

**PRODUCT
INSTALLATION GUIDE**



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Attic Floor Installation Instructions for Contractors



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Attic Installation Instructions for Contractors

The following are the manufacturer's recommendations for installation of GreenFiber Insulation in attic floors. The instructions and procedures for operating all equipment must be obtained from the equipment manufacturer and must be complied with at all times. Blowing machines must be properly maintained and serviced per the manufacturer's instructions. GreenFiber recommends the use of Spray Insulation Components (800.210.1311) for installation equipment.

Installation Requirements

1. The insulation contractor has read and familiarized themselves with this document.
2. The contractor crew has been trained in the proper, safe use and operation of the attic application equipment.
3. For breathing protection, use a NIOSH approved N95 or higher disposable or reusable particulate respirator per 29 CFR 1910.134. GreenFiber's Material Safety Data Sheet (MSDS) requires the use of safety eye wear 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.
4. The insulation contractor has a quality assurance process that guarantees in-field compliance with the installation instructions as set forth by the manufacturer and any local or national Code requirements.
5. The contractor uses only GreenFiber Stabilized or Loose-Fill Insulation for attic applications.

Precautions

Unplug equipment and comply with all applicable Lock out/ Tag out procedures before performing any maintenance or point-of-operation troubleshooting. Be sure to follow the blowing machine manufacturer's instructions for all servicing, maintenance or repairs.

Keep insulation at least 3 inches away from non IC (Insulation Contact) rated light fixtures. Only IC rated recessed lights can be covered with insulation.

Keep insulation away from exhaust flues of furnaces, water heaters, space heaters, chimney flues or other heat generating devices. ASTM C 1015-06 recommends that a minimum of three inches of air space should be maintained

between the insulation and heat source. Follow manufacturer's recommended installation instructions for the use of insulation with the above mentioned devices. If using GreenFiber Stabilized Insulation, spray tips and other installation equipment must be maintained in order to achieve coverage.

Application

1. Use current GreenFiber coverage charts to ensure the required R-value is installed.
2. The applicator must install both the minimum number of bags per 1,000 sq. ft. and the minimum installed thickness to ensure the stated R-value has been reached. Both of these requirements must be met to achieve the specified R-value.
3. Code requires attic rulers to be installed every 300 sq. ft.
4. Follow all Code and other legal requirements when adjusting for insulation thickness limitations due to construction details. Ensure that attic preparation / air sealing has been completed prior to insulation installation per IRC 2012 Sections N1102.4.1 through N1102.4.4.



5. A retaining barrier should be installed around the access to ensure the proper R-value is installed to the edge of the access.

6. Ventilation is required by Code in unconditioned attics for moisture control. Vent chutes or baffles must be in place before installing insulation.
7. Blocking material needs to be installed at eaves in order to maximize R-value over the top plate of the exterior walls. This prevents insulation spillage into the eave overhangs.
8. Begin installation at the corner farthest from the attic access and work back. Avoid walking or crawling through areas that have already been insulated.
9. The installer should hold the hose horizontally to optimize coverage. Improper hose angle may result in reduction of coverage. Wherever possible, spray directly in line with ceiling joists rather than across them to maximize coverage.
10. Completed attic cards must be in sight of the attic access per Code requirements.



Moisture Control and Verification for Stabilized Applications

1. GreenFiber requires maintaining an applied moisture reading between 18% and 22% during attic application. Use an MP20 Pump or equivalent available from Spray Insulation Components.
2. Use of the GE Protimeter Mini® BLD2000 Moisture Meter partnered with a GE extended probe part number BLD5070 is required. You must follow the manufacturer's instructions for these items.
3. Gently insert the dual pin probe to approximately mid-depth into the insulation. Withdraw the probe ¼ inch before taking and recording the reading. This prevents product over-compaction at the tip from giving a false conductivity reading. Continue this same procedure for each randomly selected testing location.
4. Clean excess buildup inside the nozzle after every 40 bags applied. Check to make sure tips are free of debris.
5. Due to the variability of pH levels in various water sources it is important to sample the primary water source to be used in the application of GreenFiber's INS500 and INS500CAN stabilized insulation. The pH of the water needs to be below 7.2. If the pH goes above this number, do not install either product mentioned above and contact your GreenFiber Technical Service person for advice on product change. The incorrect water pH will void any claims with GreenFiber.



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Troubleshooting Guide for GreenFiber Insulation Attic Applications - Contractor

Problem	Cause	Solution
Coverage	Material too wet	Maintain moisture between 18% and 22%.
		Adjust water pump. Normal settings are between 125-175 psi when using 4003 and 4002 tips.
		Adjust feed gate to increase material flow.
	Incorrect square footage	Measure house and compare to work order.
		Calculate number of bags from coverage chart based on accurate square footage. Confirm number of bags actually used.
	Incorrect number of inches installed	Ensure attic rulers were installed every 300 sq. ft. per Code requirements.
The applicator must install both the minimum number of bags per 1,000 sq. ft. and the minimum installed thickness to ensure the stated R-value has been reached.		
	Lightweight, wet or hard bags	Return trailer to plant and replace with new trailer.
Settling	Insufficient water to stabilize material	Maintain moisture reading between 18% and 22%.
	Water tips are too large	Use smaller tips at higher psi to ensure water stream penetrates material flow.
	Pump psi is too low	Normal pump settings are 125-175 psi when using 4003 and 4002 tips.
Off Gassing		If possible, use fans to speed up drying and ventilation process. Odor will dissipate with adequate ventilation.
		Contact GreenFiber if problem persists.
		If installing GreenFiber INS500 or INS500CAN, check the pH of your water. If the pH is higher than 7.2, do not install and contact GreenFiber Technical Services.
Hose clogging	Too much material flow	Close feed gate a little at a time (in half inch increments).
	Too much water flow	Lower psi or increase material flow a little at a time. Normal settings are between 125-175 psi when using 4003 and 4002 tips.
	Product buildup in hose	Take a sturdy stick to knock the insulation loose 10 feet below nozzle back to nozzle. Clean excess build up inside the nozzle after every 40 bags applied. Check to make sure tips are free of debris.
	Air pressure is too low	Increase air pressure in small increments.
Dust	Tips installed incorrectly	Make sure tips are installed vertically to material flow.
	Tips clogged	Clean tips. Do not use metal wire to clean tips, as this will damage tips. Use a wooden toothpick or broom straw.
	Water pressure is low	Increase water pressure in 10 psi increments.
	Air pressure is too high	Proper balance between material flow and air will reduce dust. Try reducing air pressure slightly or increasing material flow slightly.
	Pump is not running	Make sure bypass valve on pump (located under pump pressure valve) is in "on" position.
	Clogged water filter	Check and clean water filter.
Water in hose	Faulty check valve	

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Installation Control Log for GreenFiber Stabilized Insulation

INSTALLATION CONTROL LOG

for GreenFiber Stabilized Insulation

Completed By _____
Builder Name _____
Development _____
Address _____
Lot # _____

Date _____ Time _____
Development _____
Contractor _____
Truck Number _____
Lead Installer _____

Moisture Readings

1. Install insulation at the minimum number of bags per 1000 sq.ft. and the minimum installed thickness to ensure the stated R-value has been reached.
2. Take one moisture reading within first five minutes of blowing and document below.
3. Document a second reading at completion of installation.

Reading #	1	2
Moisture Reading		

Notes

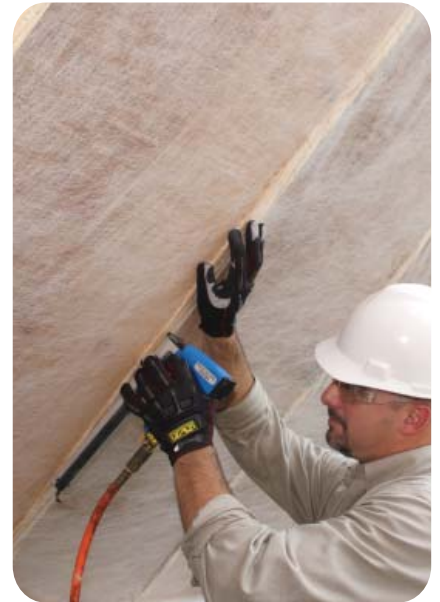
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Cathedral Ceiling Applications



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Cathedral Ceiling Applications

Cathedral ceilings have gained in popularity as architects and designers use this detail to add character to a home. A ceiling is designated as cathedral when the thermal barrier (insulation) and the pressure barrier (drywall) affixed to the underside of the roof rafters are parallel to a pitched roof. Cathedral assemblies have historically been vented since traditional thinking has been that a vent space was needed to alleviate heat gain. Studies have shown, however, that excess heat and moisture gain on a roof assembly is far more a function of roof color than the presence or absence of cavity ventilation.

Unvented cathedral ceilings were judged to provide better thermal performance and better moisture control by an international group of building scientists and contractors at the ASHRAE/DOE sponsored 'Thermal Envelopes Conference' held in Clearwater, Florida in December, 2001. In the Oak Ridge National Laboratory publication '[Moisture Control Handbook](#)', under the heading "Should Cathedral Ceilings be Ventilated?," the answer was, "Not if that space is tightly packed with insulation."

Insulated cathedral ceilings are rafter cavities which fully encapsulate the thermal insulation on 6 sides. In vented cathedral ceilings, GreenFiber Stabilized Insulation or GreenFiber Loose-Fill Insulation is Dry Dense-Packed to a minimum density of 3.5 lb.ft³ (56.1 kg/m³). In unvented cathedral ceilings, GreenFiber Stabilized Insulation or GreenFiber Loose-Fill Insulation is Dry Dense-Packed over an air impermeable insulation as prescribed per IRC 2009 Section R806.4. The thickness of the air impermeable insulation is determined per Climate Zone.

The decision whether to include venting or not in this application needs to be made by the specifier, architect, or engineer of record, taking into account climate conditions, site specific issues and assembly design. This document is not meant to imply that this assembly type, whether vented or unvented, can be used without due consideration of these and other pertinent issues. As noted above, in addition to the Code prescriptive path, the Code allows an alternate performance path, if it can be proven to the local Code body that the design choice will achieve the intended Code standard. Modeling programs such as WUFI (a hygrothermal modeling program) can be used to verify that the proposed performance path will work.

The typical installation method for Dry Dense-Packing cathedral ceilings is to staple a non-woven netting to the cathedral rafters. A hole is then cut in the netting near the ridge and a 2 1/2" or 3" hose is inserted the length of the cavity. Insulation is blown into the netted cavity to a minimum

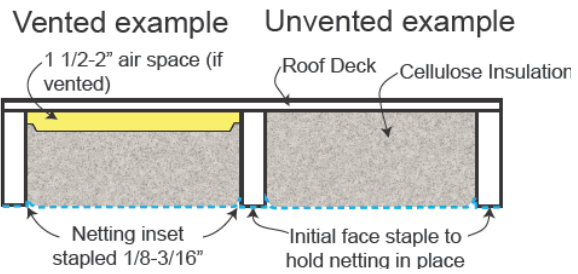
density of 3.5 pcf. At this density, there will not be any settling of the material. In hot, dry climate zones where unvented cavities can be totally filled with cellulose insulation, the insulation will always be in full contact with the roof sheathing, typically OSB. This helps avert the underside of the sheathing from becoming a condensing surface should there ever be any moisture vapor intrusion into the cavity.



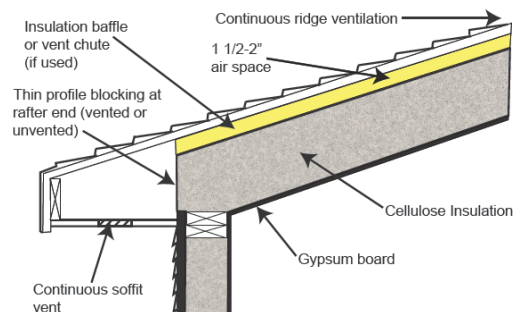
Control of air infiltration into cathedral cavities is very important. Therefore, particular attention needs to be paid to air sealing of any unvented cathedral ceiling assembly. Interior humidity should not be allowed to infiltrate the cavities and outside moisture laden air should not be allowed entry through the eaves and rafter ends. The use of the Dry Dense-Pack approach is not recommended for spaces which have high indoor humidity such as indoor pools. These applications demand a level of construction design and detail that can be difficult to meet in practice.



Procedure for Installing Netting in Attic Rafters



1. Pre-cut netting sheets to manageable size relative to the area to be covered, if necessary.
2. Be sure the rafter ends are blocked correctly with an air sealed barrier to prevent insulation from being installed into the eaves. This detail needs to be completed before netting and insulation installation. Please consult the architect or engineer of record to ensure the proper detail and construction technique is followed. If venting is used, install prior to netting which must be continuous from eave to ridge. If the application is unvented, there should not be any opening at the ridge or rafter end.



3. Netting installation is a two-step procedure. First, affix the netting to the rafter edges and peak, creating a square or rectangular stapled sheet, which is also stapled to the rafters across the netting face. Second, inset staple the netting to the sides of the wood framing around all four edges of the cavities to be insulated. It is important to inset staple to increase tension in the netting to prevent the netting from bowing out beyond the rafter surfaces.

Bowed netting can lead to difficulty in applying drywall to the ceiling after insulation is installed.



Equipment and Material Requirements for Cathedral Ceiling Applications (These guidelines are different from those for cathedralized unvented attic applications. Please refer to GreenFiber's instructions for those product applications.)

1. Hanes Insulweb™ brand netting
2. Air compressor with two or four air lines
3. Pneumatic staple guns with 1/4" staples
4. Ladder or scaffolding
5. Utility knives
6. GreenFiber INS515LD, INS735, INS745, INS765LD, or INS770LD

Installation Precautions

The installer must be familiar with cellulose insulation blowing equipment and techniques. Avoid installing netting or insulation in contact with non-UL rated electrical systems or non-insulated wiring. All lighting installed in the cathedral ceiling must be UL rated "IC" with air tight rated cans. Care must be taken during insulation installation to ensure the complete filling of the cavity around any lighting or other penetrations in the cavity, such as stereo speakers. Various other local, state and federal codes, rules and guidelines may apply.

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.

4. Taking a straight, factory netting edge, the crew may either start stapling across the peak or down the eave, stretching the netting tight along the stapled edge.
5. Beginning in one corner adjacent to the stapled edge, continue stapling out from the corner, increasing the stapled area in a triangular fashion. Face staple the netting to the rafters as installation progresses. Be sure to pull the loose ends tight to maintain a taut sheet in all netting directions. Staple spacing in the first step should be at least 2-3 staples per linear foot. The remaining loose netting is then stapled to the rafter edges while maintaining a taut sheet across the area.
6. The result should be a tight square or rectangular sheet, stapled on all four sides with at least 2-3 staples per linear foot to hold the netting in place. This includes face stapling the netting to the rafters, as well as the perimeter of the sheet.
7. When using multiple netting sheets that adjoin each other, overlap the sheets by at least one foot to prevent insulation from blowing out of the cavity.
8. Inset staple 1/8"-3/16" in from the framing face around all four edges of every cavity to prevent netting bow as previously indicated. The netting is then ready for insulation application. All inset stapling should be performed with 15-20 staples per linear foot.

Insulation Installation Instructions

1. Set the feed gate on the blowing machine opening at approximately 60% to 70%. The air setting should be set at 70% to 100%. The settings will vary depending on machine type.
2. One to three feet from the roof peak, cut a slit large enough to insert the blowing hose in the netting. Insert the three inch blowing hose behind the netting and slide the hose down the netted cavity to the eave and begin Dry Dense-Packing the insulation.



3. Begin filling cavity; do not allow the material flow to back the hose up the cavity on its own. Create some resistance in order to ensure full cavity density. Slowly retract the hose in order to avoid clogging the hose. Ensure that the Dry Dense-Packing at the ridge is complete to avoid the potential for settling.



4. The time to fill a cavity will depend on the machine being used, the material flow and air settings. The material should not clog the hose during this process. If the hose does clog, clean out the hose and close down the feed gate by 10% or increase the air flow until clogging does not occur.
5. Make sure the netting is stretched tight over the entire cavity. Patch the hose entry hole with duct tape.
6. Move on to the next cavity and repeat this process throughout the entire ceiling area.

Product Usage Estimates for Cathedral Ceiling Applications

See chart below for GreenFiber estimates on the amount of product needed. These estimates are subject to variation depending on the actual cavity volume of the installation, the operator skill level, blowing machine condition and settings, and other variables. As such, these are only guidelines, and are not to be construed as a coverage chart, or as a definitive calculation of product usage. The R-value used in these calculations is 3.70 per inch, tested at a 4" representative height per ASTM standards.

Stud Dimensions	Stud Height	Total R-value @ 3.7/inch	Ft ² covered @ 3.5 pcf
2 X 10	9.125"	33.8	11.3
2 X 12	11.125"	41.2	9.2

Helpful Tips for Application

1. For quick measurements without using a tape measure, count the number of sheets of plywood from the eave to the peak. Multiply this number by four– the width of a sheet of plywood. This will give the distance from the eave to the peak.
2. Make all of the standard cuts on the floor before stapling any netting.
3. Pull the blowing hose into the attic area as the attic is being blown. Secure the hose to a ceiling joist to relieve the hose weight.

The following list of equipment and supplies can be ordered from Spray Insulation Components at 1-800-210-1311.

1. Hanes netting, 9' width rolls
2. Josef Kihlberg pneumatic staple guns:
 - a. Model JK670 for 1/4" staples
 - b. Model JK680 for 5/16" staples
3. Staples-10,000 per box, 10 boxes per case, 1/4" or 5/16"

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Cathedralized Unvented Attic Application



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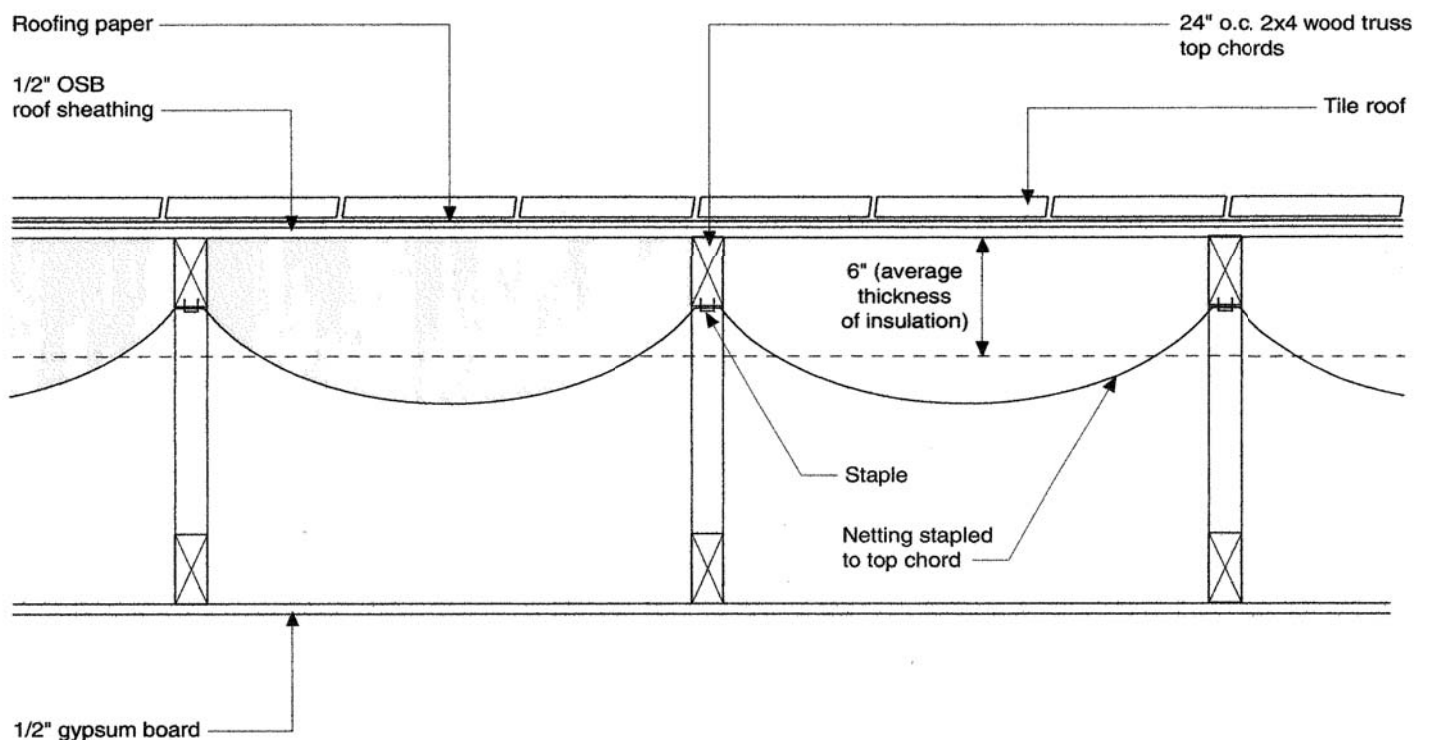
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Cathedralized Unvented Attic Application

Cathedralized attics are unvented attic assemblies in which the roof line insulation is left exposed (no drywall) to the attic space. GreenFiber Stabilized Insulation and GreenFiber Loose-Fill Insulation are Dry Dense-Packed behind netting affixed to the framing at a density of 3.5 lbs/ft³. Climate Zones 2B and 3B do not require an air impermeable insulation layer to the roof deck per IRC 2009 Section R806.4. The parallel flow path per the ASHRAE Fundamentals Handbook 2005 (Chapter 23 Equation 11) is used to determine the U Value of the assembly. The use of GreenFiber products in cathedralized attics outside of Zones 2B and 3B needs to be reviewed by a registered design professional to determine the need for air barriers on the exposed side of the insulation.

The construction detail is very specific and must be followed to achieve thermal and other performance characteristics. In addition, the installer of GreenFiber Cellulose Insulation must carefully follow the recommendations below to prevent the creation of gaps between the insulation and roof deck. Changing construction details such as roofing and decking materials, joist width, insulation density and other factors can affect the thermal and moisture management of the assembly.

This assembly has a proven track record in Climate Zone 3. It is presented as a suggestion of how to cost-effectively meet thermal requirements. It is not given as a specific design that is ready to be adapted into building plans, and GreenFiber is not the Architect or Engineer of Record. If there are questions about any aspect of this assembly and its capability of meeting local codes, please consult your architect, engineer or local building official. Contact a GreenFiber technical representative for assistance in the installation of GreenFiber Cellulose Insulation in this application. The following instructions are for the above construction detail only, with a cellulose insulation value of R-22.2. The netting dimensions given below are specific to this detail, and must be carefully followed to create the correct installation.



*If more recent codes have been adopted, you will need to go to 2x6 top chord to achieve R-30.

Equipment and Material Requirements for Applying Pre-Cut Netting to 2x4 Trusses, 24 Inch on Center

1. Hanes Insulweb™ brand netting, pre-cut 27 inch x 250 yards
2. Air compressor with two or four air lines
3. Pneumatic staple guns with ¼ inch staples
4. Ladder or scaffolding
5. Utility knives
6. Tape measure
7. Two or four-person teams
8. 25 feet of 2.5 inch blowing hose and reducer (if Dry Dense-Packing gable ends)
9. GreenFiber INS515LD, INS735, INS745, INS765LD, or INS770LD

Installation Precautions

The installer must be familiar with cellulose insulation blowing equipment and techniques. Care should be taken to avoid installing netting or insulation in contact with non-UL rated electrical systems or non-insulated wiring. After completion of the installation, care must be taken by the builder to avoid locating attic lights or other heat sources in proximity to the netted assembly.

For breathing protection, use a NIOSH approved N95 or higher disposable or reusable particulate respirator per 29 CFR 1910.134. 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.

Procedure for Installing Netting in Attic Rafters

1. Measure all standard cuts from the front eave to the attic peak and back down to the rear eave. Make cuts two feet longer than the measurement to allow for one extra foot on each side of the peak. Excess netting can be cut off at the eave after the netting has been secured from the peak to the eave.
2. After the two-person crews have made all of the standard cuts, staple the netting to the peak allowing netting to hang on both sides. Staple 20 to 24 staples per linear foot.
3. Two-person crews work together with one person stapling the netting from the peak down toward the eave until reaching his partner on the ladder, who continues stapling down to the eave. Staple netting across the top plate at the eave to retain the insulation.
4. Staple the edge of the netting to the face of the top chord to allow the netting to bulge out when the cavity is filled with insulation. Staple 20 to 24 staples per linear foot.
5. Dry Dense-Pack the gable ends. A small area such as this requires a reduced diameter blowing hose to achieve enough density to prevent settling. Attach a 2.5 inch blowing hose to the end of the larger blowing hose extending from the machine.



Installation Instructions

1. Set the feed gate on the blowing machine opening at approximately 60% to 70%. Set the air adjustment at 70% to 100%. The settings will vary on depending on machine type.
2. One foot from the roof peak, cut a slit large enough to insert the blowing hose in the netting. Insert the three inch blowing hose behind the netting and slide the hose down the netted cavity to the eave and begin Dry Dense-Packing the insulation.
3. Begin filling cavity; do not allow the material flow to back the hose up the cavity on its own. Create some resistance in order to ensure full cavity density. Slowly retract the hose in order to avoid clogging the hose.
4. The time to fill a cavity will depend on the machine being used, the material flow and air settings. The material should not clog the hose during this process. If the hose clogs, clean out the hose and close down the feed gate by 10% or increase the air flow until clogging does not occur.
5. Once reaching the entry hole, turn the machine off and slide the hose in the opposite direction, over the peak and down to the eave. Turn on the machine and repeat the blowing process, Dry Dense-Packing the cavity all the way back to the entry hole.
6. Make sure the netting is stretched tight in the entire cavity. Patch the hole with duct tape.
7. Move on to the next cavity and repeat this process throughout the entire attic area.

Coverage Estimates for R-22.2 Cathedralized Attic Application

GreenFiber gives estimated coverage numbers for cathedralized attic applications using pre-cut 27 inch netting. If pre-cut netting is not used, coverage can vary dramatically. GreenFiber is not responsible for estimated coverage if pre-cut netting is not used.

Using the pre-cut netting, one 30 pound bag of GreenFiber Insulation will cover approximately 12-14 square feet.

The average R-value for the insulation in this application is 22.2 based on an average of six inches of insulation. Installed density should be a minimum of 3.5 pounds per cubic foot to prevent settling.

Helpful Tips for Application

1. For quick measurements without using a tape measure, count the number of sheets of plywood from the eave to the peak. Multiply this number by four feet, the width of a sheet of plywood. This is the distance in feet from the eave to the peak.
2. Make all of the standard cuts on the floor before stapling any netting. When working with a two-person crew, both crew members staple all of the netting to the attic peak, allowing the netting to hang down to the eaves. Once all the netting is attached to the peak, one person runs the netting down to the other person on a ladder who continues stapling to the eave.
3. Pull the blowing hose into the attic area as the attic is being blown. Secure the hose to a ceiling joist to relieve the hose weight.
4. The netting can be pre-cut before arrival to the job. As the cuts are made, roll up the netting and secure with a rubber band. Use a marker to record the length on each roll.

The following list of equipment and supplies can be ordered from Spray Insulation Components at 800-210-1311.

**1. Hanes Insulweb™ brand netting,
pre-cut 27 inch x 250 yards**

2. Josef Kihlberg pneumatic staple guns:

- a. Model JK670 for ¼ inch staples
- b. Model JK680 for 5/16 inch staples

**3. Staples-10,000 per box, 10 boxes per case,
¼ inch or 5/16 inch**

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Dry Dense-Packing Wall and Floor Assemblies



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Dry Dense-Packing Wall and Floor Assemblies



GreenFiber Loose-Fill Insulation is required for installation in vertical wall assemblies using the netted/Dry Dense-Pack application. Any GreenFiber insulation product with a Dry Dense-Pack coverage chart can be used in this application. Do not use water or previously wetted material in this application.

Equipment and Material Requirements for Applying Netting for Insulating 16" oc 2x4 and 2x6 Walls

- Hanes Insulweb™ brand netting or equivalent non-woven, non-vapor retarding netting in 8 or 9 foot widths x 250 yards Style # 3121 natural Basis weight (1.24 oz. per sq. yd.)
- Air compressor with a minimum of two or four air lines
- Pneumatic staple gun with ¼ inch staples
- A minimum of 25 feet of 2 ½ inch blowing hose attached to the larger diameter blowing hose; total length of the two sections not to exceed 150 feet
- 8" core sample tester, scale and instructions, available through Spray Insulation Components at 800.210.1311
- GreenFiber INS515LD, INS735, INS745, INS765LD, or INS770LD

Preparation

- Any cavity taller than eight feet in height should have cross-bracing or fire stops at mid-height to help support the weight of the material and prevent settling.
- Care should be taken to avoid installing any insulation product in contact with non-UL rated electrical systems or non-insulated wiring.
- Inset stapling is recommended for any cavities wider than 16" oc.
- GreenFiber's Material Data Safety Sheet (MSDS) requires the use of safety eyewear when installing this product. The insulation contractor is responsible for managing house-keeping 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.

Procedure for Installing Netting in Exterior and Interior Walls Assemblies

1. Measure the length of the wall and add two feet to the measurement.
2. Cut one piece of netting for each wall.
3. Staple one edge of the netting across the length of the top plate of the first wall.
4. For exterior walls, staple netting down each stud face with a double row of staples. The two staple rows should land

on the two edges of the stud to prevent insulation material from obstructing the face of the stud and interfering with the drywall installation. Repeat procedure for each stud until the wall is completed.

5. For exterior walls greater than 2x4 and interior walls, inset staple ¼ inch on both sides of the wall to prevent bulging that could interfere with the drywall installation.

Repeat procedure for each stud until the wall is completed.



6. Complete the wall by stapling the bottom edge of the netting across the length of the bottom plate.

Repeat process in additional rooms until the house is complete.

7. After two rooms are completely netted, one person can begin blowing material in the first netted room.
8. Net garage partition walls and knee walls on both sides of the wall to retain blown insulation. Garage partition walls and knee walls need to have a support on both sides. Netting can be used on the back of garage partition walls; however, follow Code for the backing of knee walls.

Procedure for Installing Netting in Floor Assemblies

1. The procedure for Dry Dense-Packing floor assemblies is the same as for walls, except on the horizontal.
2. It is important to inset staple the netting to the floor joists, as the larger volume of material installed at 3.5pcf may bulge the floor cavity sufficiently to create difficulty in fastening drywall.

Procedure for Installing GreenFiber Loose-Fill Insulation in Netted Wall and Floor Assemblies

1. Using a utility knife, make a three inch incision in the center of each wall cavity, approximately one foot from the top plate.
2. Insert the 2 ½ inch hose in the cut and slide the hose to the bottom of the cavity if possible. If there are any plumbing, electrical or other obstructions, the hose must be reinserted at different points in the cavity. Multiple holes may be needed to ensure uniform density throughout the entire cavity.
3. Machine setting will vary depending on the production rate of the installation equipment. Some trials with the machine will be necessary as blowing machines and conditions can vary depending on machine type, level of maintenance, and the degree of wear.



4. A small machine capable of blowing 1800 pounds of GreenFiber Loose-Fill Insulation per hour should have the gate open approximately 50% and the air pressure set at two-thirds open. As machine capacity increases, the gate should be reduced and the air pressure turned down.
5. Begin blowing the first cavity; retract the hose slowly toward the top of the cavity as the material fills. The netting will tighten and bulge slightly as the hose is withdrawn. Once the hose end reaches the opening in the netting, point the hose at the top of the cavity until the cavity is completely filled.
6. Tape the cuts in the netting with duct tape after the material is installed.

7. Cross-bracing creates two separate cavities; blow each cavity with separate entry holes.

Density Check

GreenFiber requires the use of either a core sampling method or a bag count and volume method to assess the installed density of its products when using the Dry Dense-Pack method. GreenFiber specifications call for a minimum density of 3.5 pcf (pounds per cubic foot) in 2x4 and 2x6 cavities. These two methods are described below.

Density Checking by Core Sampling

1. Take core samples from the top, middle and bottom of the first cavity to ensure proper technique and consistent density.
2. Remove the sample from the corer and weigh the material. Divide the weight by the calculated volume of the sample. This will provide the density for that sample. Average the three sample test results to determine the installed density for that cavity.
3. Once the desired density is achieved, continue blowing the netted cavities until the house is completed. Machine may need to be reset if the required density has not been met in the test. Documenting these settings will save time the next time this application is required.
4. Do not use water or previously wetted material in this application.
5. If using the core sampling tool, please refer to enclosed instructions.



Density Checking by Bag Count and Volume

In many situations, core sampling is difficult or impossible to perform for a variety of reasons. The instructions below are for calculating the installed density of GreenFiber's insulation products in the event core sampling is too problematic or dangerous.

1. Two pieces of information are required to use this method: the total weight of the material installed as determined by bag count, and the exact volume into which the bags were installed. Determine the volume by subtracting the framing from the square footage. Dividing the total weight installed by the cavity volume will provide the pcf or density installed in the assembly.
2. When using this method it is important that it is done on an assembly basis, that is that each wall, floor, or other assembly is treated as an individual unit. Each unit must have its own calculated installed density performed to ensure consistent application of the product.

3. The level of product in the hopper at the start and finish should be accounted for in calculating the amount of material used. The number of bags used for each assembly plus/minus the material differential in the in the machine hopper must be documented for each assembly.
4. Volume calculations of each assembly can be fairly complex. The installer must make sure that these calculations are documented for each assembly as well. Many times the volume calculations can be standardized because of the use of repeating room configurations in multi-family, as one example.
5. Records must be maintained of the installed density of each assembly to ensure that GreenFiber's installation instructions have been followed.

Note: Install Dry Dense-Packed GreenFiber Loose-Fill Insulation in all exterior wall sections in bathrooms, kitchens and other rooms where added vapor transport impediments, such as cabinets, mirrors, tubs, and shower enclosures are located. If unsure where transport impediments are located, Dry Dense-Pack the entire exterior wall section(s).

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Retrofitting Existing Sidewalls with GreenFiber Insulation Contractor Work Instructions



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Retrofitting Existing Sidewalls with GreenFiber Insulation – Contractor Work Instructions



The following instructions are for contractors for the purpose of retrofitting existing sidewalls with GreenFiber Insulation. These instructions are designed for use with GreenFiber's INS770LD, INS765LD, INS745, INS735, or INS515LD products for installation in sidewall cavities. Follow the sidewall coverage charts on the bags to assure that the proper amount of insulation is installed.

Before Installation

Retrofitting any part of a home's envelope will cause changes in air, heat and moisture flow. Contractors must understand how this installation will impact the house, i.e., ventilation and combustion air requirements. Examine both the inside and outside of a home to determine areas that are inappropriate for installation. For example:

- Do not insulate any home that has active knob and tube wiring.
- Where moisture related problems are evident, the source of the problems must be determined and corrected before proceeding.
- Do not install insulation in stud runs where heat-producing devices such as an unprotected chimney, a fireplace, etc. might cause severe overheating.
- Building assembly details such as balloon framing, fire blocking, pocket door connections, dry wall gaps or other leak points must be taken into consideration when blowing GreenFiber Insulation into a house.
- 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.

Application

There are two basic techniques (Two-Hole or Double-Blow Method and One-Hole Tube Fill Method) used to fill existing, enclosed sidewall cavities. These techniques can be performed from either the exterior or interior of a home.

Installation through the interior wall is very difficult and is not detailed here. While it can be done, there is a wide range of other considerations related to someone currently occupying the home that present challenges to interior wall installation.

Required Equipment:

- Insulation blowing machine capable of at least 2.9 psi at the end of the hose
- Not all insulation blowing machines meet this requirement; please check with GreenFiber Customer Service – 800.228.0024 – for verification.
- ¼-inch fiberglass rod
- Hose clamps
- Utility knife
- Filter (such as sponge)
- Wood, plastic, cork or Styrofoam plugs
- Drill and a 2 to 3-inch hole saw / Forstner bit
- 50-100 ft. of 3-6 inch inside diameter ribbed hose
- 1 to 1½ -inch reducer nozzle
- 12 ft., 1 1/8 to 1 ¼-inch inside diameter tube
 - Best practice: 1 1/8 to 1 ¼ - inch tube will match sturdiness of a thin wall irrigation hose
- Note: When connecting hoses, a gradual reduction from the outlet to the 1 1/8 - 1 ¼ inch hose will yield the best results.

One-Hole Tube Fill Method

The one-hole tube fill method is recommended by state Weatherization Assistance Programs for the retrofit of sidewalls, and is the GreenFiber preferred method for retrofitting existing sidewalls. When performing Weatherization Assistance Program work, follow the instructions below.

Density Check

GreenFiber requires the use of either a core sampling method or a bag count and volume method to assess the installed density of its products when using the Dry Dense-Pack method. GreenFiber specifications call for a minimum density of 3.5 pcf (pounds per cubic foot) in 2x4 and 2x6 cavities. These two methods are described below.

Instructions for One-Hole Tube Fill Method

1. Remove a section of exterior siding and drill a single 2 ½-inch diameter hole through the sheathing approximately one foot from the bottom plate of the wall.



2. Using a hose clamp, attach the 1 to 1½ - inch reducer nozzle to the insulation blowing machine hose.
3. Using a hose clamp, attach the 12 ft., 1 1/8 or 1 ¼ - inch inside diameter tube to the end of the reducer nozzle.
4. Using the utility knife, cut the end of tube on a diagonal to facilitate snaking behind wiring and plumbing.
5. Suggested beginning settings for Insulation blowing machine:
 - a. Material gate set to 25% of total opening.
 - b. Air setting at 60% of capacity.

NOTE: These settings are given as a starting point. Adjustment will be needed based on machine type and condition.



6. Insert cut end of the tube through the filter into the 2 ½-inch drilled hole and feed to within 6-inches of the top of the stud cavity. Note any fire stops or other obstructions. Drill additional holes as needed if obstructions are present.
7. Turn on insulation blowing machine (Hold tube in place 6-inches from top). As material begins to flow, the cavity will fill bottom to top.
8. When you feel resistance from the tube, the cavity is full - DO NOT STOP BLOWING. You will now begin the Dry Dense-Pack Procedure. Dry Dense-Packing is required to achieve the minimum requirement of 3.5 pcf in wall cavities.
9. Dry Dense-Packing means you will begin compressing the material in the cavity and excess air will be forced out the entry hole. Move tube up and down 4 inches until material threatens to plug tube. Then retract the tube 8-10 inches.
10. Repeat Dry Dense-Packing procedures until within 6 inches of the entry hole.
11. When within 6 inches of entry hole quickly redirect tube downward to Dry Dense-Pack bottom of cavity.
12. Repeat Dry Dense-Packing procedures in bottom of cavity.
13. Retract tube to entry hole, jab forward 3 to 4 times to finish Dry Dense-Packing entry area.
14. Turn insulation blowing machine off. Keep tube in hole for 3 to 4 seconds before fully removing from cavity.

Two-Hole or Double-Blow Method

The two-hole or double-blow method is the most frequently used procedure for installing loose-fill insulation in sidewalls of existing homes. This method allows air pressure to escape from the upper hole while filling the cavity from the lower hole.

Instructions for Two-Hole or Double-Blow

1. Remove exterior siding to drill holes wherever possible to avoid potential damage/appearance defects to the exterior of the house.
2. Drill a hole between two studs approximately 2.5 to 3 feet up from the bottom plate. Drill a second hole approximately one foot below the top plate in the same stud run. On a multi-story home, repeat this process on each floor.
3. Drill holes approximately 2-inches in diameter through sheathing if siding is removed. A 2-inch diameter hole enables directional application.
4. Using a hose clamp, attach a 1-inch reducer nozzle to the insulation blowing machine hose.
5. Adjust air pressure to accommodate wall installation and nozzle size. This will ensure proper compacting of insulation and prevent settling in the cavity.
 - a. Air pressure adjustment will vary depending on machine type and condition. More air pressure is required for sidewall installation than attic installation. Contact the machine manufacturer for the correct settings.
6. Insert the nozzle into the bottom hole first and turn on the blowing machine. An increase in back pressure causes the blower to strain and alerts the installer that the cavity is filled and ready for compaction.

7. When material is no longer flowing through the hose, visually ensure the cavity is completely filled. Move the nozzle to the next hole in the stud cavity. Continue this process until each stud run in the wall is filled.
8. Fill the holes using wood, plastic, cork or Styrofoam plugs. Replace the siding if removed. If siding was not removed, use exterior-grade spackle to cover the plugs.

Contact your GreenFiber technical representative if you have questions regarding coverage, equipment or application at 800.228.0024.

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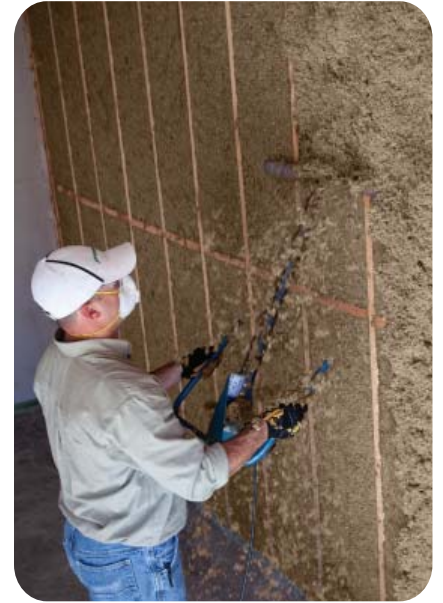


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Wall Spray Manual For GreenFiber Stabilized All Borate Insulation



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Wall Spray Manual For GreenFiber Stabilized All Borate Insulation

GreenFiber Stabilized All Borate Insulation is sprayed into open wall cavities to provide thermal insulation and sound control. The purpose of this manual is to provide application requirements for the proper installation of GreenFiber Stabilized All Borate Insulation in vertical assemblies when applied using Wall Spray.

Non-standard or unusual wall configurations (i.e., other than 2x4 and 2x6 walls) can affect thermal and sound properties and require special installation considerations. These types of designs should be analyzed and, if necessary, tested prior to plan review. For non-standard walls, contact a GreenFiber technical service representative for assistance.

REQUIREMENTS

- The contractor crew must read and understand this manual before installing GreenFiber Insulation.
- The insulation contractor must have a quality assurance process that ensures in-field compliance with the installation instructions set forth by the manufacturer.

RECOMMENDED EQUIPMENT, CREW SIZE AND MATERIAL

- Two hopper insulation blowing machine with vacuum
- 2.5 inch, two jet water nozzle
- 25 or 40 series jets with maximum orifice capacity size of .002
- Motorized wall scrubber
- MP20 water pump system or equivalent
- Three-person crew
- GreenFiber INS735 or INS745

Equipment

Two Hopper Insulation Machine

A two hopper insulation machine is a complete system, mounted on a truck or enclosed trailer, that consists of a dry hopper and a recycle hopper. This system allows for control of density and moisture. Separate hoppers and material gates with individual adjustments provide greater control of the installation process.

A Wall Spray truck is self-contained and includes the following:

- Auxiliary electrical power
- A powerful recycle vacuum
- 150-200 feet of 3 inch hose
- 10 feet of 2.5 inch hose
- 200 feet of 4 inch vacuum hose
- Hose reels
- Water nozzle
- Wall scrubbers
- Water pump
- Heated water tank
- 200 feet of high pressure water line

2.5 Inch, Two Jet Wall Cavity Nozzle

The wall cavity nozzle consists of:

- A tube to give direction and pattern to the material.
- Two jets for injecting water into the material and completing the shape of the material pattern.

Machine Settings

Hopper Gate Settings and Adjustments

Test insulation blowing machine settings prior to the first installation due to the inherent variability of installation equipment, ambient conditions, machine condition, maintenance, and installer technique. Adjust settings to accommodate the machine's ability to deliver product and the installer's technique. Material gate settings will vary from one machine to another. Adjust settings to apply a sufficient volume of material.

Air Pressure Setting

Adjust air pressure to get sufficient velocity needed to carry the material to the wall. Start with air pressure at a high level and decrease air pressure in small increments to the desired rate of flow. Using this method will avoid the potential of material plugging the hose due to insufficient air flow. The amount of air pressure needed will vary depending on:

- Length and condition of the hose
- Condition of insulation machine
- Height of vertical climb from truck to application area
- Volume of material being pushed through the hose

High Pressure Water Pump

The minimum water pressure for a Wall Spray water pump must be 200 pounds per square inch (psi).

The “Pass”

When holding the nozzle, place one hand under the nozzle with the valve down. With the other hand, grasp the blower hose and the water hose about 18” to 24” behind the nozzle.

The pass is the spray application of insulation into a cavity by successive layering in a side to side motion. Consistent rhythm and accuracy are the keys to proper application.

The speed of the pass determines the thickness. Fast passes produce thin layers. A smooth thin layer is very stable and is the desired method. Slow passes produce thick layers and will not achieve optimum adhesion. This could cause a weak area that would not support the material that will be installed on top of it. Contain the pass to a single wall cavity.

WALL SPRAY - GETTING STARTED

Preparation

1. Remove all debris from the floor within ten feet of the walls to be insulated. This prevents construction debris from damaging the machinery when vacuuming the excess material off the floor.
2. Fill cavities less than one inch in width with minimal expansion foam.



3. Cover tubs, drains, fireplaces, wooden doors, open ducts and windows with poly. Cover any duct registers.
4. Cover electrical boxes with tape.
5. Ensure that all air sealing measures have been completed.



Installation

1. For breathing protection, use a NIOSH approved N95 or higher disposable or reusable particulate respirator (reference ASTM C 1015-06).



2. 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.
3. Remove the plastic packaging and load the dry hopper with GreenFiber Stabilized All Borate Insulation. Do not allow packaging to go through the hopper.
4. The person spraying the insulation should position themselves sideways to the wall. Hold the nozzle three feet from the cavity being insulated. Point the nozzle at a slightly downward angle toward the bottom of the first cavity. Turn the insulation equipment on with the remote control.
5. When the material begins to flow, engage the water jets by opening the valve on the bottom side of the wall nozzle.
6. Begin the side to side layering of the material into the cavity using the center of the cavity as a pivot point. Remember that the speed of pass must match the volume of material. Speed up or slow down the “pass” to fill the cavity.



7. Once you have layered the first foot from the bottom beyond the stud face of several cavities, continue spraying the first cavity by slowly leveling the nozzle with the plane of the floor. It is important to fill the cavity completely as you move upward. Continue layering the GreenFiber Insulation into the cavity, maintaining a level nozzle until you are within six to eight inches of the top.
8. When you are within six to eight inches of the top of the cavity, step in closer towards the cavity and continue spraying. Increase the speed of the pass as the top of the cavity fills. Do not apply more than is required to fill the area. Excessive overspray could cause the top to sag.

Stepping toward the wall optimizes the following:

- Increases velocity and therefore, increases density (packs tightly into the wall).
 - Concentrates the material by reducing the range of spray which allows attachment to the bottom of the top plate.
 - Avoids separation of material from top plate.
8. After completing a cavity, quickly move the nozzle to the bottom of the next cavity.
 9. Complete five cavities before starting wall scrubbing. Begin scrubbing the wall upward from the bottom of the cavity.



10. Vacuum loose material from the floor back to the recycle hopper. The machine will mix the reclaimed product with dry product for reapplication to the wall.
11. Teamwork is important for consistent and productive Wall Spray application. While the equipment is engaged and material is flowing through the hose, another crew

member must be scrubbing walls and adding GreenFiber Stabilized All Borate Insulation bags to the dry hopper, while the third crew member is vacuuming the excess material.

WALL SPRAY INSTRUCTIONS AND TECHNIQUES

Moisture Control and Verification

1. The primary control factor for spray-applied GreenFiber Stabilized All Borate 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.
2. Some climate zones may require a vapor retarder per Code. If a Class I retarder is used, then cover the insulation only when 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.
3. GreenFiber requires maintaining applied moisture content below 35% during wall application.



4. Use of the GE Protimeter Mini® BLD2000 partnered with a GE extended probe part number BLD5070 is required.
5. Several factors affect the drying rate for GreenFiber Stabilized All Borate 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. Again, in any and all circumstances, 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.
6. Do not use kerosene or other fossil fuel heaters to try to accelerate the drying of GreenFiber Stabilized All Borate 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.

Special Considerations

- On walls higher than eight feet, use a ladder to maintain a level application angle with the wall nozzle.
- Higher areas may require scaffolding.

Material Velocity

Material velocity can be changed by adjusting the air to product mixture.

- If the material velocity is too low, the density will be too light and the material may not support itself.
- If the material velocity is too high, the material will rebound off of the wall of the cavity.

Adjust the air to product mixture so that the material reaches the cavity with sufficient force to adhere without an excessive amount of material falling out. This loose material is referred to as “roll off” in this manual.

Typical problems related to pass speed:

Symptom	Cause
Very thick build up near edge of the studs	Moving the nozzle too slowly as the installer reverses direction back across the cavity
Center of the cavity is too shallow	Moving the nozzle too quickly through the center of the cavity
Material falling out of the cavity	Moving the nozzle too slowly

Slightly change the distance of the nozzle from the cavity for minor material velocity adjustments. This will impact the density and appearance of the finished product.

Depth of Overspray

Overspray is the material that extends beyond the stud face and is removed with a wall scrubber. Spray one inch of overspray beyond the cavity to ensure there will be no shallow spots and to provide enough reclaimed material to be mixed with dry material for uniformity of continued spraying.



Maintaining Spray Integrity

When spraying a wall cavity, the bottom of the next cavity often builds up with loose material from the roll off of the previous cavity. Spraying on top of this loose material hinders the integrity of the layering process and of the appearance of the finished product along the bottom section of the cavity.

To create a good foundation in each cavity, spray one foot above the floor several cavities ahead (or the entire room) before completing the first cavity.

Netting



Netting is a non-woven polyester material used as a backing in wall cavities against which to spray. It is a durable material and has very little stretch. Common areas that may require netting include interior walls and knee walls. Staple netting one to two inches apart. Stretch netting tightly to prevent bulging.

When applying drywall to netted and insulated wall areas, it is important that the drywall be installed first on the sprayed side of the cavity. If applied first on the netting side, the material could break loose and affect the thermal/sound performance.

SPECIAL APPLICATIONS

Insulating Behind Cabinets, Mirrors, Tubs, and Shower Enclosures



Identify and prepare areas of exterior walls that will require Dry Dense-Pack application. Install Dry Dense-Packed GreenFiber Stabilized All Borate Insulation into all exterior wall sections of bathrooms, kitchens and other rooms where added vapor transport impediments, such as cabinets, mirrors, tubs, and shower enclosures are located. If unsure

where impediments are located, Dry Dense-Pack the entire exterior wall section(s).

Dry Dense-Packed GreenFiber Stabilized All Borate Insulation is required for installation in these special applications in vertical wall assemblies using the netted/Dry Dense-Pack application. Do not use reclaimed material in this application. For complete Dry Dense-Packing instructions, see GreenFiber’s Dry Dense-Packing Wall and Floor Assemblies.

Cross-Bracing

Install cross-bracing to support the weight of the insulation in the following situations:

- When spraying 2x6 cavities taller than 8 feet, install cross-bracing at 4' to 5' vertical intervals.
- When spraying 2x4, 24" on center cavities taller than 8 feet, install cross-bracing at 4' to 5' vertical intervals.



Horizontal Blocking and Window Sills

Treat horizontal blocking and window sills like top plates (see Wall Spray-Getting Started, Installation step 7).

Pipes, Wires and Receptacle Boxes

Treat pipes, wires and receptacle boxes running parallel with the floor, like top plates (see Wall Spray-Getting Started, Installation step 7).

If these obstructions are running vertically, spray the area between the stud and the obstruction using the same procedure as in a normal cavity.

Repairing Cavities

Repair shallow spots, damaged areas and top plate gaps in cavities, following these steps:

1. If there is a shallow spot or damaged area, lightly tamp the area and repair with quick layered passes of the nozzle to fill the area.
2. If there is a gap on the underside of a top plate or any horizontal framing, push the material in with a trim broom. Pre-condition the repair area by slightly aiming the nozzle up from below the repair area. With a faster than normal pass speed, layer across the repair area to fill the gap.
3. Scrub all repaired areas.

Band Joists

1) To insulate band joists, follow these steps:

- Pre-condition the band joist with a light water spray.
- Direct the first pass to the top corner.
- Turn the nozzle sideways.
- Make a 24" wide pass.
- Make each layer about one inch thick.
- Raise the nozzle with each pass to be more perpendicular with band joist.
- Completely fill the bottom edge to support the material above.
- Repeat another one inch layer starting at the top, working down.

- Repeat the third time as before.
- Build the cavity as thick as needed.
- Avoid overfilling.
- Pack the material with a trim broom to maximize stability, if needed.

2) If a floor joist is too close to the band joist:

- Net between the two joists creating a pocket for Dry Dense-Packing against the exterior wall.
- Create entry holes in the netting approximately every six to eight feet to ensure insulation fills entire cavity.
- Detach nozzle from the hose.
- Insert the hose into the netted cavity and Dense-Pack the area completely with dry GreenFiber Stabilized All Borate Insulation at a minimum of 3.5 lbs/ft³.

MAINTAINING NOZZLES

Keep the outside of the nozzle clean. Material build up will create a random pattern, causing an unstable wall cavity, and slow down the installation process.

The jets are "quick change tips" which can be removed easily. Check for consistent water stream from both jets. If a jet gets plugged, release it from the nozzle by pushing down and turning to clean. Use a wooden toothpick or broom straw to clean by pushing the restricting particle into the inside of the jet. Push the debris from the outside inward. Flush the jet with water from the nozzle. Do not use hard materials like steel or brass to clean the jet.

MOISTURE TESTING GUIDELINES

Moisture readings for standard wall assemblies (2x4 and 2x6) are determined by a measurement at mid-depth, halfway between the studs.

Testing Procedure

1. Gently insert the dual pin probe halfway up the wall unit and centered between the two studs. Insert to mid-depth into the wall using a slight side to side motion.
2. Withdraw the probe ¼ inch before taking and recording the reading. This prevents product over-compaction at the tip from giving a false conductivity reading.
3. Continue this same procedure for each randomly selected testing location.
4. Verify machine settings by taking the first installed measurement after spraying 200 square feet. Take two additional measurements from two separate rooms of Wall Spray application.
5. Record the data on a quality control moisture measurement control log. One suggested form is the GreenFiber Stabilized All Borate Insulation Installation Control Log, attached.
6. If a moisture reading exceeds 35% at installation, do not continue Wall Spray application until the equipment is adjusted properly.



TROUBLESHOOTING GUIDE FOR WALL SPRAY

Symptom	Cause	Solution
Material not adhering to walls	Insufficient water and/or too much material flow	Increase pump pressure, not to exceed 250 psi or close material feed gate a little at a time. Pressure should be higher with 40 series jets than 25 series jets.
	Standing too far from wall	Stand closer to the wall, approximately three feet.
	Too much air pressure	Lower air pressure in small increments.
	Nozzle upside down	Water line should be on bottom.
Material falling out of wall	Too much water	Install smaller jets or lower pump pressure gradually.
	Too much recycle	Maintain approximately 60% dry to 40% recycle ratio.
	Improper spray technique	Make sure nozzle is perpendicular to the wall surface except at the bottom of the cavity.
		Refer to section above for correct application technique.
		Spray one layer on top of the previous layer making sure each pass goes from one stud to the other.
	Non-standard framing	2x6 framing, taller than 8 feet high should have cross-bracing every 4' to 5'.
		2x4 framing, 24" oc taller than 8 feet high should have cross-bracing every 4' to 5'.
Spraying too far out past the face of the studs	Keep overspray to about 1 inch past the face of the studs.	
Gaps or smiley faces at the top of the cavity	Installed moisture content is above 35%	Adjust recycle and dry mixture to maintain moisture level between 25% and 35%.
	Improper spray technique	Step in closer and speed up the pass. Do not spray too far past the face of the studs. Excess build up of material will cause the tops to pull loose or fall out.
	Improper wall scrubbing	Operate wall scrubber from the bottom of the cavity upward.
Coverage	Density is too high	Inspect nozzle angle, air pressure, water pump pressure, jet size and distance from wall.

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INSTALLATION CONTROL LOG

for GreenFiber Stabilized All Borate Insulation

Completed By _____
 Builder Name _____
 Development _____
 Address _____
 Lot # _____

Date _____ Time _____
 Development _____
 Contractor _____
 Truck Number _____
 Lead Installer _____

Wall Spray Moisture Readings

Install insulation at minimum of 2.7 pcf. Take one moisture reading from three different rooms per house.

Lot #			
Reading #	1	2	3
Room			
Sq. Ft. of Wall			
Moisture Reading			

Dry Dense-Pack Core Sample Density

Install Dry Dense-Packed GreenFiber Stabilized All Borate Insulation in all exterior wall sections in bathrooms, kitchens and other rooms where added vapor transport impediments such as cabinets, mirrors, tubs and shower enclosures are located. If unsure where impediments are located, Dry Dense-Pack the entire exterior wall section(s). Do not use reclaimed material in this application. Install insulation at a minimum of 3.5 pcf. Take core samples from the top, middle and bottom of the first cavity to ensure proper technique and consistent density.

Reading	Top	Middle	Bottom
Exterior Wall			
Core Sample Weight			
Density Reading			

Notes

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Wall Spray Installation Best Practices



Today's condensed building cycles require careful attention to these installation best practices and GreenFiber's instructions to ensure proper product performance. GreenFiber offers the following instructions for attaining the highest quality results and performance for installing 2x4 and 2x6 wall insulation. For complete Wall Spray installation instructions, please see GreenFiber's Wall Spray Manual.

COVERAGE CHARTS

- 1) Consult the GreenFiber Stabilized All Borate Insulation Fact Sheet for the current Wall Spray coverage chart.
- 2) For Wall Spray application, install GreenFiber Stabilized All Borate Insulation in walls at a minimum density of 2.7 pounds per cubic foot.
- 3) Bag coverage is dependent upon density and moisture levels. As the density and moisture levels increase, the coverage per bag decreases.

DRYING TIME

- 1) Drying time varies due to local climate conditions including temperature, humidity and the installed moisture. 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 in accordance with GreenFiber's Wall Spray Manual.
- 2) Some climate zones may require a vapor retarder per Code. If a Class I retarder is used, then cover the insulation only when 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.
- 3) Install Dry Dense-Packed GreenFiber Stabilized All Borate Insulation in all exterior wall sections in bathrooms, kitchens and other rooms where added vapor transport impediments, such as cabinets, mirrors, tubs, and shower enclosures are located. If unsure where impediments are located, Dry Dense-Pack the entire exterior wall section(s).

CROSS-BRACING

- 1) Install cross-bracing to support the weight of the insulation in the following situations:
 - a) When spraying 2x6 cavities taller than 8 feet, install cross-bracing at 4' to 5' vertical intervals.
 - b) When spraying 2x4, 24" on center cavities taller than 8 feet, install cross-bracing at 4' to 5' vertical intervals.

NON-STANDARD WALL CONFIGURATIONS

- 1) Non-standard or unusual wall configurations (i.e., other than 2x4 and 2x6 walls) can affect thermal and sound properties and require special installation



considerations. These types of designs should be analyzed by a design professional and, if necessary, tested prior to plan review. For non-standard walls, contact a GreenFiber technical service representative for assistance.

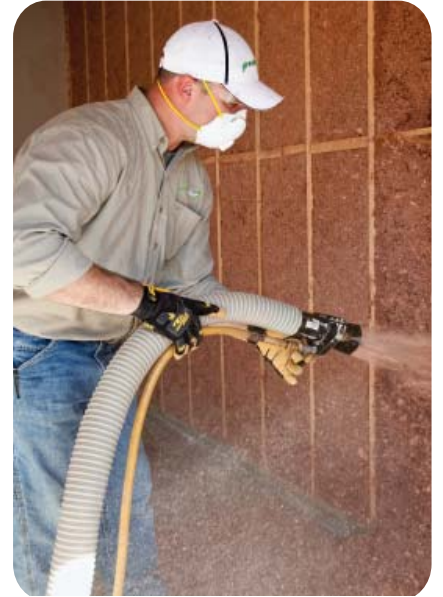
QUALITY ASSURANCE PROCESS

- 1) The insulation contractor must have a quality assurance process that ensures in-field compliance with GreenFiber installation instructions.
- 2) For Wall Spray applications, record and maintain on a quality control log three moisture readings, one from three different rooms per house.
- 3) For Dry Dense-Pack applications, record three core sample weights on a quality control log, from the top, middle and bottom, of the first cavity to ensure proper technique and consistent density.



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FRM® Fire Rated Material in Fire-Resistance Rated Assemblies



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FRM® Fire Rated Material in Fire-Resistance Rated Assemblies

Scope

The purpose of these instructions is to provide application requirements for the proper installation and testing of FRM 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 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, bearing the UL classification mark, for all UL fire-resistance rated assemblies (UL U370, for example).

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 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 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. 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 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 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 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.**



4. 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.



Density

Differing UL fire-resistance rated assemblies may have different minimum finished dry densities. It is the installer's responsibility to ensure that the installed minimum dry density meets the UL listing requirement. **See Appendix I: Checking for Target / Dry Density.** The installing contractor must take a minimum of two core readings and two moisture readings per floor per fire wall.

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/ft³	3.89 lbs/ft³
(Target Density)	4.0 lbs/ft³	4.5 lbs/ft³

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 needs repair. Replace FRM 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 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. See web site: www.ul.com-Go to Certification Link and TYPE IN U370 or U377 in the UL File Number box to see the assemblies or
- **GreenFiber's UL U370 Fire-Resistance Rated Assembly:** http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/showpage.html?name=BXUV.U370&ccnshorttitle=Fire+Resistance+Ratings+-+ANSI/UL+263&objid=1075301647&cfgid=1073741824&version=versionless&parent_id=1073984818&sequence=1
- **GreenFiber's UL U377 Fire-Resistance Rated Assembly:** http://database.ul.com/cgi-bin/XYV/template/LISEXT/1FRAME/showpage.html?name=BXUV.U377&ccnshorttitle=Fire-resistance+Ratings+-+ANSI/UL+263&objid=1077733442&cfgid=1073741824&version=versionless&parent_id=1073984818&sequence=1
- UL Fire Wall Field Test Log (PM-6.3-121)

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 US GreenFiber INS735 and FRM 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 ½ 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.

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8" Cavity



Dry Density Calculation Chart

		Meter Reading (#)																												
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100
Core Weight (wet)(g)	29	3.3	3.3	3.2	3.2	3.1	3.0	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.1	2.1
	30	3.4	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2	2.2
	31	3.6	3.5	3.4	3.4	3.3	3.3	3.2	3.1	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.2
	32	3.7	3.6	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.3
	33	3.8	3.7	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.2	3.1	3.0	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4
	34	3.9	3.8	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.2	3.2	3.1	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5
	35	4.0	4.0	3.9	3.8	3.7	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.1	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5
	36	4.1	4.1	4.0	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6
	37	4.3	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7
	38	4.4	4.3	4.2	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.9
	39	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.9
	40	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9
	41	4.7	4.6	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0
	42	4.8	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.0
	43	4.9	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1
	44	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2
	45	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3
	46	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3
	47	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.5	3.5	3.4	3.4	3.4
	48	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5
	49	5.6	5.5	5.5	5.4	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.4	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.5
	50	5.7	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.6
	51	5.9	5.8	5.7	5.6	5.5	5.3	5.2	5.1	5.0	4.9	4.8	4.6	4.5	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7
	52	6.0	5.9	5.8	5.7	5.6	5.5	5.3	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8
	53	6.1	6.0	5.9	5.8	5.7	5.6	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8
	54	6.2	6.1	6.0	5.9	5.8	5.7	5.5	5.4	5.3	5.2	5.0	4.9	4.8	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0	4.0	3.9
	55	6.3	6.2	6.1	6.0	5.9	5.8	5.6	5.5	5.4	5.3	5.1	5.0	4.9	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0
	56	6.4	6.3	6.2	6.1	6.0	5.9	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1
	57	6.6	6.4	6.3	6.2	6.1	6.0	5.9	5.7	5.6	5.4	5.3	5.2	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1
	58	6.7	6.6	6.5	6.3	6.2	6.1	6.0	5.8	5.7	5.5	5.4	5.3	5.1	5.0	4.9	4.9	4.8	4.9	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.3	4.3	4.2	4.2
	59	6.8	6.7	6.6	6.4	6.3	6.2	6.1	5.9	5.8	5.6	5.5	5.4	5.2	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3
	60	6.9	6.8	6.7	6.6	6.4	6.3	6.2	6.0	5.9	5.7	5.6	5.4	5.3	5.2	5.1	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.4	4.4	4.3
	61	7.0	6.9	6.8	6.7	6.5	6.4	6.3	6.1	6.0	5.8	5.7	5.5	5.4	5.2	5.2	5.1	5.1	5.0	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4
	62	7.1	7.0	6.9	6.8	6.6	6.5	6.4	6.2	6.1	5.9	5.8	5.6	5.5	5.3	5.3	5.2	5.2	5.1	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.5	4.5
63	7.2	7.1	7.0	6.9	6.7	6.6	6.5	6.3	6.2	6.0	5.9	5.7	5.6	5.4	5.4	5.3	5.2	5.2	5.1	5.1	5.0	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	
64	7.4	7.2	7.1	7.0	6.9	6.7	6.6	6.4	6.3	6.1	6.0	5.8	5.7	5.5	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	
65	7.5	7.4	7.2	7.1	7.0	6.8	6.7	6.5	6.4	6.2	6.1	5.9	5.7	5.6	5.5	5.5	5.4	5.3	5.3	5.2	5.2	5.1	5.1	5.0	4.9	4.9	4.8	4.8	4.7	
66	7.6	7.5	7.3	7.2	7.1	6.9	6.8	6.6	6.5	6.3	6.2	6.0	5.8	5.7	5.6	5.6	5.5	5.4	5.4	5.3	5.2	5.2	5.1	5.1	5.0	5.0	4.9	4.8	4.8	
67	7.7	7.6	7.5	7.3	7.2	7.0	6.9	6.7	6.6	6.4	6.2	6.1	5.9	5.8	5.7	5.6	5.6	5.5	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	
68	7.8	7.7	7.6	7.4	7.3	7.1	7.0	6.8	6.7	6.5	6.3	6.2	6.0	5.8	5.8	5.7	5.7	5.6	5.5	5.5	5.4	5.3	5.3	5.2	5.2	5.1	5.0	5.0	4.9	
69	7.9	7.8	7.7	7.5	7.4	7.2	7.1	6.9	6.8	6.6	6.4	6.3	6.1	5.9	5.9	5.8	5.7	5.7	5.6	5.5	5.5	5.4	5.4	5.3	5.2	5.2	5.1	5.1	5.0	
70	8.0	7.9	7.8	7.6	7.5	7.3	7.2	7.0	6.9	6.7	6.5	6.4	6.2	6.0	6.0	5.9	5.8	5.8	5.7	5.6	5.6	5.5	5.4	5.4	5.3	5.3	5.2	5.1	5.1	
71	8.2	8.0	7.9	7.8	7.6	7.4	7.3	7.1	7.0	6.8	6.6	6.4	6.3	6.1	6.0	6.0	5.9	5.8	5.8	5.7	5.6	5.6	5.5	5.5	5.4	5.3	5.3	5.2	5.1	
72	8.3	8.1	8.0	7.9	7.7	7.6	7.4	7.2	7.1	6.9	6.7	6.5	6.4	6.2	6.1	6.1	6.0	5.9	5.9	5.8	5.7	5.7	5.6	5.5	5.5	5.4	5.3	5.3	5.2	
73	8.4	8.3	8.1	8.0	7.8	7.7	7.5	7.3	7.2	7.0	6.8	6.6	6.5	6.3	6.2	6.1	6.1	6.0	5.9	5.9	5.8	5.7	5.7	5.6	5.5	5.5	5.4	5.3	5.3	
74	8.5	8.4	8.2	8.1	7.9	7.8	7.6	7.4	7.2	7.1	6.9	6.7	6.5	6.4	6.3	6.2	6.2	6.1	6.0	6.0	5.9	5.8	5.7	5.7	5.6	5.5	5.4	5.3	5.3	

9" Cavity



Dry Density Calculation Chart

		Meter Reading (#)																													
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	
Core Weight (wet)(g)	33	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.1	2.1	
	34	3.5	3.4	3.4	3.3	3.2	3.2	3.1	3.0	3.0	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.1	2.1
	35	3.6	3.5	3.5	3.4	3.3	3.3	3.2	3.1	3.0	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3
	36	3.7	3.6	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3
	37	3.8	3.7	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4
	38	3.9	3.8	3.8	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.4
	39	4.0	3.9	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5
	40	4.1	4.0	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.2	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6
	41	4.2	4.1	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.5	3.4	3.3	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.6
	42	4.3	4.2	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.5	3.4	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7
	43	4.4	4.3	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.8
	44	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.8
	45	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9
	46	4.7	4.6	4.5	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	3.0
	47	4.8	4.7	4.6	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0
	48	4.9	4.8	4.7	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.1
	49	5.0	4.9	4.8	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.7	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.2	3.2
	50	5.1	5.0	4.9	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.1	4.0	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.3	3.2
	51	5.2	5.1	5.0	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3
	52	5.3	5.2	5.1	5.0	5.0	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3
	53	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4
	54	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.5
	55	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.4	4.3	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5
	56	5.7	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.6	4.5	4.4	4.3	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5
	57	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.7
	58	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7
	59	6.0	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.1	5.0	4.9	4.8	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8
	60	6.1	6.0	5.9	5.8	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	4.0	3.9	3.9	3.9	3.9
	61	6.2	6.1	6.0	5.9	5.8	5.7	5.6	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	4.0	3.9
	62	6.3	6.2	6.1	6.0	5.9	5.8	5.7	5.5	5.4	5.3	5.1	5.0	4.9	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	4.0
	63	6.4	6.3	6.2	6.1	6.0	5.9	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1
	64	6.5	6.4	6.3	6.2	6.1	6.0	5.8	5.7	5.6	5.4	5.3	5.2	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1
	65	6.6	6.5	6.4	6.3	6.2	6.1	5.9	5.8	5.7	5.5	5.4	5.2	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.2
	66	6.7	6.6	6.5	6.4	6.3	6.2	6.0	5.9	5.7	5.6	5.5	5.3	5.2	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2
	67	6.8	6.7	6.6	6.5	6.4	6.2	6.1	6.0	5.8	5.7	5.5	5.4	5.3	5.1	5.1	5.0	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3
	68	6.9	6.8	6.7	6.6	6.5	6.3	6.2	6.1	5.9	5.8	5.6	5.5	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.4
	69	7.0	6.9	6.8	6.7	6.6	6.4	6.3	6.2	6.0	5.9	5.7	5.6	5.4	5.3	5.2	5.1	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.5	4.5	4.4	4.4	4.4
	70	7.2	7.0	6.9	6.8	6.7	6.5	6.4	6.2	6.1	5.9	5.8	5.6	5.5	5.4	5.3	5.2	5.1	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.5
	71	7.3	7.1	7.0	6.9	6.8	6.6	6.5	6.3	6.2	6.0	5.9	5.7	5.6	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.6
	72	7.4	7.2	7.1	7.0	6.9	6.7	6.6	6.4	6.3	6.1	6.0	5.8	5.7	5.5	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6
	73	7.5	7.3	7.2	7.1	6.9	6.8	6.7	6.5	6.4	6.2	6.0	5.9	5.7	5.6	5.5	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.7
	74	7.6	7.4	7.3	7.2	7.0	6.9	6.8	6.6	6.4	6.3	6.1	6.0	5.8	5.7	5.6	5.5	5.4	5.4	5.3	5.2	5.2	5.1	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.7
	75	7.7	7.5	7.4	7.3	7.1	7.0	6.8	6.7	6.5	6.4	6.2	6.1	5.9	5.7	5.7	5.6	5.5	5.5	5.4	5.4	5.3	5.2	5.2	5.1	5.1	5.0	4.9	4.9	4.8	4.8
	76	7.8	7.6	7.5	7.4	7.2	7.1	6.9	6.8	6.6	6.5	6.3	6.1	6.0	5.8	5.7	5.7	5.6	5.6	5.5	5.4	5.4	5.3	5.2	5.2	5.1	5.1	5.0	5.0	4.9	4.9
	77	7.9	7.7	7.6	7.5	7.3	7.2	7.0	6.9	6.7	6.5	6.4	6.2	6.1	5.9	5.8	5.8	5.7	5.6	5.6	5.5	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	5.0
	78	8.0	7.8	7.7	7.6	7.4	7.3	7.1	7.0	6.8	6.6	6.5	6.3	6.1	6.0	5.9	5.8	5.8	5.7	5.6	5.6	5.5	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0

10" Cavity



Dry Density Calculation Chart

		Meter Reading (#)																													
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	
Core Weight (wet)(g)	37	3.4	3.3	3.3	3.2	3.2	3.1	3.0	3.0	2.9	2.8	2.8	2.7	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.1	
	38	3.5	3.4	3.4	3.3	3.3	3.2	3.1	3.0	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2	
	39	3.6	3.5	3.5	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3
	40	3.7	3.6	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.3	2.3	2.3
	41	3.8	3.7	3.6	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4
	42	3.9	3.8	3.7	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.4
	43	4.0	3.9	3.8	3.8	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.1	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5
	44	4.0	4.0	3.9	3.8	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5
	45	4.1	4.1	4.0	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6
	46	4.2	4.2	4.1	4.0	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.7
	47	4.3	4.3	4.2	4.1	4.0	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7
	48	4.4	4.3	4.3	4.2	4.1	4.0	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7
	49	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7
	50	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	2.9	2.9	2.9	2.8	2.8
	51	4.7	4.6	4.5	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	2.9	2.9
	52	4.8	4.7	4.6	4.5	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0
	53	4.9	4.8	4.7	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.8	3.7	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1
	54	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1
	55	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.2
	56	5.1	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2
	57	5.2	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.1	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3
	58	5.3	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.4
	59	5.4	5.3	5.3	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4
	60	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.5
	61	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5
	62	5.7	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.7	4.6	4.5	4.4	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.6
	63	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.5	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.7
	64	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.1	5.0	4.9	4.8	4.6	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.8	3.7
	65	6.0	5.9	5.8	5.7	5.6	5.5	5.3	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.8
	66	6.1	6.0	5.9	5.8	5.7	5.5	5.4	5.3	5.2	5.0	4.9	4.8	4.7	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8
	67	6.2	6.1	6.0	5.9	5.7	5.6	5.5	5.4	5.3	5.1	5.0	4.9	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9
	68	6.3	6.2	6.1	5.9	5.8	5.7	5.6	5.5	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9
69	6.3	6.2	6.1	6.0	5.9	5.8	5.7	5.5	5.4	5.3	5.1	5.0	4.9	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	4.0	
70	6.4	6.3	6.2	6.1	6.0	5.9	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	
71	6.5	6.4	6.3	6.2	6.1	6.0	5.8	5.7	5.6	5.4	5.3	5.2	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	
72	6.6	6.5	6.4	6.3	6.2	6.0	5.9	5.8	5.6	5.5	5.4	5.2	5.1	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.2	
73	6.7	6.6	6.5	6.4	6.3	6.1	6.0	5.9	5.7	5.6	5.4	5.3	5.2	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	
74	6.8	6.7	6.6	6.5	6.3	6.2	6.1	5.9	5.8	5.7	5.5	5.4	5.2	5.1	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.3	
75	6.9	6.8	6.7	6.6	6.4	6.3	6.2	6.0	5.9	5.7	5.6	5.4	5.3	5.2	5.1	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.4	4.4	4.3	4.3	
76	7.0	6.9	6.8	6.6	6.5	6.4	6.2	6.1	6.0	5.8	5.7	5.5	5.4	5.2	5.2	5.1	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	
77	7.1	7.0	6.9	6.7	6.6	6.5	6.3	6.2	6.0	5.9	5.7	5.6	5.4	5.3	5.2	5.1	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	
78	7.2	7.1	6.9	6.8	6.7	6.5	6.4	6.3	6.1	6.0	5.8	5.7	5.5	5.4	5.3	5.3	5.2	5.1	5.1	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.5	
79	7.3	7.2	7.0	6.9	6.8	6.6	6.5	6.3	6.2	6.0	5.9	5.7	5.6	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6	4.6	
80	7.4	7.2	7.1	7.0	6.9	6.7	6.6	6.4	6.3	6.1	6.0	5.8	5.7	5.5	5.4	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6	
81	7.4	7.3	7.2	7.1	6.9	6.8	6.7	6.5	6.3	6.2	6.0	5.9	5.7	5.6	5.5	5.4	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6	
82	7.5	7.4	7.3	7.2	7.0	6.9	6.7	6.6	6.4	6.3	6.1	6.0	5.8	5.6	5.6	5.5	5.5	5.4	5.3	5.3	5.2	5.2	5.1	5.0	4.9	4.9	4.8	4.7	4.7	4.6	

11" Cavity



Dry Density Calculation Chart

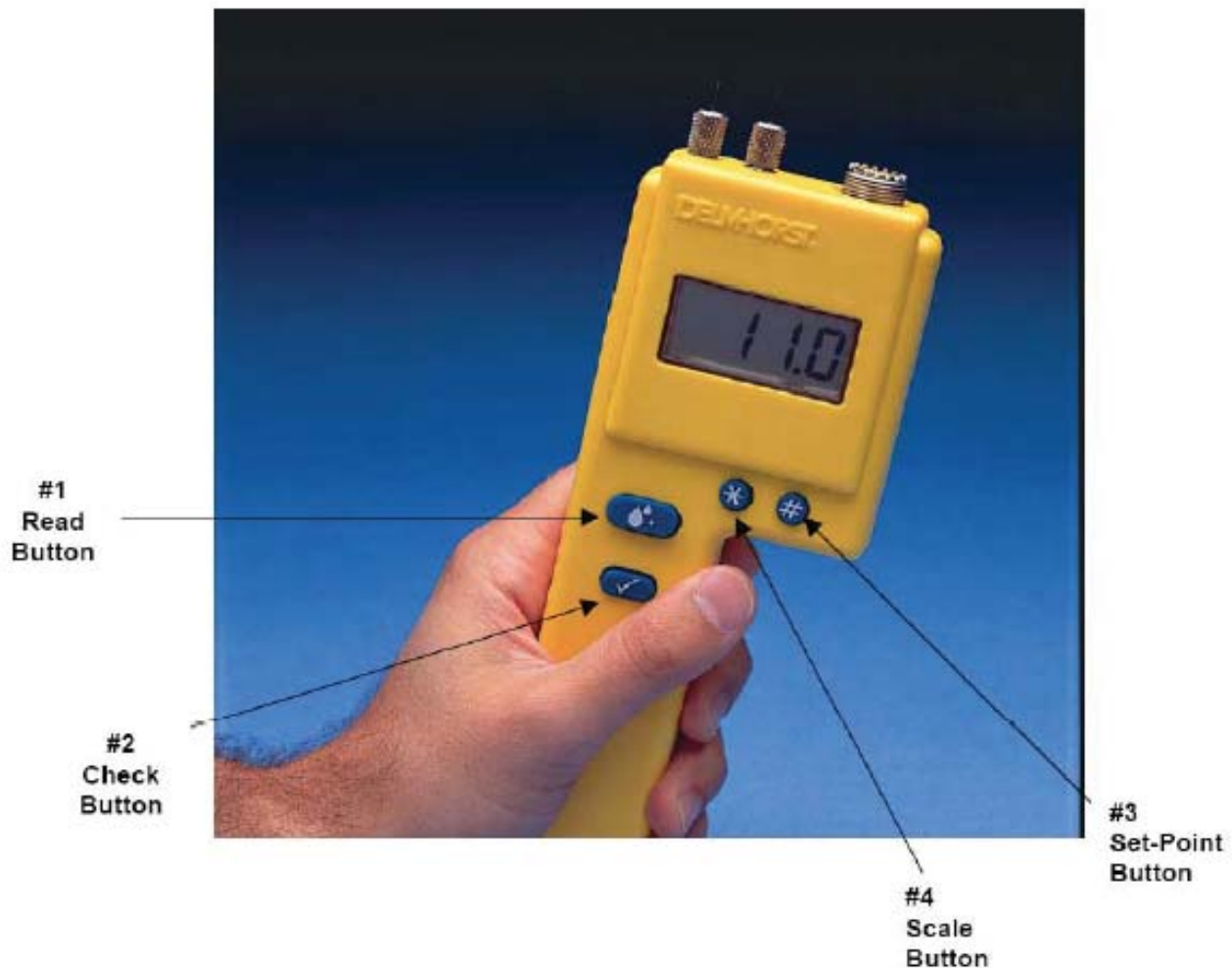
	Meter Reading (#)																												
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100
40	3.3	3.3	3.2	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2	2.1	2.1
41	3.4	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.9	2.7	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.2
42	3.5	3.5	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2
43	3.6	3.5	3.5	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3
44	3.7	3.6	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.3	2.3
45	3.8	3.7	3.6	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.0	3.0	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4
46	3.8	3.8	3.7	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.0	3.0	2.9	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4
47	3.9	3.9	3.8	3.7	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.1	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5
48	4.0	3.9	3.9	3.8	3.7	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.1	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5
49	4.1	4.0	4.0	3.9	3.8	3.7	3.7	3.6	3.5	3.4	3.3	3.2	3.2	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6
50	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6
51	4.3	4.2	4.1	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.8	2.7	2.7
52	4.3	4.3	4.2	4.1	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.8
53	4.4	4.4	4.3	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8
54	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	2.9	2.9	2.9	2.8
55	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9
56	4.7	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	2.9
57	4.8	4.7	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0
58	4.8	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.1
59	4.9	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1
60	5.0	4.9	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.2	3.2	3.2
61	5.1	5.0	4.9	4.8	4.8	4.7	4.6	4.5	4.3	4.2	4.1	4.0	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2
62	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3
63	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3
64	5.3	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.4	4.3	4.2	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4
65	5.4	5.3	5.3	5.2	5.1	5.0	4.9	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4
66	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5
67	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.2	4.1	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.5
68	5.7	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6
69	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.0	4.9	4.8	4.7	4.6	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6
70	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.3	4.2	4.2	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.8	3.8	3.7
71	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.4	4.4	4.3	4.3	4.2	4.2	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8
72	6.0	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.1	5.0	4.9	4.8	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8
73	6.1	6.0	5.9	5.8	5.7	5.6	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8
74	6.2	6.1	6.0	5.9	5.8	5.6	5.5	5.4	5.3	5.1	5.0	4.9	4.8	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9
75	6.3	6.2	6.1	6.0	5.8	5.7	5.6	5.5	5.3	5.2	5.1	5.0	4.8	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	4.0
76	6.4	6.3	6.1	6.0	5.9	5.8	5.7	5.5	5.4	5.3	5.2	5.0	4.9	4.8	4.7	4.7	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0
77	6.4	6.3	6.2	6.1	6.0	5.9	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1
78	6.5	6.4	6.3	6.2	6.1	6.0	5.8	5.7	5.6	5.4	5.3	5.2	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1
79	6.6	6.5	6.4	6.3	6.2	6.0	5.9	5.8	5.6	5.5	5.4	5.2	5.1	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2
80	6.7	6.6	6.5	6.4	6.2	6.1	6.0	5.8	5.7	5.6	5.4	5.3	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2
81	6.8	6.7	6.6	6.4	6.3	6.2	6.0	5.9	5.8	5.6	5.5	5.3	5.2	5.1	5.0	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3
82	6.9	6.7	6.6	6.5	6.4	6.3	6.1	6.0	5.8	5.7	5.6	5.4	5.3	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3
83	6.9	6.8	6.7	6.6	6.5	6.3	6.2	6.1	5.9	5.8	5.6	5.5	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4
84	7.0	6.9	6.9	6.7	6.5	6.4	6.3	6.1	6.0	5.9	5.7	5.5	5.4	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4
85	7.1	7.0	6.9	6.8	6.6	6.5	6.3	6.2	6.1	5.9	5.8	5.6	5.5	5.3	5.3	5.2	5.1	5.1	5.0	5.0	4.9	4.9	4.8	4.7	4.7	4.6	4.6	4.5	4.5

12" Cavity



Dry Density Calculation Chart

		Meter Reading (#)																													
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	72	74	76	78	80	82	84	86	88	90	92	94	96	98	100	
Core Weight (wet)(g)	44	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.2	2.2	2.2	2.1	2.1	
	45	3.4	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.8	2.7	2.7	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.2	2.2	2.2	2.2	
	46	3.5	3.5	3.4	3.3	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.9	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	2.2	2.2	
	47	3.6	3.5	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.3	
	48	3.7	3.6	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.3	2.3
	49	3.8	3.7	3.6	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.0	3.0	2.9	2.8	2.8	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4
	50	3.8	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.3	3.2	3.1	3.0	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.4	2.4
	51	3.9	3.8	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.2	3.2	3.1	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5	2.5
	52	4.0	3.9	3.9	3.8	3.7	3.6	3.6	3.5	3.4	3.3	3.2	3.1	3.1	3.0	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6	2.6	2.5	2.5
	53	4.1	4.0	3.9	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.6	2.6	2.6
	54	4.1	4.1	4.0	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.3	3.2	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.6
	55	4.2	4.1	4.1	4.0	3.9	3.8	3.8	3.7	3.6	3.5	3.4	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8	2.8	2.8	2.7	2.7	2.7
	56	4.3	4.2	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.5	3.4	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.9	2.9	2.8	2.8	2.8	2.7	2.7
	57	4.4	4.3	4.2	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8	2.8
	58	4.4	4.4	4.3	4.2	4.1	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	3.0	2.9	2.9	2.9	2.8	2.8
	59	4.5	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.9	3.8	3.7	3.6	3.5	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.1	3.0	3.0	3.0	2.9	2.9	2.8
	60	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1	3.1	3.0	3.0	3.0	3.0	2.9	2.9
	61	4.7	4.6	4.5	4.4	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0	2.9
	62	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.4	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.1	3.0	3.0
	63	4.8	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2	3.1	3.1	3.0	3.0
	64	4.9	4.8	4.7	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.6	3.5	3.5	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.2	3.2	3.2	3.1	3.1
	65	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1
	66	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.2
	67	5.1	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	3.9	3.8	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3	3.2
	68	5.2	5.1	5.0	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.4	3.4	3.4	3.3	3.3	3.3
	69	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.3	3.3	3.3
	70	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.3	4.2	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.6	3.6	3.5	3.5	3.5	3.4	3.4	3.4
	71	5.4	5.4	5.3	5.2	5.1	5.0	4.9	4.7	4.6	4.5	4.4	4.3	4.2	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.5	3.4
	72	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	3.6	3.6	3.6	3.5	3.5	3.5
	73	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.6	3.5	3.5
	74	5.7	5.6	5.5	5.4	5.3	5.2	5.1	4.9	4.8	4.7	4.6	4.5	4.4	4.2	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.6	3.6	3.6
	75	5.7	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.7	3.6
	76	5.8	5.7	5.6	5.5	5.4	5.3	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.8	3.8	3.8	3.7	3.7	3.7
77	5.9	5.8	5.7	5.6	5.5	5.4	5.3	5.1	5.0	4.9	4.8	4.7	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.7	3.7	
78	6.0	5.9	5.8	5.7	5.6	5.5	5.3	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	3.9	3.9	3.9	3.8	3.8	3.8	
79	6.1	6.0	5.9	5.8	5.6	5.5	5.4	5.3	5.2	5.0	4.9	4.8	4.7	4.5	4.5	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0	4.0	4.0	4.0	3.9	3.9	3.8	
80	6.1	6.0	5.9	5.8	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.8	4.7	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.0	4.0	4.0	4.0	3.9	3.9	
81	6.2	6.1	6.0	5.9	5.8	5.7	5.5	5.4	5.3	5.2	5.0	4.9	4.8	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0	4.0	4.0	3.9	
82	6.3	6.2	6.1	6.0	5.9	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.8	4.7	4.7	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	4.0	4.0	4.0	
83	6.4	6.3	6.2	6.0	5.9	5.8	5.7	5.6	5.4	5.3	5.2	5.0	4.9	4.8	4.7	4.7	4.6	4.6	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.2	4.1	4.1	4.1	4.0	
84	6.4	6.3	6.2	6.1	6.0	5.9	5.7	5.6	5.5	5.4	5.2	5.1	5.0	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	4.1	
85	6.5	6.4	6.3	6.2	6.1	5.9	5.8	5.7	5.6	5.4	5.3	5.1	5.0	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.1	4.1	
86	6.6	6.5	6.4	6.3	6.1	6.0	5.9	5.8	5.6	5.5	5.3	5.2	5.1	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	4.2	
87	6.7	6.6	6.5	6.3	6.2	6.1	6.0	5.8	5.7	5.5	5.4	5.3	5.1	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	
88	6.7	6.6	6.5	6.4	6.3	6.2	6.0	5.9	5.7	5.5	5.3	5.2	5.0	5.0	4.9	4.9	4.8	4.8	4.7	4.7	4.6	4.6	4.5	4.5	4.4	4.4	4.3	4.3	4.2	4.2	



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 #1 (paper); #2 (0-100 reference); #3 (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 5.

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: "141", "7", "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 IMMERSE 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 e-mail 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 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. 06-03

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