumulated readings in memory** release the calibration check button (#2) before the total cycle time is complete.
- **To erase readings**, hold the calibration check button (#2) for more than five seconds. The total, average, and highest readings will be displayed as above, followed by a zero to indicate all readings have been erased.

## TO RESET METER

- **Press and release** the calibration check button (#2).
- **Within one second** press and hold the scale button (#4). The meter will display a reset sequence as follows 441", 17", 1.0", 11.1". The last number, "11.1" is a calibration check.
- **Resetting the meter** clears the memory and restores default settings.

## APPLICATIONS

### TESTING PAPER, PAPER CORES, AND CORRUGATED PRODUCTS

- **Set the meter scale** for #1 paper. Check that the contact pins are firmly hand tightened.
- **Push the contact pins** into the paper product to their full penetration if possible.
- **Press the read button (#1)**. The meter displays the %MC for two seconds.

Since the readings are the result of an "average" calibration, if a high degree of accuracy is required, the meter should be checked on the specific material and corrections determined by the user.

Meter readings indicate moisture content at room temperature of 70° F -90° F. Meter readings will be affected by lower or higher temperatures. Lower temperatures cause readings to be lower; higher temperatures cause readings to be higher than the actual MC.

The meter tends to read the highest moisture content that is in contact with both pins. If thick samples are not well equalized, it may be necessary to make tests at different depths to determine the degree of uniformity of moisture distribution in the sample.

If the meter is used on stock so thin that the full length of the pins is not entirely embedded in the thickness of the sample, the readings tend to indicate a lower than actual MC. This can be overcome by testing more than one sample in stacks.

### USING THE 0-100 ARBITRARY SCALE

This scale is used to test the moisture content of hygroscopic materials for which a calibration is not available. Depending on the material, a special application external electrode, instead of the integral contact pins may be required. Increasing readings on the 0-100 reference scale indicate higher levels of moisture content. These readings can be translated into percent moisture content once a calibration has been developed

- **Set the meter scale** for #2. If necessary, attach an external electrode to the meter.
- **Push the contact pins** into the material or apply the external electrode.
- **Press the read button (#1)**. The meter displays a relative value for two seconds.

The readings may also be used for comparative tests, after meter readings have been related to given conditions for the materials involved. When the meter is used as a gauge for comparative tests, readings should be taken on samples

considered to be at “safe” levels or in satisfactory condition. These readings are then used as the “standard” against which subsequent readings on the same material are evaluated.

The “standard” for any given material is related to safe storability or any other property which is important for further production processing.

### TESTING BALED SCRAP PAPER

- **Set the meter scale** for #3 baled scrap paper. Attach an external electrode to the meter.
- **Push the external electrode into** the material being tested.
- **Press the read button (#1).** The meter displays the %MC for two seconds.

The level of accuracy of meter readings depends on a number of factors: similarity between the material tested and samples on which the calibration was made; moisture distribution, and chemical application or processing which may affect the electrical properties of the paper product.

The required electrode is the H-3 with a #830-series prod. (10" or 18"). A sharp, steel rod to open the hole for the prod may be helpful if the bale is very dense.

A few meter readings in a limited number of specific areas of a large mass can hardly be projected to indicate an average moisture content of an entire bale. The readings can be very helpful in providing an indication of the overall moisture condition inside the bale and to detect areas of excessive moisture.

Meter readings may be used as an arbitrary guideline in determining whether or not to accept or reject the material. Since checking the moisture condition of bales is performed when buying and selling, the specific value of the meter readings remains an element to be agreed upon between buyer and seller. Such an agreement should consider not only a specific “range” of readings, but the number and location of where they are taken.

The following ranges can be used as a guideline and may help to interpret the readings:

- Readings of 5%-10%, with EMC to 60% RH are usually considered “dry”.
- Readings from 11%-20% with EMC to 95% are usually considered “acceptable” but should be taken with some reservation.
- Readings of 20%-40% are considered “wet” and unacceptable.

### CARE OF YOUR METER

To keep your meter in good working order:

- Store your meter in a clean, dry place. The protective

carrying case provided is an ideal storage place when the meter is not in use.

- Change the 9 - Volt battery as needed. Continued use with a low battery may cause the meter to go out of calibration.
- Change contact pins as needed. Keep pin retainers hand tightened.
- Clean the meter, contact pins, and probes with any biodegradable cleaner. Use the cleaner sparingly and on external parts only. Keep the cleaner out of the external connector. **DO NOT IMMERSER THE METER OR ANY ELECTRODE IN WATER.**
- Remove the battery if the meter will not be used for one month or longer.

### SERVICE FOR YOUR METER

- Pack your meter securely. Enclose a purchase order or letter with a brief description of the problem.
- There is no need to call us for a return authorization number if you are within the U.S. Customers outside the U.S. must contact us for more specific instructions prior to returning a meter.
- Include your name, address, daytime phone, and fax numbers or email address. If you believe the meter is under warranty, please provide the original sales slip or invoice.
- Ship via UPS, Express Mail, Priority Mail, or any overnight courier who provides prompt service. Do not use standard parcel post.
- Insure your instrument for its full value and ship prepaid. We are not responsible for damage in transit.
- We do not accept COD shipments or cover any incoming freight or duty charges on returned merchandise.
- Turnaround time on repairs is approximately two weeks.
- We will call you with an estimate if you specifically request one, or if we determine that the meter may be too costly to repair.
- Non -warranty repairs will be returned via UPS/COD unless you have already established other payment terms. There is no COD service outside the U.S. To pay by credit card, include the card number and expiration date with your repair. We accept Visa/MasterCard, American Express, and Discover.
- Warranty repairs will be returned at no charge if shipped within the U.S. via UPS Ground Service. Freight charges for expedited services (i.e., Federal Express, UPS/2 Day, UPS/1 Day, etc.) are the customer's responsibility and will be charged as per the above terms.

## WARRANTY

Delmhorst Instrument Co., referred to hereafter as Delmhorst, guarantees its P-2000 meter for one year from the date of purchase and any optional electrodes against defects in material or workmanship for 90 days. If, within the warranty period of the P-2000, you find any defect in material or workmanship, return the meter following the instructions in the “**Service for Your Meter**” section. This limited warranty does not cover abuse, alteration, misuse, damage during shipment, improper service, unauthorized or unreasonable use of the meter or electrodes. This warranty does not cover batteries, pin assemblies, or pins. If the meter or any optional electrodes have been tampered with, the warranty shall be void. At our option, we may replace or repair the meter.

Delmhorst shall not be liable for incidental or consequential damages for the breach of any express or implied warranty with respect to this product or its calibration. With proper care and maintenance the meter should stay in calibration; follow the instructions in the “**Care of Your Meter**” section.

Under no circumstances shall Delmhorst be liable for any incidental, indirect, special, or consequential damages of any type whatsoever, including, but not limited to, lost profits or downtime arising out of or related in any respect to its meters or electrodes and no other warranty, written, oral or implied applies. Delmhorst shall in no event be liable for any breach of warranty or defect in this product that exceeds the amount of purchase of this product.

The express warranty set forth above constitutes the entire warranty with respect to Delmhorst meters and electrodes and no other warranty, written, oral, or implied applies. This warranty is personal to the customer purchasing the product and is not transferable.

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For over 50 years, Delmhorst has been the leading manufacturer of high-quality resistance moisture meters. Today we offer a complete line of portable moisture meters for a variety of different applications including woodworking/lumber, agriculture, construction, and paper.

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Rev. 08-21

Appendix III is a direct copy of the Delmhorst P -2000 Moisture Meter.