

IN-CHIE®

THERMOLOK INSULATION



Hamilton Manufacturing, Inc.
901 Russet Street
Twin Falls, ID 83301 USA
Phone: 001.208.733.9689
Email: info@hmi-mfg.com
Web: www.hmi-mfg.com





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Pest control



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Air infiltration



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Standard specification



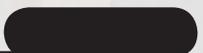
Cathedral ceilings & moisture



Recessed lighting



InCide certification



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•••• Company introduction

Hamilton Manufacturing, Inc. was established in 1962. The cellulose industry was a young concept at that time and Hamilton Manufacturing, Inc. was one of the first cellulose insulation manufacturing facilities built in the United States.

Since then, many people have seen the advantages of using the cellulose insulation and continue to call on our products for all of their green insulation needs.

As green building specialists, we provide our services and products to 15 US states and over 35 countries worldwide. We strive to meet the individual needs of each and every customer to the best of our ability. We work hard to provide quality products and



develop new or improved products that can address our customers' continually changing needs and the result is the added protection and enrichment of the environment and ecosystem around the world.

All of the **Thermolok** cellulose insulation products that we offer provide a safe, cost efficient, and sound absorbing solution for all types of buildings and lifestyles around the globe.



•••• Thermolok InCide® Insulation overview

Thermolok InCide® is an all natural cellulose insulation manufactured from recycled paper products. It has no formaldehyde, asbestos, or fiberglass making it safer and more environmentally friendly than other insulation products on the market today.

Thermolok InCide® is manufactured using 85% recycled paper, part of the approximate 7,000 ton of paper that Hamilton Manufacturing, Inc. keeps from entering the landfill every year. It has the highest level of recycled content in the insulation industry.



Additionally, **Thermolok InCide®** is made from 100% born 10 (boric acid/sodium poly borate). We do not ever use ammonium sulfate in the manufacturing of our insulation, a chemical known to corrode pipes inside insulated walls and cause failure of the

insulation over time due to its hygroscopic attributes.

••••• Fire rating & testing

Thermolok InCide® insulation has been manufactured to meet the amended CPSC standard for flame resistance and corrosiveness of cellulose insulation.

Thermolok InCide® is a class one fire-rated building material. It meets the stringent fire safety standards of the U.S. Consumer Product Safety Commission.

Tests have proven that cellulose insulation actually increases a the fire resistance of a wall 22% to 55%, while fiberglass insulation was found to be no better than a non-insulated wall.

Research shows that the fire retardant capabilities of **Thermolok InCide®** and its density, keeps air from feeding a fire. So a structure insulated with **Thermolok InCide®** will burn slower, which could very well provide the time it takes to save a life. Fiberglass, on the other hand, melts which can allow fires to spread quickly.



Classification: Cellulose Insulation
Thermolok InCide®
Reference File: RDS-LF9298

This product meets the amended CPSC standard HH-I-515E; 16CFR, Sections 1209, 1404 for flame resistance and corrosiveness of cellulose insulation.

Classified in accordance with the following ASTM C739 characteristics.

Flammability Characteristics

Critical Radiant Flux	Greater than or equal to 0.12 W/cm ²
Smoldering Combustion	Less than or equal to 15.0%
Flame Spread	5
Smoke Spread	0

Environmental Characteristics

Corrosiveness	Acceptable
Fungi Resistance	Acceptable

Physical Characteristics

Density (Settled)	1.45 lb/ft ³
Thermal Resistance	3.7 R/in. (at 4 in.)
Moisture Vapor Sorption	Acceptable
Odor Emission	Acceptable

Physical Characteristics (Sidewall Application)

Density	3.0 lb/ft sq.
Thermal Resistance	3.8 R/in. (at 4 in.)

••••• Fire Wall Design

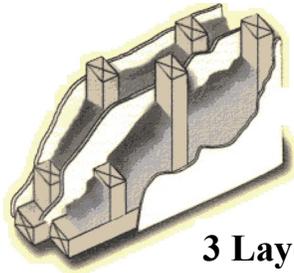
1 Hour Firewall Design

Using Only 3 Layers 5/8 inch
Type X Gypsum Wallboard
Design No. U360

Bearing Wall Rating 1 Hr.

Riverbank Acoustical
Laboratories

**STC
Rating: 51**



3 Layers

1. Wallboard, Gypsum -

Any Classified 5/8 in. thick gypsum wallboard, 4 ft. wide, paper surfaced, with beveled, square, or tapered edges, applied vertically. Wallboard fastened 6 in. o.c. at joints and edges and 12 in. o.c. in the field with No. 6 by 1 -5/8 in. long bugle head dry wall screw. One layer of wallboard was applied to each side of the wall assembly and one layer was applied in the middle—3 layers total.

2. Wood Studs -

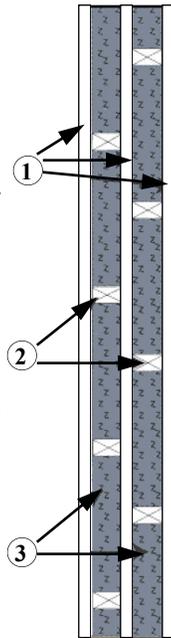
Nominal 2 by 4 in. no. 2 grade spruce, pine, fir, spaced 16 in. on center.

3. Spray—Applied Material -

Thermolok InCide® classified spray-applied insulation material. Applied to completely fill the cavities between the wood studs of both sides of wall to a nominal depth of 3-1/2 in.

4. Joints and Screw Heads -

Wallboard joints covered with tape and joint compound and screw heads covered with joint compound. UL Reference R-13173



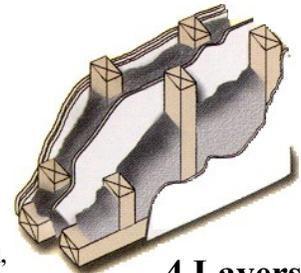
1 Hour Firewall Design

Using Only 4 Layers 5/8 inch
Type X Gypsum Wallboard
Design No. U360

Bearing Wall Rating 1 Hr.

Riverbank Acoustical
Laboratories

**STC
Rating: 58**



4 Layers

1. Wallboard, Gypsum -

Any Classified 5/8 in. thick gypsum wallboard, 4 ft. wide, paper surfaced, with beveled, square, or tapered edges, applied vertically. Wallboard fastened 6 in. o.c. at joints and edges and 12 in. o.c. in the field with No. 6 by 1 -5/8 in. long bugle head dry wall screw. Two layer of wallboard are to be attached to the wood studs on one side of the wall. The face and base layer joints of the wallboard are to be staggered. A 5/8 in. air space is to be placed in between those studs and the inner layer of wallboard which is to be attached to the studs of the other side of the wall. A fourth layer of wallboard is to be attached on the opposite side of those studs.

2. Wood Studs -

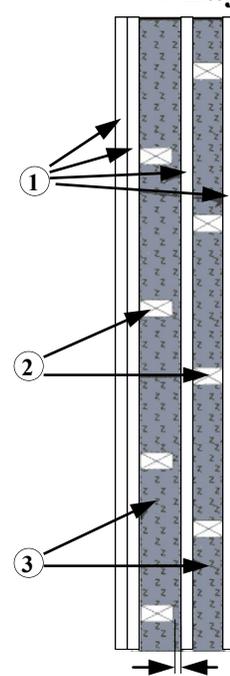
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4. Joints and Screw Heads -

Wallboard joints covered with tape and joint compound and screw heads covered with joint compound. UL Reference R-13173



5/8" air space

Fire Retardant Permanency

Fire Retardants used in cellulose insulation do not lose their effectiveness over time. Tests by scientists and technicians at Oak Ridge National Laboratory, Tennessee Technological University, Allied Signal corp., US Borax Corp., Underwriters Laboratories, and United States Testing Company, found no sign of “disappearing fire retardants.”

As the fire wall test results demonstrate, the dense structure of cellulose and its fire retardants slow the spread of fire through a building by blocking flames and hot gases and restricting the availability of oxygen in insulated walls and ceilings. Scientists at the National Research council Canada report that “cellulose in the wall cavity provided an increase in the fire resistance performance of 22% to 55%.” Fire roars right through conventional insulation. The NRCC study showed that “the fire resistance of an assembly with glass fibre insulation was slightly lower than that of a non-insulated assembly.”

••••• **R-Value**

R-Values are measured in a laboratory, however, in the real world insulation is subjected to a wide range of temperature conditions in a house. The insulation is affected by air movement and it is also degraded by the convection forces that develop within the insulation material.

R-Value is a measure of how well an insulation product resists heat or cold. R-Value is the result of a laboratory test in which an insulation material is sandwiched between a cool and warm surface. The ability of the material to resist temperature differences results in an R-Value for that material.

Incide® has an R-value at 3.7 per inch that remains true to the value even over time. The density of the cellulose fills in all crevices to greatly reduce the airflow that creates a tight barrier to keep your building at a comfortable temperature.

The Colorado Study:

The University of Colorado School of Architecture tested the “real world” performance of cellulose and fiberglass insulation. The building with cellulose insulation used **26.4% less energy** than the fiberglass structure. Additionally, the researchers concluded that cellulose performs **38% better** than fiberglass.

Horizontal Open Blow									
			Maximum Net Coverage		2x4 Joists 16" OC	2x4 Joists 24" OC	2x6 Joists 16" OC	2x6 Joists 24" OC	
R-Value	Initial installed thickness (in.)	Min. settled thickness (in.)	Min. wt. lb/sq. ft.	Maximum Sq ft /bag	Minimum bags/1000 Sq ft				
13	4.3	3.9	0.34	73.2	13.7	12.5	12.9	12.4	12.8
19	6.0	5.4	0.56	44.3	22.6	21.2	21.7	20.5	21.2
22	6.8	6.2	0.68	36.9	27.1	25.7	26.1	24.8	25.6
30	9.2	8.3	0.98	25.4	39.3	37.8	38.3	36.9	37.7
38	11.5	10.4	1.29	19.4	51.6	50.0	50.5	49.0	49.9
49	14.8	13.3	1.71	14.6	68.5	66.9	67.4	65.9	66.8
60	18.0	16.2	2.14	11.7	85.5	83.8	84.4	82.8	83.7
Walls									
13	2x4	3.5	0.68	31.6	31.6	27.2	29.6		
21	2x6	5.5	1.07	20.2	49.5			42.8	44.2

Coverage chart is based on the settled thickness and is for estimating purposes only. The above calculations are based on progressive density. The initial installed thickness was obtained using a Krendl 500 blowing machine. The machine settings are not adjustable. Actual coverage will be influenced by job conditions and application techniques and may vary as much as 10% without significantly affecting the stated R-value. Regardless of initial thickness, you must use the number of bags required to achieve the proper R-value.



••••• Sound transmission Coefficient (STC) rating

During general full scale wall testing, cellulose effectively reduces the airborne sound from room to room. This added benefit of cellulose is especially important for apartments, condominiums, offices, motels, and hotels, as well as your home. Buildings insulated with cellulose have a noticeable “quietness”. The sharp sounds that easily transmit through normally insulated structures are subdued by the increased mass of cellulose.

The Sound Transmission Coefficient (STC) rating is based on performance with frequencies from 125 to 4000 Hertz (the speech frequencies)

STC	Privacy Achieved
25	Normal speech easily understood
30	Normal speech audible but not intelligible
35	Loud speech audible and fairly understandable
40	Loud speech audible but not intelligible
45	Loud speech barely audible
50	Shouting barely audible
55	Shouting not audible

General guidelines for controlling noise between spaces:

- Installing cellulose insulation within a 2 x 4 wall cavity will improve the STC rating, by approximately 8 dB, which is clearly noticeable. Cellulose installed in a 2 x 6 wall cavity will add approximately 14 dB to the STC rating.
- Cellulose insulation outperforms all other insulation systems for sound attenuation. In a typical 2 x 4 wall with a single layer of 1/2” drywall on each side (Tested STC):
 - o Cellulose STC 41
 - o Fiberglass or mineral fiber STC 38
 - o Icynene STC 37
 - o The installed performance in batt insulation systems is typically well below that of their tested STC values.
- Metal studs perform better than wood studs by about 5db.
- Staggering the studs or using dual studs can provide a substantial increase in sound isolation.
 - A wall must extend to the structural deck in order to achieve optimal isolation. Walls extending only to a dropped ceiling will result in poor sound isolation.
 - Sound will travel through the weakest structural elements, which, many times, are doors, windows or electrical outlets.

The STC of wall assemblies complete with the installation of cellulose insulation can be estimated by using the table below.

STC	Wall Component
27	Starting wall: Uninsulated wood studs 2x4 - 16” OC
+3	Studs 24” OC
+5	Metal studs
+3	1/2” Gypsum
+4	1/2” Type X Gypsum
+4	5/8” Gypsum
+5	5/8” Type X Gypsum
+2	3/8” Plywood
+3	1/2” Plywood
+4	5/8” Plywood
+3	3/8” OSB
+4	1/2” OSB
+5	5/8” OSB
+8	3 1/2” Cellulose insulation
+14	5 1/2” Cellulose insulation
+3	Resilient Channel

Wood Stud Assemblies		
Description	Cellulose	STC
2x4 stud 16” OC, faced on both sides with 1/2” gypsum wall board	3 1/2”	41
2x6 stud 16” OC, faced on both sides with 1/2” gypsum wall board	5 1/2”	47
Metal Stud Assemblies		
3 5/8” metal studs 16” OC faced on both sides with 5/8” gypsum wall board	3 1/2”	48
3 5/8” metal studs 24” OC faced on both sides with 5/8” gypsum wall board	3 1/2”	51

ASTM standards for testing	
ASTM E90	Sound transmission loss
ASTM E413	Sound transmission loss
ASTM E1042	Acoustical absorption
ASTM C423	Noise reduction coefficients

•••• Safety and toxicity

Thermolok InCide® meets the safety standards of the U.S. Consumer Products Safety Commission, (CPSC) American Society of Testing Materials (ASTM), the Cellulose Insulation Manufacturers Association (CIMA), and Federal Specification HHI-515. It also complies with all requirements of the Environmental Protection Agency's (EPA) Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). No other insulation meets such exacting quality control standards.



Intertox, Inc., has extensive experience reviewing the general use and toxicity of boron-based products, and in particular sodium polyborate. A general review of boron-based compounds indicates that these compounds occur naturally in low concentrations in air, water, and soil, and are of generally low toxicity. We review here six acute animal toxicity studies in which a 100% all boron-containing cellulose insulation (BCI) product, essentially identical to Hamilton Manufacturing, Inc's., **Thermolok InCide®** was tested. The acute toxicity studies reviewed, include those examining adverse health effects associated with contact with the product on the skin and eyes, and through inhalation and ingestion. These studies appear to have been performed according to acceptable experimental protocols.

Thermolok InCide® with the benchmark LD50, in excess of several grams per kilogram of body weight, can be classified as "relatively harmless." Table salt, with an oral LD50 of about 4000 mg/kg 22, is several times more acutely toxic than Thermolok InCide.® Compared to other related household products and materials, **Thermolok InCide®** is generally less toxic.

For example, the LD50 for aspirin is 1500 mg/kg in male rats, requiring substantially less to be ingested to produce a toxic effect than would be the case for **Thermolok InCide®**. The results of the reviewed studies indicate that the effects of exposures to **Thermolok InCide®** are minor and temporary unless large doses are taken orally.

Furthermore, ingestion of large doses, by weight, of **Thermolok InCide®** is impractical due to the low density of the product. The minor and temporary health impacts of exposure to the product noted in the studies are consistent with exposure to non-toxic particulate matter, which can cause irritation when introduced under the eyelid and into the respiratory system. Beyond these effects, we expect no adverse health impacts to result from exposure to **Thermolok InCide®** under foreseeable product application and building occupation conditions.

Richard C. Pleus, Ph. D.
July 1997

INTERTOX, Inc.
2601 Elliott Avenue, Suite 201
Seattle, WA 98121

•••• Mold & Fungi Resistance

Thermolok InCide® Cellulose Insulation contains Board Defence (EPA registered No. 44757-20) a 100% borate at no less than 23% by weight. The inclusion of borate has been tested for the resistance to the growth of fungi in accordance with ASTM C 739 and helps to prevent the growth of the following fungi:

Aspergillus niger
Aspergillus flavus
Aspergillus versicolor
Penicillium funiculosum
Chaetomium globosum

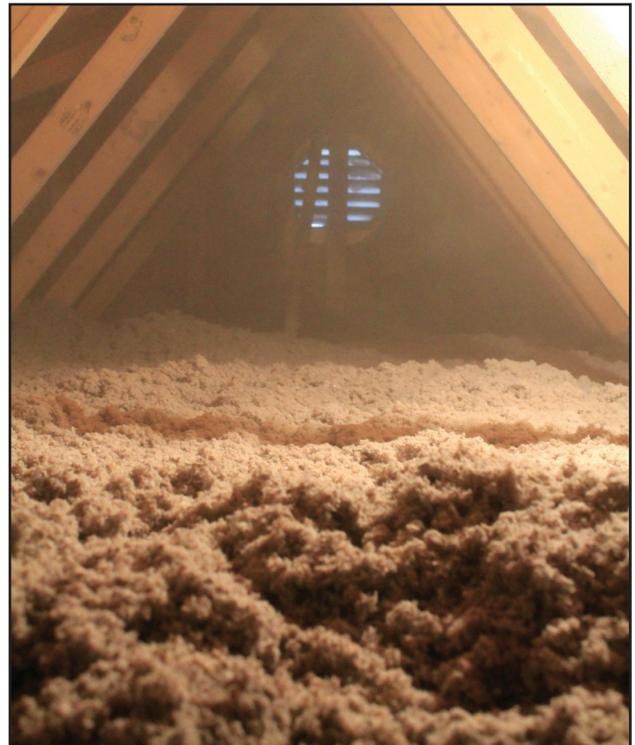
In accordance with ASTM C 739, specimens of the insulation were inoculated with the test fungi listed below and maintained at $30^{\circ} \pm 2^{\circ} \text{C}$ and $95\% \pm 5\%$ relative humidity for an incubation period of 28-days. At the end of the 28-day incubation period the insulation specimens and the comparative material were examined at 40X magnification as specified in the standard. The insulation being tested passes, if at least two of the test specimens exposed to a particular fungi exhibit growth that is no greater than that exhibited by the comparative material.



•••• Pest Control

Thermolok InCide® insulation is a unique product that provides both high thermal performance and the added advantage of pest control. **Thermolok InCide®** is registered with the United States Environmental Protection Agency (EPA) No. 44757-4-65049. It is an odorless, nonflammable formula that is strong enough to protect from pest infestation, but harmless to humans and pets.

Thermolok InCide® insulation has been proven 99.7% effective in killing cockroaches, and is also effective in controlling ants, termites, and other insects. Properly installed, **Thermolok InCide®** insulation will retain its insecticide activity for the life of the structure, and insects cannot develop an immunity to it.



• • • • Moisture & vapor retarders

Moisture is one of the more misunderstood aspects of building-shell performance. Different insulation materials exhibit different moisture handling characteristics. These characteristics must be considered in designing insulated assemblies.

Glass fibers do not absorb moisture, however, moisture can condense within the insulation and migrate to parts of the insulated assembly that may be damaged. Fiberglass insulation is very susceptible to air exfiltration, the major cause of moisture migration into walls and ceilings.

Exfiltration of moisture-laden air into walls and ceilings is the major moisture transfer mechanism. The low air permeability

of cellulose all but eliminates this means of moisture movement. Cellulose insulation demonstrates the ability to control moisture migration by eliminating air movement, making vapor retarders unnecessary when cellulose insulation is installed.

Therefore, the Cellulose Insulation Manufacturers Association does not recommend use of a polyethylene vapor retarder with any cellulose wall installation, unless there are specific extraordinary conditions indicating that a vapor retarder would enhance the moisture performance of the wall. Increasingly, building science is coming down against prescriptive use of polyethylene vapor retarders.

• • • • Air infiltration

Uncontrolled leakage of air through exterior walls and ceilings of homes is almost as important as R-value in determining how much energy will be required to heat and cool a building. This factor is all too often totally ignored in specifying insulation.

Fiberglass is used as air filter media, and fiberglass in walls and ceilings behaves much as the fiberglass in an air filter. Air rushes right through it. During remodeling when old fiberglass-insulated wall cavities are opened, the batts are usually found to be covered by dust, just as an air filter would be.

Cellulose insulation is very effective at sealing buildings against air infiltration. Controlled air infiltration is one of the most important factors for energy efficiency in the thermal performance of a building.



Research shows cellulose to be up to 40% better than fiberglass at controlling air infiltration.

•••• Standard Specification

1. Scope

1.1 This specification provides data pertinent to the pneumatic application of **Thermolok InCide**[®] cellulose insulation in attics and walls. **Thermolok InCide**[®] cellulose insulation provides outstanding resistance to heat flow for thermal applications, noise control for acoustical treatments, and fire control in walls and attics of residential and commercial construction.

2. Materials

2.1 More than 80% of the content of **Thermolok InCide**[®] cellulose insulation is processed from recycled cellulose fiber. These fibers are chemically treated to create permanent flame resistance. The additives are non-toxic, will not irritate normal skin, will not attract vermin or insects, and will not adversely affect other building materials.

3. Functions

3.1 Insulation. **Thermolok InCide**[®] cellulose insulation resists the flow of heat in three ways. Air is trapped (1) within, (2) by the wall of the fiber, and (3) between fibers creating significant resistance to air movement. This natural ability to trap air provides cellulose insulation with 25% to 40% more effective insulation power than the same R-Value of other low-density loose-fill fibrous insulation materials.

3.2 Sound Control. These same isolated air pockets and density also provide effective noise reduction in walls and between floors by effectively creating a customized batt at the job site.

4. Material Characteristics

4.1 All cellulose insulation sold in the U.S. must conform to the Consumer Products Safety Commission (CPS) standard 16 CFR Part 1209 and 1404. In addition, Comfort plus cellulose meets all the test requirements of American Society of Testing and Materials (ASTM) C739. Underwriter's Laboratories (UL) R 8296 tested the following properties:

4.1.1 Density

The maximum density anticipated after long-term settling of dry applications was determined by the following specifications:

ASTM C739 1.45 lb/ft³ (25.6 kg/cm³)

4.1.2 Thermal Resistance

The average thermal resistance per inch was determined by test method ASTM C518 (4 in. thick):

ASTM C739 3.7 (R-Value/in)

4.1.3 Surface Burning Characteristics

Two surface burning characteristics are evaluated. They are Critical Radiant Flux using test method ASTM E970, and Flame Spread using ASTM E84. **Thermolok InCide**[®] cellulose insulation meets or exceeds the specified requirements for each test as follows:

ASTM E970 greater than 0.12 watts/cm

ASTM E84 less than 25

4.1.3.1 Building Codes

Properly installed **Thermolok InCide**[®] cellulose insulation meets the requirements for thermal insulation materials set forth in CABO, ICBO, BOCA, SBCCI and the Model Energy Code.

4.1.4 Moisture Vapor Sorption

This requirement assures that normal variations in relative humidity will not adversely affect thermal resistance. **Thermolok InCide**[®] insulation meets the requirements of less than 15% for maximum weight gain under the specified test conditions.

4.1.5 Corrosiveness

When in contact with steel, copper, aluminum, or galvanized materials, **Thermolok InCide**[®] cellulose insulation was determined to be non-corrosive.

4.1.6 Other Properties Tested

Thermolok InCide[®] cellulose insulation passed additional tests:

Odor Emission	Flame Spread Permanency
Fungi Resistance	Smolder Resistance
Acute Toxicity Study	EPA Registration

•••• Cathedral Ceilings and Moisture

In a cathedral ceiling, what is the purpose of having a 1 inch air space above the insulation? Some researchers will claim that it is to allow the air to remove the accumulated moisture out of the enclosed ceiling area. But how does the moisture get there in the first place?

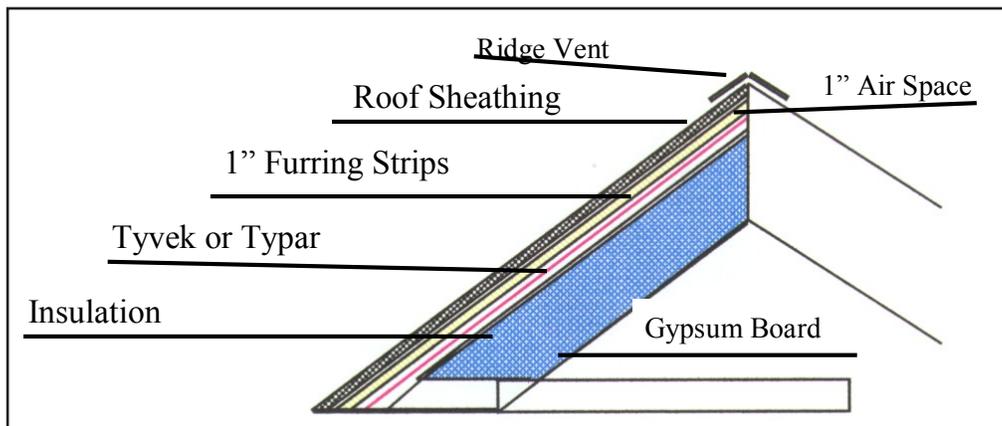
If an air space is designed in a cathedral ceiling for air to move, isn't it logical that moisture will be present within that air space on any given day when moisture levels are high in the air? Is that really what you want?

If air accounts for the removal of the moisture, what prevents air from transporting moisture into the air space?

We would have to conclude that air is the vital force that transports any moisture movement. Therefore, the absence of air, or the lack of air movement, would prohibit moisture migration.

The main function of a quality insulation is to block or minimize air movement, which enhances the quality and efficiency of the real R-value of the insulation.

The superior quality of cellulose insulation offers the unique features of minimizing air movement, giving a high R-value, plus prevents air movement and limiting moisture migration into an insulated area.



Some scientists advocate a 1" air space is necessary to maintain a lower roof temperature during hotter seasons. A study conducted in Las Vegas, Nevada, concluded that the maximum measured plywood sheathing temperature increased only 17° using a closed (no vented air space) vs. an open 1" air space. The maximum measured plywood sheathing temperature of 126° was well within an acceptable temperature range (less than 180° F) of wood-based roof sheathing.

The roof rafters are covered with an airtight but moisture-permeable "under-roof" membrane, such as Tyvek or Typar, and the cavity is filled full with insulation. Then install 1 inch furring strips on top of the membrane and roof rafters and before sheathing is applied. The roof is then ventilated above the under-roof. Ventilation would be supplied through a continuous ridge and soffit vents.

•••• Recessed lighting

IC - for areas in which insulation is used

IC (Insulated Ceiling) housings are UL (Underwriter Laboratories) listed for direct contact with insulation and may be completely covered by insulation. They minimize heat loss, lower heating and air conditioning energy usage, and reduce operation costs. IC housings can be used anywhere, but should be used in all areas where insulation is installed.



For **Thermolok InCide®** we recommend using only “IC” rated, when installing recess lighting.

TC - for areas without insulation

TC housings are UL listed for general usage but if insulation is present, a 3” ventilation space must be provided between the insulation and the housing. TC units are recommended for all areas where insulation is not present.



**The insulation installer must be sure the cover housing is securely mounted in place.
Do not cover with insulation if the recess light housings are not in place.**

••••• **Insulation Certificate**



R&D Services
PO Box 2400
Cookeville, TN 38502-2400
Phone: 001.931.372.8871

Classification: Cellulose Insulation
Thermolok InCide®
Reference File: RDS-LF9298
Class 1 building material

This product meets the amended CPSC standard HH-I-515E; 16CFR, Sections 1209, 1404 for flame resistance and corrosiveness of cellulose insulation.

Classified in accordance with the following ASTM C739 characteristics.

Flammability Characteristics

Critical Radiant Flux	Greater than or equal to 0.12 W/cm ²
Smoldering Combustion	Less than or equal to 15.0%
Flame Spread	5
Smoke Spread	0

Environmental Characteristics

Corrosiveness	Acceptable
Fungi Resistance	Acceptable

Physical Characteristics

Density (Settled)	1.45 lb/ft ³
Thermal Resistance	3.7 R/in. (at 4 in.)
Moisture Vapor Sorption	Acceptable
Odor Emission	Acceptable

Physical Characteristics (Sidewall Application)

Density	3.0 lb/ft sq.
Thermal Resistance	3.8 R/in. (at 4 in.)

Limited Warranty for life of structure

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Email: info@hmi-mfg.com
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