NU-WOOL® Premium Cellulose Insulation

This binder contains the information you need to easily specify our insulation product in your projects. This book attempts to cover all the issues that architects and other specifiers have about the product based on our surveys. However, there may be new issues and applications that have not been addressed and you are encouraged to call the Technical Services Department at NU-WOOL Co. Inc. to have those questions answered.

NU-WOOL Premium Cellulose Insulation makes your building more efficient, healthy and quieter. NU-WOOL also is a product with a high recycled (85% post consumer) content. This helps our environment and also helps make your project “Greener.”

Visit us on the web at www.nuwool.com to learn more about this product. To contact the Technical Services Department, call 800-748-0128. If you would like one of our knowledgeable staff to present an AIA Accredited Learning Event at your facility call our toll free number.
Product Specification

1. PRODUCT NAME

NU-WOOL Premium Cellulose Insulation and WALLSEAL are registered trademarks for NU-WOOL Co., Inc.

2. MANUFACTURER

NU-WOOL Premium Cellulose is made from recycled paper (85%) and is packaged in 26 pound bags. Installation is done by factory trained installers. NU-WOOL WALLSEAL Cellulose Insulation is a spray-in-place cellulose insulation made from recycled paper, primarily newspaper. It is installed in both attics and walls of residential and commercial buildings because of its superior thermal and air infiltration properties. WALLSEAL is an energy-saving material that has an R-Value of 3.8 per inch, and will last for the life of the structure. NU-WOOL uses borate chemicals as a fire retardant, making NU-WOOL WALLSEAL Cellulose Insulation one of the most environmentally friendly materials used in construction.

3. PRODUCT DESCRIPTION

NU-WOOL Premium Cellulose Insulation is an energy saving insulation made from recycled paper. NU-WOOL Premium Cellulose Insulation, with its superior thermal and air infiltration properties, is installed in both attics and walls of residential and commercial buildings. This environmentally friendly, “green” insulation provides up to 40%* savings on energy bills when compared to fiberglass insulation materials. NU-WOOL Premium Cellulose Insulation also contains an EPA registered fungicide making it resistant to the growth of mold.

WALLSEAL is applied by a spray-on method that insures the correct density to prevent settling while making the wall resistant to air movement and achieving maximum thermal performance.

NU-WOOL Attic insulation is applied with air to open spaces at a density of 1.6 pounds per cubic foot. The manufacturers’ coverage chart has reflects the settling after application in open blow situations.

4. TECHNICAL DATA

4.1 All cellulose insulation must conform to the CPSC standard 16 CFR Part 1209 and 1404. NU-WOOL also meets ASTM C-739. Also refer to UL R-8078 and R-13173.

4.2 Density is measured using ASTM C-739 standards and is 1.6 lb/ft³.

4.3 Thermal resistance was measured by test method ASTM C-518 (4 in. thick) and is 3.8 (R-value/in.)

4.4 Surface Burning Characteristics: Surface burning characteristics are determined using two methods. Critical radiant flux using test method ASTM E 970 and ASTM E 84. ASTM E 970 Greater than 0.12 watts/cm² ASTM E 84 Less than 25, Class 1

4.5 Moisture Vapor Sorption: NU-WOOL meets the requirements of ASTM C 739 of less than 15% maximum weight gain under test conditions. Variations in relative humidity will not affect the thermal properties of the insulation.

4.6 Corrosiveness: NU-WOOL is tested for contact against copper, steel and aluminum under the test conditions of ASTM C 739 and is not corrosive to these metals.

4.7 Building Codes: NU-WOOL meets all the current building codes.

4.8 Sound Transmission Loss (STC) Ratings: NU-WOOL has been tested for numerous wall assemblies at Riverbank Laboratories using ASTM E 90. Specific wall assemblies are listed in this book.

4.9 Other Test Properties: Under ASTM C 739, there are tests for fungi resistance, odor and smolder resistance.
SECTION 072100 - THERMAL INSULATION

1.1 SUMMARY

A. Applications:
   1. Cavity-wall insulation
   2. Concealed building insulation
   3. Exposed building insulation
   4. Loose-fill building insulation
   5. Self-supported, spray-applied cellulosic insulation
   6. Vapor retarders
   7. Sound attenuation insulation.

1.2 PERFORMANCE REQUIREMENTS

A. Product meets ASTM E 84 for surface burning characteristics
B. Product is tested for ASTM E 90 for STC ratings
C. Product is tested to ASTM C 739 standards
D. Product is tested to ASTM E 119 standards

1.3 MATERIALS

A. Insulation:
   1. Cellulose Spray-on Insulation: Installed Density 3.2 lb/cu. ft. (51 kg/cu. m)
   2. Cellulose Attic Insulation: Installed Density 1.60 lb/cu. ft. (26 kg/cu.)

B. Vapor Retarders: [Polyethylene] [Reinforced polyethylene] [Fire-retardant, reinforced polyethylene] [Foil-polyester film]. Vapor barriers needed for high humidity areas only.

C. Auxiliary Insulating Materials
   1. Eave ventilation troughs
   2. Insulation fabric

END OF SECTION 072100
UL Evaluation Report

UL ER8078-01

Issued: May 14, 2015

Visit UL’s On-Line Certifications Directory:  www.ul.com/erdirectory
for current status of report.

UL Category Code:  ULEX

CSI MasterFormat®

DIVISION:  07 00 00 – THERMAL AND MOISTURE PROTECTION
Sub-level 2:  07 20 00 – Thermal Protection
Sub-level 3:  07 21 00 – Thermal Insulation
Sub-level 4:  07 21 23 – Loose Fill Insulation
Sub-level 4:  07 21 26 – Blown Insulation

COMPANY:

Nu- Wool Company Inc.
2472 Port Sheldon St
Jenison, MI 49428
(800) 748-0128
www.nuwool.com

1. SUBJECT:

NU-WOOL PREMIUM CELLULOSE INSULATION, NU-WOOL ENERGY CARE CELLULOSE INSULATION AND NU-WOOL WALLSEAL FIRE & SOUND INSULATION

Throughout this report, the reference to Nu-Wool Insulation will apply to all products described above, except where indicated otherwise, and except for Nu-Wool Wallseal Fire & Sound Insulation.
2. SCOPE OF EVALUATION

- 2015, 2012 and 2009 International Residential Code ® (IRC)
- ICC-ES Acceptance Criteria for Quality Documentation (AC10), dated June 2014

The products were evaluated for the following properties:

- Surface Burning Characteristics (ANSI/UL723, ASTM E84)
- Physical Properties (ASTM C739)
- Thermal Resistance (ASTM C739, ASTM C518)
- Sound Transmission (ASTM E90, ASTM E413)
- Fireblocking
- Fire-Resistance Rated Construction (ANSI/UL263)
- Ignition Barrier – Attics
- Attic and crawlspace applications

3. REFERENCED DOCUMENTS

- ANSI/UL723, 10th Ed. (ASTM E84), Test for Surface Burning Characteristics of Building Materials
- ANSI/UL263, 14th Ed. (ASTM E119), Fire Test of Building Construction and Materials
- ASTM C739-11, Standard Specification for Cellulosic Fiber Loose Fill Thermal Insulation
- ASTM C1015-06, Standard Practice for Installation of Cellulosic and Mineral Fiber Loose Fill Thermal Insulation
- ASTM E413-10, Classification for Rating Sound Insulation
- CPSC 16 CFR Part 1404 (2002), Cellulose Insulation
- ICC-ES Acceptance Criteria for Quality Documentation (AC10), dated June 2014

4. USES

Nu-Wool Insulation is used as nonstructural thermal insulating material in buildings of all types of construction. The insulation is for use as an interior finish on or within floors, floor-ceiling or roof-ceiling assemblies, attics, crawl spaces, walls and partitions. See Sections 5 and 6 for specific applications for each product. The insulation is recognized for use in sound transmission assemblies, as fire blocking material, in both non-fire-resistance rated construction and fire-resistance rated construction in accordance with Section 703 of the 2015, 2012, or 2009 IBC, and as an ignition barrier over foam plastic in accordance with Section R316.5.3 of the 2015, 2012, or 2009 IRC.
Nu-Wool Wallseal Fire & Sound Insulation is for use in specific fire-resistance rated construction in accordance with Section 703 of the 2015, 2012, or 2009 IBC, as described in Section 6.10.

5. PRODUCT DESCRIPTION

5.1 General:

Nu-Wool Insulation consists of a uniform low density mixture of recycled cellulosic fibers and borate-based fire retardant chemicals. Product application methods include wall spray (spray-applied), loose fill, and dry dense-pack, as described in Section 6. Spray-applied applications are applied with water. Loose fill and dry dense-pack applications are applied without water. Fire-blocking, and fire-resistance rated applications are non-thermal insulation applications for use in various structures.

Nu-Wool Wallseal Fire & Sound Insulation is a spray-applied, uniform, low density mixture of recycled cellulosic fibers and borate-based fire retardant chemicals.

5.2 Surface Burning Characteristics

The products meet the requirements of CPSC 16 CFR Part 1209 and have a flame spread index of not more than 25, and a smoke developed index of not more than 50 when tested in accordance with ANSI/UL 723 (ASTM E84) in accordance with the requirements set forth in Section 720 of the 2015 or 2012 IBC (Section 719 of the 2009 code) and Section 302.10 of the 2015, 2012, or 2009 IRC.

5.3 ASTM C739 Properties

Nu-Wool insulation has a thermal resistance R-value of 3.8 F-ft²-h/ Btu at a nominal density of 1.6 lb/ft³ when tested in accordance with ASTM C739 and C518, at a mean sample temperature of 75°F. In addition, the insulation has been evaluated in accordance with ASTM C739 for the following properties:

<table>
<thead>
<tr>
<th>Property</th>
<th>Tested in Accordance with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Settled Density</td>
<td>ASTM C739 / CPSC 16 CFR 1209</td>
</tr>
<tr>
<td>Smoldering Combustion</td>
<td>ASTM C739 / CPSC 16 CFR 1209</td>
</tr>
<tr>
<td>Odor Emission</td>
<td>ASTM C739 / ASTM C1304</td>
</tr>
<tr>
<td>Critical Radiant Flux</td>
<td>ASTM C739 / ASTM E970 / CPSC 16 CFR 1209</td>
</tr>
<tr>
<td>Corrosiveness</td>
<td>ASTM C739 / CPSC 16 CFR 1209</td>
</tr>
<tr>
<td>Fungi Resistance</td>
<td>ASTM C739 / ASTM C1338</td>
</tr>
<tr>
<td>Moisture Vapor Sorption</td>
<td>ASTM C739</td>
</tr>
</tbody>
</table>
5.4 Sound Transmission:

The products described in this section have been evaluated in accordance with ASTM E90 and ASTM E413 for use as part of the Sound Transmission Rated Assemblies as summarized below:

<table>
<thead>
<tr>
<th>Product</th>
<th>In accordance with</th>
<th>UL Design Assembly</th>
<th>STC rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nu-Wool Insulation</td>
<td>ASTM E90, ASTM E413</td>
<td>U360</td>
<td>50 or greater</td>
</tr>
<tr>
<td>Nu-Wool Wallseal Fire &amp; Sound Insulation</td>
<td>ASTM E90, ASTM E413</td>
<td>U382</td>
<td>50 or greater</td>
</tr>
</tbody>
</table>

Refer to the UL Fire Resistance Directory, File R8078 (CCAŻ), for details of the sound assemblies above.

6. INSTALLATION

6.1 General:

Installation of Nu-Wool Insulation and Nu-Wool Wallseal Fire & Sound Insulation must comply with ASTM C1015, as applicable, this report, and the manufacturer’s published installation instructions.

Installation must be in accordance with CPSC 16 CFR 1404, Section E4004 of the 2015, 2012, or 2009 IRC, and NFPA 70 (NEC) 410.116 when installation is above or adjacent to recessed luminaires (lighting fixtures) or other heat-producing elements. A permanent barrier is necessary to maintain a 3 inch (76 mm) clearance between the item and the insulation, unless the recessed luminaire is identified as Type IC and is listed in accordance with the applicable code for direct contact with insulation, or the heat-producing element is listed for zero clearance to combustibles. The insulation is limited to areas where the temperature will not exceed 194°F (90°C) in accordance with Section E4003.2 of the 2015, 2012, or 2009 IRC.

When Nu-Wool Insulation or Nu-Wool Wallseal Fire & Sound Insulation is installed within a plenum, the installation must be in accordance with Section 602.2.1 of the 2015, 2012, or 2009 IMC. Installation is not permitted in the area from the exit of the cooling coil to the downstream end of the drain pan, in accordance with Section 604.13 of the 2015, 2012, or 2009 IRC.

The code official may require an approved vapor retarder to be installed in accordance with Section 1405.3 of the 2015, 2012, or 2009 IBD, Section R702.7 of the 2015 or 2012 IRC, Section R601.3 of the 2009 IRC, or Section 402.1.1 of the 2015 IECC. Protection against condensation in exterior wall assemblies must be provided in accordance with these sections of the code.

Attic ventilation, when required by the code, must not be blocked by the application of the insulation when installed in accordance with Section R806.3 of the 2015, 2012, or 2009 IRC.

6.2 Wall Spray (Spray-Applied):

Nu-Wool Insulation may be used in spray-applied, exposed applications as an interior finish and in concealed applications within walls and partitions at a density of between 3 and 4.6 lbs/ft³ (43.2 and 73.7 kg/m³).

Before enclosing spray applied Nu-Wool insulation in walls, the insulation must be left uncovered for a minimum of 24 hours.
Spray-applied Nu-Wool insulation must be installed in accordance with the manufacturer’s detailed instructions, published by Nu-Wool, Co. Inc.

Nu-Wool Wallseal Fire & Sound Insulation is a spray-applied, uniform, low density mixture of recycled cellulosic fibers and borate based fire retardant chemicals used for UL fire wall design designation U382. The product is spray-applied with water at a minimum density of 4.58 lbs/ft³ (73.4 kg/m³), and is assembly specific.

Before enclosing Nu-Wool Wallseal Fire & Sound Insulation in walls, the insulation must be left uncovered for a minimum of 24 hours.

6.3 Loose Fill:

Nu-Wool Insulation is used for exposed loose fill applications on horizontal or sloped attic floors at a density of between 1.5 and 3.0 lbs/ft³ (19.2 and 48.0 kg/m³) when installed in accordance with Section R806.3 of the 2015, 2009, or 2009 IRC.

Nu-Wool Loose Fill Insulation is installed into its final position using a pneumatic device. The insulation may be applied to sloped attic floors having a maximum slope of 5:12 (41.7 percent slope).

Loose fill Nu-Wool Insulation applications must be installed in accordance with the manufacturer’s detailed instructions, published by Nu-Wool Co., Inc.

6.4 Dry Dense-Pack:

Nu-Wool Insulation is used in dry dense-pack applications for concealed spaces of walls, partitions, and roof-ceiling or floor-ceiling assemblies. Dry dense-pack products are installed at a density of between 3.5 and 5.0 lbs/ft³ (56.1 and 80.0 kg/m³) when installed in accordance with Section R806.5 of the 2015 or 2012 IRC or Section R806.4 of the 2009 IRC, as applicable.

Dry dense-pack installation requires pneumatic application of the product in closed or netted cavities. Nu-Wool Insulation installed in dry dense-pack applications must be installed in accordance with the manufacturer’s detailed instructions, published by Nu-Wool Co., Inc.

6.5 Installation Directly Beneath the Roof:

Nu-Wool Insulation may be installed beneath the roof deck when installed in accordance with Section R806.5 of the 2015 or 2012 IRC, or Section R806.4 of the 2009 IRC, for the following applications using the dry dense-pack methodology:

- **Exposed Roof Decks and Roof Framing Members:**

  May be installed beneath exposed roof decks when dry dense-packed behind netting at a minimum density of 3.5 lbs/ft³. Climate Zones 2B and 3B do not require an air impermeable insulation layer to the roof deck per Section R806.5 of the IRC. The use of Nu-Wool products in cathedralized attics outside of Zones 2B and 3B needs to be reviewed by a hygric / thermal analysis evaluation tool, such as WUFI (Wärme und Feuchtetransport Instationär, or Transient Heat and Moisture Transport), to determine the need for air barriers on the exposed side of the insulation.
• **Enclosed Rafter Spaces (Insulated Cathedral Ceilings):**

Insulated cathedral ceilings are rafter spaces, formed where ceilings are applied directly to the underside of the roof framing members, which fully encapsulate the thermal insulation on all sides. In applications with vented rafter spaces, Nu-Wool insulation is dry dense-packed to a density of 3.5 to 5.0 lbs/ft\(^3\) (56.1 to 80.0 kg/m\(^3\)) and installed in accordance with Section 1203.2 of the 2015, 2012, or 2009 IBC and Section R806.5 of the 2015 or 2012 IRC or Section R806.4 of the 2009 IRC, as applicable.

In applications with unvented rafter spaces, Nu-Wool Insulation may be dry dense-packed over an air impermeable insulation in accordance with Section R806.5 of the 2015 or 2012 IRC or Section R806.4 of the 2009 IRC, as applicable. The air impermeable insulation must be of a thickness necessary to comply with the R-Value specified in Table R806.5 of the 2015 or 2012 IRC or Table R806.4 of the 2009 IRC, as applicable.

6.6 **Metal Construction:**

Nu-Wool Insulation may be used in construction using metal studs, metal buildings, or any construction in which Nu-Wool Insulation will be in contact with metal structural or sheathing members.

6.7 **Crawl Spaces:**

Nu-Wool Insulation can be applied to foundation walls in unvented crawl spaces. Nu-Wool Insulation may be used as floor / ceiling insulation over a crawl space.

6.8 **Fireblocking:**

Nu-Wool Insulation may be used as fireblocking materials in accordance with Section 718.2.1 of the 2015 or 2012 IBC, Section 717.2.1 of the 2009 IBC, Sections R302.11.1 and R602.8 of the 2015, 2012 or 2009 IRC, and may be used as alternatives to the fireblocking materials required in Section R302.11.1 of the 2015, 2012 or 2009 IRC.

The insulation may be placed in concealed spaces of wood or steel stud walls and partitions of combustible construction with stud spacing up to 24 inches (610 mm) on center. When the walls and partitions have existing insulation in the spaces between the studs, access holes measuring from 1 inch (25.4 mm) in diameter to 6 inches (152 mm) square are cut in the wall covering at each space between studs, and the plugs are removed. The existing insulation is cut and pushed away to form a space with a minimum height of 16-inches (406 mm) above the floor level. Nu-Wool Insulation is then installed into the open space, filling from the floor a full 16-inch (406 mm) (or greater) height, and contacting all surfaces. After installation has been completed, the plugs are replaced and the wall covering is repaired with tape and joint compound in accordance with ASTM C840 or GA 216.

When there is no insulation in the wall or partition, insulation must completely fill the stud cavity to a minimum depth of 16 inches (406 mm).

6.9 **Installation in Attics when used as a Prescribed Ignition Barrier:**

Nu-Wool Insulation may be used as an ignition barrier over foam plastics on attic floors in accordance with Section R316.5.3 of the 2015, 2012, or 2009 IRC, when applied at a minimum thickness of 1-1/2 inches (38.1 mm) and a minimum installed density of 1.6 lbs/ft\(^3\) (25.6 kg/m\(^3\)).
6.10 Fire-Resistance:

6.10.1 Calculated Fire-Resistance

The fire-resistance rating of wood-stud walls is increased by 15 minutes when calculating fire-resistance in accordance with Table 722.6.2(5) of the 2015 or 2012 IBC, or Table 721.6.2(5) of the 2009 IBC, when the spaces between wood studs are completely filled with Nu-Wool Insulation having a nominal density not less than 2.6 pcf (41.6 kg/m³).

6.10.2 Fire-Resistance Ratings

Refer to the UL Fire Resistance Certification information for File R8078 (CCAZ) for applicable design coverage and details of the fire-resistance wall assemblies covered by this report. Fire-resistance ratings are only applicable when the assemblies are constructed in accordance with the published designs.

Nu-Wool Wallseal Fire & Sound Insulation is for use only in UL Fire Resistive Design No. U382. All other designs specified in the File R8078 (CCAZ) Classification Card are applicable for Nu-Wool Insulation.

7. CONDITIONS OF USE

7.1 General:

The products described in this report comply with, or are suitable alternatives to what is specified in, those codes listed in Section 2.0 of this report, subject to the following conditions:

7.2 Installation must comply with this report, the manufacturer’s published installation instructions, and the applicable code. If there is a conflict between this report and the manufacturer’s published installation instructions, this report governs.

7.3 Nu-Wool Insulation and Nu-Wool Wallseal Fire & Sound Insulation may be installed in noncombustible construction without affecting the noncombustible classification as described in Section 603.1 of the 2015, 2012, or 2009 IBC.

7.4 The installer must provide the code official a signed and dated statement describing the type of insulation installed, including thickness, coverage area, $R$-value and number of bags or pounds of insulation installed.

7.5 When the fire-resistance rated wall or floor-ceiling assemblies described in Section 6 are used in multi-family applications, design and details to verify compliance with all of the applicable requirements of any code must be prepared by a registered design professional where required by state or local jurisdictions in which the project is constructed and submitted to the local code official for approval.

7.6 Nu-Wool Insulation and Nu-Wool Wallseal Fire & Sound Insulation are manufactured under the UL LLC Classification and Follow-Up Service Program at the following Nu-Wool Co. Inc. plant, which includes audits in accordance with ICC-ES Acceptance Criteria for Quality Documentation, AC10:

Jenison, Michigan
8. SUPPORTING EVIDENCE

8.1 Manufacturer’s published installation instructions.

8.2 UL test reports and Classification in accordance with the following:
   - Surface Burning Characteristics in accordance with ANSI/UL 723 (ASTM E84). See UL Product Certification Category for Loose Fill Materials (BNST) Thermal transmission testing in accordance with ASTM C518
   - Physical properties testing in accordance with ASTM C739. See UL Product Certification Category for Loose Fill Materials (BPHX)
   - Fire Resistance in accordance with ANSI/UL 263 (ASTM E119). See UL Product Certification Category for Sprayed Fiber (CCAZ)

8.3 Reports of physical property testing in accordance with CPSC 16CFR Parts 1209 and 1404

8.4 Reports of sound transmission testing in accordance with ASTM E90 and ASTM E413

8.5 Reports of fireblocking testing

8.6 Documentation of quality system elements described in AC10, ICC-ES Acceptance Criteria for Quality Documentation (AC10), dated June 2014

9. IDENTIFICATION

Each package of Nu-Wool Insulation and Nu-Wool Wallseal Fire & Sound Insulation described in this evaluation report is identified by a marking bearing the report holder’s name (Nu-Wool Co. Inc.), the product name, the address of the manufacturing plant, the date of manufacture, the UL Classification Mark, and the evaluation report number UL ER8078-01. Additionally, each package must bear a label with information required by FTC 16 CFR Part 460 and CPSC 16 CFR, Parts 1209 and 1404.

The validity of the evaluation report is contingent upon this identification appearing on the product or UL Classification Mark certificate.

Jobsite labeling for the insulation must comply with Section N1101.10.1.1 of the 2015 IRC or Section N1101.12.1.1 of the 2012 IRC.

10. USE OF UL EVALUATION REPORT

10.1 The approval of building products, materials or systems is under the responsibility of the applicable authorities having jurisdiction.

10.2 UL Evaluation Reports shall not be used in any manner that implies an endorsement of the product, material or system by UL.

10.3 The current status of this report, as well as a complete directory of UL Evaluation Reports may be found at UL.com via our On-Line Certifications Directory:

   www.ul.com/erdirectory
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Product Guide Specification

Specifier Notes: This product guide specification is written according to the Construction Specifications Institute (CSI) 3-Part Format, including MasterFormat, SectionFormat, and PageFormat, as described in *The Project Resource Manual—CSI Manual of Practice, Fifth Edition*.

This section must be carefully reviewed and edited by the Architect to meet the requirements of the project and local building code. Coordinate this section with other specification sections and the Drawings. Delete all “Specifier Notes” after editing this section.


SECTION 07210 (07 21 00)
THERMAL INSULATION

Specifier Notes: This section covers Nu-Wool® Company, Inc. Nu-Wool® Premium Cellulose Insulation pneumatically blown dry into attics and floor assemblies and pneumatically sprayed damp into open wall cavities. Consult Nu-Wool Company, Inc. for assistance in editing this section for the specific application.

Nu-Wool Premium Cellulose Insulation may contribute points toward LEED™ certification. Consult Nu-Wool Company, Inc. for more information.

PART 1 GENERAL

1.1 SECTION INCLUDES

Specifier Notes: Edit the following paragraph for the specific application.

A. Cellulose Insulation:
   1. Pneumatically blown dry into attics and floor assemblies.
   2. Pneumatically sprayed damp into open wall cavities.

1.2 REFERENCE STANDARDS

Specifier Notes: List reference standards mentioned in this section, complete with designations and titles. Delete reference standards not included in this edited section. This article does not require compliance with reference standards, but is merely a listing of those used.


D. CPSC Standard 16 CFR Parts 1209 and 1404.


1.3 SUBMITTALS

Specifier Notes: Edit submittal requirements as required. Delete submittals not required.

A. Comply with Section 01330 (01 33 00) – Submittal Procedures.

B. Product Data: Submit manufacturer’s product data, including installation instructions.

C. Manufacturer’s Certification: Submit manufacturer’s certification that materials comply with specified requirements and are suitable for intended application.

D. Warranty Documentation: Submit manufacturer’s standard warranty.

1.4 QUALITY ASSURANCE

A. Manufacturer’s Qualifications: Manufacturer regularly engaged, for past 10 years, in manufacture of cellulose insulation of similar type to that specified.

B. Installer’s Qualifications:
   1. Installer regularly engaged, for past 1 year, in installation of cellulose insulation of similar type to that specified.
   2. Employ persons trained for installation of cellulose insulation.
   3. Installer: Certified by cellulose insulation manufacturer.
   4. Installer’s Equipment: Approved by cellulose insulation manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements: Deliver materials to site in manufacturer’s original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Storage and Handling Requirements:
   1. Store and handle materials in accordance with manufacturer’s instructions.
   2. Keep materials in manufacturer’s original, unopened containers and packaging until installation.
   3. Store materials in clean, dry area indoors.
   4. Protect materials during storage, handling, and installation to prevent damage.

PART 2 PRODUCTS

Nu-Wool Cellulose Insulation 07210 (07 21 00) - 2
2.1 MANUFACTURER


2.2 THERMAL INSULATION

Specifier Notes: Nu-Wool Premium Cellulose Insulation is used for both methods of installation – pneumatically blown dry into attics and floor assemblies and pneumatically sprayed damp into open wall cavities.

A. Cellulose Insulation:
   2. Pneumatically Sprayed Damp into Open Wall Cavities: Nu-Wool WALLSEAL Insulation.

B. Material Description:
   1. Manufactured from recycled newspapers.
   2. Post-Consumer Recycled Content: 85 percent minimum.
   3. Fibers: Treated with boric acid and sodium polyborate additives to create permanent flame resistance.
   4. Fungicide Additive:
      a. EPA registered.
      b. Makes insulation resistant to mold growth.
   5. Additives:
      a. Non-toxic.
      b. Non-corrosive.
      c. Does not irritate normal skin.
      d. Does not give off odor during or after installation.
      e. Does not attract vermin or insects.
      f. Does not adversely affect other building materials.

C. Compliance:
   1. UL classified R-8078.
   2. CPSC Standard 16 CFR Parts 1209 and 1404.
   3. ASTM C 739.
   5. ES Report ESR-2217.

D. Test Results:
   1. Settled Density:
      a. Maximum density after long-term settling of dry installation: 1.6 lbs per cu ft.
   2. Thermal Resistance:
      a. Average thermal resistance (R-value) per inch: 3.8.
   3. Flammability Characteristics:
      a. Critical Radiant Flux: 0.12 W/cm² minimum.
      b. Smoldering Combustion: No evidence of flaming and weight loss of 15.0 percent maximum.
4. Moisture Vapor Sorption:  
a. Moisture Gain in Insulation: 15 percent maximum by weight.

5. Environmental Characteristics:  
a. When in contact with steel, copper, aluminum, or galvanized materials: Non-corrosive.
   b. Does not support fungal growth.

a. Flame Spread Index: 15.
   b. Smoke Developed Index: 5.

PART 3 EXECUTION

3.1 EXAMINATION  
A. Examine areas to receive cellulose insulation.
B. Notify Architect of conditions that would adversely affect installation or subsequent use.
C. Do not begin installation until unacceptable conditions are corrected.

3.2 PREPARATION  
A. Protection of In-Place Conditions:  
   1. Protect adjacent surfaces, electrical boxes, open pipes, and register openings in accordance with manufacturer’s instructions.
   2. Protect adjacent surfaces from contact with pneumatically blown dry or pneumatically sprayed damp cellulose insulation.
   3. Prevent cellulose insulation from plugging soffit vents in attics.
B. Preparation: Ensure mechanical, plumbing, electrical, and other utility installations have been completed before installation of cellulose insulation.

3.3 INSTALLATION  
A. Install cellulose insulation in accordance with manufacturer’s instructions at locations indicated on the Drawings.
B. Install cellulose insulation to uniform density without voids, gaps, or air pockets.
C. Install cellulose insulation to density and depth to achieve required R-values.
D. Pneumatically Blown Dry Cellulose Insulation:  
   1. Pneumatically blow cellulose insulation dry into attics and floor assemblies after mechanical, plumbing, electrical, and other utility installations have been completed.
   2. Ensure heat-producing devices in attics have barriers constructed around them to prevent contact with cellulose insulation.
   3. Install cellulose insulation to a density of 1.6 lbs. per cu. ft.
E. Pneumatically Sprayed Damp Cellulose Insulation:
1. Pneumatically spray cellulose insulation with controlled water fog for adhesion into open wall cavities after mechanical, plumbing, electrical, and other utility installations have been completed.
2. Install cellulose insulation to a density of 3.0 to 3.5 lbs. per cu. ft to prevent settling in wall cavities.
3. Use quantity of water in installation to ensure proper adhesion into wall cavities and proper density.

Specifier Notes: Insert the section number in the following sentence.

4. Install gypsum board to 2-by-4 walls as specified in Section __________ a minimum of 24 hours after installation of pneumatically sprayed damp cellulose insulation.

3.4 PROTECTION

A. Protect installed cellulose insulation from damage during construction.

END OF SECTION
Underwriters Laboratories Testing
Information

R-8078 Underwriters Laboratories Inc.
R-13173
Classified Spray Fiber
Surface burning characteristics applied to
inorganic reinforced cement board with a
maximum thickness of 5 inches*

FLAME SPREAD 15
SMOKE DEVELOPED 5
• Must be applied with water in
  accordance with the application
  instructions.

Underwriters Laboratories Inc. R-8078
Classified Loose Fill Material
Classified in accordance with the following
ASTM C-739 Characteristics.

Flammability Characteristics
• Critical Radiant Flux: Greater than or
  equal to 0.12 w/cm2
• Smoldering Combustion: Less than or
  equal to 15.0%

Environmental Characteristics
• Corrosiveness; Acceptable
• Fungal Growth: Acceptable

Physical Characteristics
• Density (Settled): 1.6 pcf
• Thermal Resistance: 3.8 R (in.) (HH-I-515-E)
• Moisture Absorption: Acceptable
• Odor Emission: Acceptable
• Starch Content: Negative

3/2009
ASTM E 84-05 Standard Test Method
for Surface Burning Characteristics of
Building Materials
UL-723
NFPA-225

Scope
1.1 This fire-test-response standard for the comparative surface burning behavior of building materials is applicable to exposed surfaces such as walls and ceilings. The test is conducted with the specimen in the ceiling position with the surface to be evaluated exposed face down to the ignition source. The material, product, or assembly shall be capable of being mounted in the test position during the test. Thus, the specimen shall either be self-supporting by its own structural quality, held in place by added supports along the test surface, or secured from the back side.

1.2 The purpose of this test method is to determine the relative burning behavior of the material by observing the flame spread along the specimen. Flame spread and smoke developed index are reported. However, there is not necessarily a relationship between these two measurements.
ASTM E 970 Test Method for Critical Radiant Flux of Exposed Attic Insulation

This test method is used for flooring, carpeting, aircraft insulation and attic insulation. The critical radiant flux for attic insulation shall be equal to or greater than 0.12 W/cm².

Quality control radiant panel tests are done throughout the production day. These tests are also witnessed twice monthly during the inspections done by personnel from Underwriters Laboratories.

A full-scale Radiant Panel is part of the NU-WOOL testing facility.
Thermal Resistance

NU-WOOL Premium Cellulose Insulation is tested for thermal resistance regularly at Underwriters Laboratories under the follow-up program for ASTM C 739.

Test Method ASTM C 518

Testing Laboratory: Underwriters Laboratories

Test Results: 3.8 R (in.)
Firewalls

U382
Nu-Wool Co., Inc. has over 50 firewall assemblies that are approved for use with Nu-Wool Premium Cellulose Insulation, including three proprietary designs. UL design U382 is a revolutionary 2-hour or 3-hour load-bearing firewall that uses only two layers of type C board and Nu-Wool WALLSEAL Fire and Sound Insulation. Most assemblies are four layers of type C board to get the same rating. UL Design U360 is the only 2-hour, load-bearing firewall tested by UL that needs only three layers of 5/8" type X board resulting in savings of 25% on drywall labor and materials. Sound-absorbing UL design U369 has a high STC rating of 58 making it the design choice for sound control.

Cost Saving Two-Hour Firewall
Using Only 3 layers 5/8 in.
Type X Gypsum Wallboard
Design No. U360
Underwriters Laboratories
Bearing Wall Rating 2 Hr.
Riverbank Acoustical Laboratories
STC Rating: 51

Sound Absorbing Two-Hour Firewall
Using 4 layers 5/8 in.
Type X Gypsum Wallboard
Design No. U369
Underwriters Laboratories
Bearing Wall Rating 2 Hr.
Riverbank Acoustical Laboratories
STC Rating: 58
Wood Fire Wall Assemblies
Underwriters Laboratories

Wood Studs

45 Min.

U317  Single wood studs 16" o.c.; single layer 1/4" or 1/2" type "x" gypsum board each side; WALLSEAL 3 1/2" thick.

U340  Single wood studs staggered 12" o.c. on opposite sides; single layer 5/8" type "x" gypsum board each side; WALLSEAL 5 7/8" thick.

1 Hour

U305  Single wood studs 16" o.c.; single layer 5/8" type "x" gypsum board each side; WALLSEAL 3 1/2" thick.

U341  Double layer wood studs 24" o.c.; single layer 5/8" type "x" gypsum board each side; 7/16" wood structural panels in wall with air space between; WALLSEAL in stud cavity.

U307  Single wood studs 16" o.c.; single layer 5/8" type "x" gypsum board each side; 7/16" wood particle board each side;

U321  Single wood studs 16" o.c.; 1/4" hard board each side; 5/8" or 1/4" type "x" gypsum board each side; WALLSEAL 3 1/2" thick.

U333  Single wood studs 16" o.c.; single layer 5/8" type "x" gypsum board each side; WALLSEAL 3 1/2" thick.

U360  Double layer wood studs 16" o.c. opposite sides; 5/8" type "x" gypsum board on outside and between stud layers; WALLSEAL in stud cavity.

U338  Single wood studs flat wise 24" o.c.; double layer 5/8" type "x" gypsum board each side; WALLSEAL 1 1/2" thick.

U339  Double layer wood studs flat wise 24" o.c.; double layer 5/8" type "x" gypsum board each side; plywood sheathing within wall with air space between; WALLSEAL in stud cavities.

U342  Double layer wood studs 16" o.c.; double layer 5/8" type "x" gypsum board each side; single layer 5/8" gypsum board within wall with air space between; WALLSEAL in stud cavity.

U349  (Configuration A) Double layer wood studs staggered 16" o.c. on opposite sides; double layer 5/8" type "x" gypsum board on one side; single layer 5/8" type "x" gypsum board on other side; air space within wall with single layer gypsum board on one side; WALLSEAL in stud cavity.

U369  (Configuration B) Double layer wood studs staggered 16" o.c. on opposite sides; single layer 5/8" type "x" gypsum board on each side; single layer 5/8" type "x" gypsum board with 0" to 3 1/2" air space between gypsum board; WALLSEAL in stud cavity.
Steel Fire Wall Assemblies
Underwriters Laboratories

<table>
<thead>
<tr>
<th>Steel Studs</th>
<th>1 Hour</th>
<th>2 Hour</th>
<th>3 Hour</th>
<th>4 Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U040</strong></td>
<td>Single steel studs 24&quot; o.c.; double layer 5/8&quot; type &quot;X&quot; gypsum board one side; 1/2&quot; galv. steel subfrnt and insulated steel panel on other side; WALLSEAL 3 5/8&quot; thick.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>U434</strong></td>
<td>Single steel studs 24&quot; o.c.; single layer 5/8&quot; type &quot;X&quot; gypsum board one side; 3/4&quot; cement plaster other side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U440</strong></td>
<td>Single steel studs 24&quot; o.c.; steel resilient channel one or both sides; double layer 1/2&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U465</strong></td>
<td>Single steel studs 24&quot; o.c.; single layer 5/8&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U469</strong></td>
<td>Single steel &quot;C-T&quot; shaped studs 24&quot; o.c.; 1/2&quot; gypsum board between studs, single layer 5/8&quot; type &quot;X&quot; gypsum board one side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U495</strong></td>
<td>Single steel studs 24&quot; o.c.; single layer 5/8&quot; or 1/2&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U497</strong></td>
<td>Single steel studs 24&quot; o.c.; one layer 1/4&quot; type &quot;X&quot; gypsum board one side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U438</strong></td>
<td>Single &quot;C-T&quot; shaped steel studs 24&quot; o.c.; 1&quot; gypsum board between studs double layer 1/2&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U499</strong></td>
<td>(2 Hour) Single steel studs 24&quot; o.c.; single layer 5/8&quot; or 1/2&quot; type &quot;X&quot; gypsum board and single layer 5/8&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>V410</strong></td>
<td>Single steel studs 24&quot; o.c.; one layer 1/2&quot; and 5/8&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U426</strong></td>
<td>Single steel studs 24&quot; o.c.; quadruple layer 1/8&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
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</tr>
<tr>
<td><strong>U435</strong></td>
<td>(3 Hour) Single steel studs 16&quot; or 24&quot; o.c.; triple layer 1/2&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
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<tr>
<td><strong>U462</strong></td>
<td>Single steel studs 24&quot; o.c.; quadruple layer 1/2&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U463</strong></td>
<td>(3 Hour) Single steel studs 24&quot; o.c.; triple layer 1/8&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>U478</strong></td>
<td>Single steel stud slabs 24&quot; o.c.; triple layer 1/8&quot; type &quot;X&quot; gypsum board one side; double layer 1/2&quot; type &quot;X&quot; gypsum board and 1/4&quot; or 5/8&quot; plaster on other side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U436</strong></td>
<td>(4 Hour) Single steel studs 16&quot; or 24&quot; o.c.; quadruple layer 1/8&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U468</strong></td>
<td>Single steel stud slabs 24&quot; o.c.; quadruple layer 1/8&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>U463</strong></td>
<td>(4 Hour) Single steel studs 24&quot; o.c.; quadruple layer 1/8&quot; type &quot;X&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
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</tbody>
</table>

3/2008

www.nuwool.com
1-800-748-0128
Minneapolis Blower Door™

Today, many builders are routinely building houses that are very airtight, often without realizing it. The common use of building wraps, moisture barriers, high efficiency windows and even simple plywood sheathing all have direct effects on reducing air leakage and infiltration. An airtight house has fewer openings through which fresh air can enter. Without the addition of mechanical ventilation, a tight house can result in stagnant air, less natural ventilation and dissatisfied homeowners. On the other hand, houses with large amounts of uncontrolled air leakage are equally troublesome with comfort complaints due to drafts, building failures and high energy bills. Despite the growing importance of house airtightness, few builders, architects or homeowners know how tight their houses are. Until recently, the building community has tended to rely on subjective estimates of airtightness. Unfortunately, it is impossible to accurately estimate the tightness level of a building by visual inspection alone. Without knowing the airtightness level, it is difficult or impossible to design for effective approaches to ventilation and air quality, or to accurately diagnose performance problems.

The Minneapolis Blower Door has long been recognized as the best designed and supported building airtightness testing system in the world. Combined with specialized accessories and testing procedures developed by The Energy Conservatory, the Minneapolis Blower Door is the system of choice for utility DSM programs, energy raters, HVAC contractors and weatherization professionals.

Copyright ©1999-2005 The Energy Conservatory
Infrared Analysis

Infrared (IR) is a great way to solve building problems without doing destructive testing to a building. When a problem such as moisture, missing insulation, or air movement is impacting on the performance of a building; IR can help solve this problem.

Nu-Wool’s Technical Services Department has three cameras that are available to solve problems in the field. We use Infrared Solutions IR-Insight cameras that are very sensitive to small differences in temperature. Infrared cameras can be used throughout the year as they are able to “see” in the wall or ceiling without great differences in temperature that limited earlier cameras. Below are some actual IR photos from these cameras.
Vapor Barriers and High Humidity Areas

While NU-WOOL WALLSEAL Insulation is designed to work without a vapor barrier under normal conditions, it is not recommended for use in pool areas and other situations where high humidity is present without the use of a vapor barrier.

Under typical conditions—normal relative humidity—the insulation will act as an air and vapor barrier. The insulation is designed to manage the moisture that could move in to the wall cavity under normal conditions. In pool rooms and other places where unusually high humidity could be present, a vapor retarder is necessary.

Pool rooms and other high humidity areas should be designed for adequate dehumidification and ventilation. The Technical Services Department at NU-WOOL Co., Inc. can give you recommendations for equipment designed for pool areas.
Guaranteed to Perform Without A Vapor Retarder

Nu-Wool Co., Inc. advises contractors that a vapor retarder is not necessary with the Nu-Wool WALLSEAL system in walls using gypsum wallboard. This is due to the product’s unique ability to resist air movement, and therefore, the transmission of moisture. Air movement is the primary mechanism for moisture transfer. In fact, air accounts for 98% of all vapor movement in insulated cavities. Clearly, stopping air movement is the fundamental issue that builders and insulators should address. Vapor retarders on walls are not necessary or even desirable in all buildings or in all climates, because they can trap moisture. ASHRAE standards warn against the use of vapor retarders in any structure in warm climates. There is also danger with moisture problems in cold climates caused by moisture being driven into the wall in the summer. Vapor retarders are installed on the interior in cold climates to control moisture movement from inside out during the heating season, however those same vapor retarders trap the moisture contained in solar driven, warm summer air.

The Nu-Wool Guarantee

Nu-Wool Co., Inc. is the oldest manufacturer of cellulose insulation in the world. Nu-Wool Co., Inc. guarantees the proper application of Nu-Wool WALLSEAL without a vapor retarder in buildings with walls using gypsum wallboard and normal relative humidity levels. Vapor retarders are still necessary in buildings with high relative humidity levels, such as those with indoor pools. Many university research studies and building scientists have concluded that the vapor retarder provisions in building codes should be eliminated. Nu-Wool Co., Inc., along with the Environmental Protection Agency and others, is involved in work with the International Code Council to promote a change in the building codes relating to vapor retarders.
STC Values for Wall Assemblies

Staggered 2x4 Wood Studs on 6 inch plate 37
Double Row Wood Studs on Separate Plates 40
Gypsum Board Per Sheet 4
Resilient Channel, 16 inch Centers* 10
3-½ inch Cellulose Material, Wood Studs 5
3-½ inch Cellulose Material, Steel Studs 8

Double Wall with Cellulose Insulation and RC
Air space in center 68 STC

Double Wall with Cellulose Insulation
On Common Plate 64 STC

*24 inch on center is slightly better for STC
Cellulose Drying

Nu-Wool Co., Inc. advises our contractors that walls insulated with the Nu-Wool WALLSEAL system can be covered with drywall within 24 hours of application. This is due to the product’s ability to release moisture in a controlled manner.

Air is the primary mechanism for moisture transfer. In fact, air accounts for 98% of all vapor movement in insulated cavities. Clearly, the best method to control vapor movement is to control the air. Moisture will always move from areas of high concentrations to low concentration. During winter months, this usually means that the moisture moves from inside towards the outside air. If the outside air is below freezing, the drying process can be slowed, however Nu-Wool Co., Inc. stands behind its recommendation to cover with drywall within 24 hours.

Nu-Wool WALLSEAL Insulation contains Boron-10 which is an EPA registered fungicide and pesticide as well as a wood preservative and an excellent fire-retardant. The small amount of moisture in Nu-Wool WALLSEAL helps the Boron-10 provide protection to wood studs and exterior sheathing. Our Lifetime Warranty covers the permanency of the Boron-10. The Nu-Wool Lifetime Warranty extends to walls that are covered with drywall within 24 hours of application.

Nu-Wool Co., Inc. Guarantee

If Nu-Wool WALLSEAL Insulation, when installed in compliance with our recommended installation methods, should fail, Nu-Wool Co., Inc. will replace the insulation and repair any structural damage attributable to a defect in the insulation product. This guarantee covers the recommended practice of covering the wall with drywall within 24 hours of application.
Corrosion Guarantee

NU-WOOL Premium Cellulose Insulation is warranted for all the test items currently in effect for insulation materials under ASTM Standard C 739. Included in this standard is a test for corrosion resistance.

NU-WOOL Co. Inc. warrants its insulation product, when properly installed, to be corrosion resistant to all types of metal for the life of the structure. NU-WOOL Co. Inc. has offered, since 1978, a full lifetime warranty for their products. That warranty clearly lists each test characteristic, including corrosion.

NU-WOOL Co. Inc. specifically warrants those test characteristics to metal buildings properly insulated with NU-WOOL Premium Cellulose Insulation.
Thermal Barrier for Foam Plastic Insulation

Nu-Wool WALLSEAL, spray-applied or loose-filled, 1.5 inches thick, can be used as an ignition barrier over foam plastic insulation in accordance with 2009 IRC Section R316.5.3.

Nu-Wool WALLSEAL is equivalent to the entire thermal barrier materials as listed in the code.
Fire Blocking

Nu-Wool WALLSEAL, spray-applied or dense pack loose-fill, can be used as a fire blocking material in accordance with 2009 IBC Section 717.2.1 and 2009 IRC Section R302.11.1.

Please refer to the ICC-ES Report ESR 2217 for further information.
Control Moisture, Control Mold

Mold can grow on many materials commonly found in the home. The key to controlling mold growth is to control the level of moisture in a house. There is no practical way to keep mold spores from entering buildings, but mold problems can be prevented before they arise by regulating humidity levels in the home.

A certain amount of moisture occurs naturally in the air within a building, but when moisture reaches excessive levels the likelihood of mold growth is increased. The most common sources of excessive moisture are leaks! Roofs, walls, siding, pipes, sinks, showers, toilets, etc., are all potential sources of leaks. Other major moisture sources include kitchens, bathrooms, laundry rooms, fish tanks, humidifiers, etc.

How does Nu-Wool Premium Cellulose Insulation protect against mold?

Nu-Wool Premium Cellulose Insulation contains an EPA registered fungicide that makes the insulation resistant to the growth of mold. While molds can grow on many different materials in a building, Nu-Wool Insulation resists the growth of mold even in conditions favorable to mold growth. Nu-Wool Premium Cellulose Insulation is tested for mold growth by actually inoculating the insulation with the five most common fungi.

Nu-Wool Premium Cellulose Insulation is one of the few insulation products that contain a mold-fighting fungicide registered by the Environmental Protection Agency. Registration is achieved only after rigorous testing to ensure that the borate-based fungicide makes Nu-Wool Premium Cellulose Insulation resistant to the growth of mold, even when exposed to conditions favorable to mold growth.

Under federal law, a claim of mold resistance can only be made by a product registered with the EPA as a fungicide, or by a product which contains a fungicide registered with the EPA for use in that product. Very few insulation products meet those requirements, but Nu-Wool Premium Cellulose Insulation does.
Controlling Moisture in Houses*

High indoor humidity levels can lead to serious moisture problems during the winter in cold regions. These problems range from mildew in wall corners and closets to condensation on windows to decay inside the wall or on the underside of the roof sheathing. On the other hand, moderate levels of indoor humidity are important for human health and comfort. With an understanding of the basic principles of moisture balance, you can design and manage for proper moisture levels.

Determining indoor humidity

In a home, moisture comes from several sources. People, plants, and pets provide part of the moisture; washing, showering, and cooking supply more. A damp basement or crawl space, or a leaky roof can also add to this. Typically, a family of three produces around 20 pounds of water vapor per day, of which about 80 percent is from human respiration and perspiration.

Water vapor escapes from a house in two ways. The first is convection; water vapor escapes the house through open windows, the chimney, and cracks and other air leaks. The second way is diffusion through walls and ceilings from areas of higher concentration to areas of lower concentration of water vapor. Energy-efficient homes are more likely to have moisture problems than conventional homes.

If vapor continues to condense on a window, the window may be to blame. If both window and storm are tight and the condensation persists, indoor humidity should be lowered.

Lowering indoor humidity

What can you do to lower the indoor humidity if moisture problems persist? If the high humidity can be traced to a single moisture source, eliminate it. For instance, install a 6-mil polyethylene ground cover in a crawl. Increasing ventilation is another effective way to lower indoor humidity. If ventilation is increased from 0.2 ACH to 0.4 ACH, the indoor relative humidity decreases 19 percent.

Two workable systems are exhaust fans or an air-to-air heat exchanger. A fan can be controlled either manually, with a timer, or with a humidistat. An air-to-air heat exchanger reduces heat losses but maintains sufficient ventilation. The heat exchanger transfers part of the heat that would otherwise be lost in the exhaust air to the fresh intake air.

Summary

- Most moisture problems in homes in Canada and the northern United States during the winter are related to too-high indoor humidity.
- Excessive moisture sources such as damp crawl spaces and lack of ventilation cause this humidity problem.
- Exhaust fans or air-to-air heat exchangers can easily and economically provide sufficient ventilation.
- Vapor retarders generally do not affect indoor humidity.

*Excerpts from a study done by Anton TenWolde and Jane Charlton Suleski of Forest Products Laboratory

3/2008
Ducts in Unconditioned Spaces

Ducts in unconditioned spaces can negatively impact on a home in two significant ways:

1. Heat loss from the ducts results in less conditioned air being provided to a room.
2. Heat loss raises the temperature of unconditioned spaces often contributing to condensation or warming of an attic space that contributes to ice formation and potential mold problem.

Without insulation and air sealing, ducts may lose up to 30 percent of the energy used to heat or cool. This loss, through conduction, is due to the thin uninsulated metal or poorly insulated ducting materials.

1.0 To minimize these effects, the following procedure shall be used:

1.1 All ducts in unconditioned spaces should use an R-4-11 (depending on climate) manufactured flex duct. Solid plenums should be insulated with a minimum of 3 inches of loose-blown insulation (measured R-value per inch of 3.8).
1.2 Burying a flex duct in an R-38 blown insulation makes the duct “effectively” an R-15.
1.3 All ducts shall be kept as close to a conditioned area as possible, i.e., ducts should be close to the warm ceiling.
1.4 Flex duct should not be bent to 90° angles; make all bends gradual so that airflow is not restricted.
1.5 Support flex duct so that airflow is not restricted due to sagging.
1.6 Stretch flex duct to its full length so that air passages are as smooth as possible.
Insulation Installation around Vents and Fireplaces

### Vent Insulation

**Check thimble to make sure it maintains required clearance.**
- **Do not over-blow into the thimble.**
- **Use fire block sealant to fill gaps between vent and spacer.**
- **Check behind chimneys and vents to make sure you are not blowing into an open cavity below.**
- **Install sheet metal draft stop around masonry chimney. Seal gaps with fire block sealant and install an insulation shield made from rolled flashing or hardware cloth.**

### Fireplace Insulation

1. **Preferred method:** Have the builder install drywall prior to fireplace installation. Punch holes in drywall and dense pack; patch holes with plugs and gypsum cement.
2. **Alternate method:**
   - **Install unfaced fiberglass batts. Secure batts in place with rolled flashing and roofing nails.**
   - **Check for gaps between insulation and framing.**
   - **In all cases:**
     - **Seal around all openings, gas line, electric wires, vents.**
     - **Insulate under the fire place if the space is cantilevered over the exterior.**
     - **Clean all debris off and around fireplace.**

---

### Vent Types and Clearances

<table>
<thead>
<tr>
<th>Vent Types</th>
<th>Clearances*</th>
<th>Typical appliance vented</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>1” from all combustibles</td>
<td>Typical natural gas furnaces, water heaters and direct vent fireplaces</td>
</tr>
<tr>
<td>L</td>
<td>3” from all combustibles</td>
<td>Oil burning furnaces, Pellet stoves (corn or wood)</td>
</tr>
<tr>
<td>Chimney</td>
<td>See manufacturers listing.</td>
<td>Solid fuel burning fireplace. Typically wood.</td>
</tr>
<tr>
<td>Factory</td>
<td>2” Air gap. Only draft stopping allowed in the 2” space</td>
<td></td>
</tr>
<tr>
<td>Masonry</td>
<td>See manufacturers listing.</td>
<td></td>
</tr>
</tbody>
</table>

*Manufacturers listed clearances take precedence over all code required clearances.
Moisture Migration

This bulletin serves as an advisory to help you avoid the problem of moisture migrating from the stud cavity toward the interior of the building. All of the walls discussed here are 2x6 construction.

• The first wall was covered with pre-finished oak strips. The finish coat of the oak strips acted as a vapor barrier for moisture. This caused the unfinished side of the oak to load with moisture and eventually swell and buckle. This problem could have been avoided with a vapor barrier on the insulation, which would have prevented moisture from moving into the oak strips. No drywall was used in this application.

• The second wall was covered with drywall and then very heavy vinyl wallpaper. The vinyl paper acted as a vapor barrier causing the drywall to load with moisture and eventually weaken the adhesive holding the vinyl paper. For this particular application it would have been better for the wall to have a vapor barrier at the insulation interface.

• The third wall involved the gluing of mirrors to the drywall. The moisture migrated toward the mirrors weakening the adhesive on the mirrors.

• This particular wall had an impermeable surface on the opposite side of the mirrors; moisture was blocked from moving out of the wall.

If you encounter an application that you are not sure about, call the Technical Services Department at Nu-Wool Co., Inc.
Nu-Wool WALLSEAL Below Grade

Should Nu-Wool WALLSEAL be used in below grade applications

The answer to that question is a qualified yes. Rooms built below grade are naturally more susceptible to moisture problems because at least part of the exterior walls and generally the entire floor are in direct contact with the soil: Moisture from the soil and concrete moves toward areas of lesser moisture content. Also, below-grade areas lack the air circulation necessary for constant temperature/humidity conditions that typically exist above-grade.

Moisture management is important regardless of the type of insulation installed below grade. Below grade walls cannot dry to the outside like above-grade walls. The special considerations of moisture movement in areas below-grade require increased awareness on the part of insulation contractors to insure that moisture does not reach a level where molds/mildew can form.

Mindful of those concerns, WALLSEAL can be successfully installed below grade. The superior moisture management properties (hygro-buffer) of WALLSEAL actually make it a better choice than fiberglass insulation for below grade application. WALLSEAL absorbs moisture, redistributes it and lets a wall dry in a controlled manner. Nevertheless, a good possibility exists that at certain times of the year WALLSEAL installed below grade will feel damp or even wet. It is also possible that building materials in contact with WALLSEAL (lumber, drywall) could grow mold because of the increased presence of moisture below grade. Moisture and the growth of mold below grade is not the fault of WALLSEAL, or generally any other insulation installed below grade.

However, the increased risk of moisture and mold in below grade construction increases the potential liability of the installer and the manufacturer of any insulation if moisture damage or mold occurs. Please note that the small amount of moisture used in the application of WALLSEAL is insignificant when compared to the other sources of moisture below grade.

If you choose to install WALLSEAL below grade, DO NOT install a vapor retarder! Whether against the outside wall, on the backside of the drywall or other wall surface, or in the form of vapor barrier paint—no vapor barriers should be used below grade. It will only serve to trap moisture inside the wall, because the wall can only dry to the interior. If your building inspector insists on a vapor retarder, do not install WALLSEAL below grade. To do so is asking for problems.

For the reasons mentioned above, any below grade application of WALLSEAL where a vapor retarder of any kind is installed will void any and all product warranties from Nu-Wool Co., Inc.
OSB (Oriented Strand Board) Recommendations

There have been cases where OSB has buckled. This is more common with manufactured homes as they are built in controlled environments and then suddenly exposed to varying amounts of moisture. The American Plywood Association (APA), through their web site, has several publications directed toward the buckling of OSB.

The APA also has publications regarding the installation of their products. One specification that builders should be aware of is the publication regarding nailing of OSB. There are definite guidelines for installing OSB. That publication is noted below. The most important part of this specification is the spacing of the fasteners when installing OSB. For PDF versions of the APA guidelines go to: http://www.apawood.org
Type IC Recessed Lighting Fixtures
Must Be Specified in the Building Envelope

If you are a builder or code official, you must ensure that recessed lighting fixtures installed in the building envelope be Type IC. The latest version of the Model Energy Code, 1995 edition (Chapter 5, Section 502.3.4 and 602.3.3 - Recessed Lighting Fixtures), specifies that recessed lighting fixtures installed in the building envelope must be "Type IC." ICAA has always recommended that only Type IC recessed lighting fixtures be installed in the building envelope. Type IC fixtures should be used wherever ceiling insulation is present.

Type IC Recessed Lighting Fixtures are selected for their safety, energy efficiency, and utility.

- Energy Efficient: since IC recessed fixtures can be covered with insulation, they reduce energy loss.
- Safety: Insulation can be in direct contact with the fixture housing
- Fewer Callbacks: Homeowners have less problems with IC Fixtures. They minimize moisture condensation; reduce the "blinking light" problem associated when insulation is in direct contact with Non-IC Fixtures; and they minimize drafts.

ICAA - Insulation Contractors Association of America
703.739.0356
IC Recessed Lights

“IC” means that the recessed light can have Insulation Contact. This design also allows the light to be covered with insulation. Lights going off or flickering are symptoms of other problems—not insulation related problems.

1. Each light has a specific trim package that is designed to work with that fixture.
2. Each light has a specific bulb size.
3. Recessed lights have adjustable sockets, if they are pushed beyond the “stop” built into the light they cease to be a protected fixture.
4. Halogen lights will sometimes give problems for IC lights.
5. Halogen lights and dimmer switches give more problems than incandescent lights without dimmers. Very often, incorrect dimmers are at fault.

Please make this information available to your builders if they have experienced these problems. If you have any questions regarding this information, please call the Nu-Wool Technical Services Department at (800) 748-0128.

“IP” refers to Internally Protected: This type of light is not designed to be covered with insulation. An IP fixture contains a thermal switch to shut off the light in the event the fixture becomes too hot from having a lamp installed that is a higher wattage than the fixture is designed for. The IP fixture must not have insulation contact and insulation must be kept 3 inches away from all sides.
Condensation

Condensation problems are caused by air reaching its maximum holding ability for water vapor. This holding capacity is linked to temperature; the colder the air the less its holding capacity and relative humidity rises. Relative humidity relates to the water holding capacity of the air in relation to the temperature. The relative humidity will continue to rise with falling temperature until it becomes 100 percent—the dew point.

Moisture forms on windows and other cold surfaces in the winter due to the windows reaching the dew point. This indicates there is too much moisture in the building relative to the surface temperature of the window. This can be controlled by improving the window or controlling the interior humidity.

As a home becomes tighter it has less opportunity to leak and get rid of excess moisture. Certainly having a tighter structure is better than a leaky building. We need to develop strategies to control moisture when we have a more efficient building. This can be achieved through ventilation and by controlling the sources of moisture.

**Build Tight—Ventilate Right**

While the activities that develop moisture—cooking, bathing and occupants—are not easy to change, ventilation can be controlled and designed into the building. Areas where moisture is created should be ventilated and that ventilation should be a balanced part of the building to create a healthy environment. Refer to ASHRAE ventilation standards 62.2.

Monitor Relative Humidity

Automatic humidifiers are often not monitored and they often lead to levels of increased relative humidity. Comfort is achieved with an indoor relative humidity of 20-50%. Allowing the humidity to exceed 60% can cause problems in the building.
“Effective R-values”

Laboratory R-values are an FTC regulated test standard. The intent is to give consumers the information they need to compare the relative R-values of different insulation products. However, a laboratory R-value test does not take into account air movement and extreme temperature conditions.

Nu-Wool Co., Inc. feels that showing an R-value more closely related to actual conditions that occur in a house is an appropriate way of stating differences in actual performance. While “effective” R-value cannot be measured reliably in a laboratory, we base these numbers on over a decade of actual computer simulations on actual houses. Nu-Wool Co., Inc. has guaranteed the performance of homes since 1987.

In order to guarantee the actual operating cost of homes under the guarantee program, we enter each house in a computer program that calculates energy use. In order for the computer program to accurately reflect the increased performance of the WALLSEAL System, we use “effective” R-values for the calculations. Using nominal R-values would not show the improvement the insulation makes in decreased air infiltration and the resulting decrease in energy use. Nu-Wool Co., Inc. currently recommends using R-17 for the nominal four-inch wall and we use R-25 for the six-inch wall. These numbers represent many years of actual energy costs for thousands of homes. We feel they are accurate and are in the best interests of the consumer.

If you have any questions concerning “effective” R-values and how they are used to calculate energy costs, contact The Technical Services Department at 800-748-0128.
Field Sound Transmission Class (FSTC)

Field Sound Transmission Class (FSTC) evaluates the sound rating of in-place construction. As with STC, a numerical value is assigned to the wall between rooms. A laboratory STC, in some cases, does not accurately reflect the actual sound rating for an assembly.

FSTC quantifies the “leaks” in a sound wall assembly and also detects flanking sound paths. These leaks are areas where the wall has not been sealed. Acoustic caulk is very effective in raising the sound level of a room. Flanking is sound that is taking a different path than from what was intended—through the demising wall. Duct work between rooms can be an area where flanking sound travels.

FSTC also is taking into account the absorption levels in a room, the windows and room volumes, something a laboratory STC value does not represent. FSTC ratings are done by placing a sound source in one room and calibrated listening devices in another room that calculate the db loss just as an STC would. The frequencies in an FSTC are more heavily weighted to human hearing.

Reference:

*Classification for Rating Sound Insulation, ASTM E 413.*
Knob & Tube Wiring

Before the wiring we are now so accustomed to, there was a simpler form of wiring, two wires running parallel suspended on insulated knobs, no ground wire, and cloth insulation around the wires. This type of wiring was popular in the 1940’s.

Knob & Tube wiring was fine when there were few appliances and very low power running in the wires. You can see what the problem is: the home has little or no insulation, the wires run up the walls and across the attic, and the load on the wires has changed. Homeowners, wanting to add more outlets, splice into the wiring and may not do a thorough job of taping their splice. Another problem is that the load on the wiring has changed by installing larger amperage fuses to deal with fuses blowing. The wires have been exposed to the changing temperature and humidity for 50 years and there can be deterioration. The home now needs insulation to make it more energy efficient and comfortable and you aren’t sure whether to insulate or not. When the wires were new they probably didn’t present an unusual safety hazard. Over time the wires are spliced or become brittle and the insulation material on the wires can break off.

Does knob and tube wiring represent a “clear and present danger?”

If you encounter a home with knob & tube, you should inspect the wiring for damage and splicing. You should also keep in mind that once you insulate over the wires people can unknowingly step on the wires when they access the attic. Don’t insulate an attic with damaged knob & tube and/or have the homeowner either sign a waiver or demand an inspection by a qualified electrician prior to insulating.
Sound Control Details

When soundproofing a home, there are details that can be just as important as the choice of soundproofing material. A typical new home has many out of sight places where sound can leak through. These leaks bypass the soundproof material and increase the interior noise level. The items listed below are often overlooked, but can be critical to keeping sound levels down. As a rule of thumb, if it’s good at stopping air or heat movement, it’s good at stopping sound.

Details to maintain or improve sound control

Building Penetrations
• All holes need to be sealed – phone, cable, gas, electric, water, dryer, kitchen, and bath. All of these holes need to be sealed to maintain the sound performance of the wall or ceiling. Use a long lasting caulk that remains flexible after it has cured.
• Insulate all band and rim joists around the perimeter of the house.
• Insulate the attic access hatch and seal its perimeter with weather-stripping.
• If recessed lights are used, choose IC (insulation contact) rated enclosures and cover them with insulation.
• Seal the wall top and bottom plates with caulk.
• A 1/16-inch gap ten feet long could drop an STC 50 wall down to an STC 32.

Ductwork and Venting
• Do not place HVAC ducts in exterior walls, insulated floors, or attics. Sound travels easily through ducts, so they need to be isolated from the sound source.
• Make sure exhaust vents have louvered outlets that close automatically. Use flex duct when possible on vents. Flex duct performs better than metal or PVC.

Doors and Windows
• The house is only as good as its weakest link. Don’t put an STC 25 door in an STC 50 wall.
• Use French Doors instead of Sliding Glass Doors. French doors control sound much better.
• Insulate around the frames of doors and windows.
Vapor Barriers and High Humidity Areas

While NU-WOOL WALLSEAL Insulation is designed to work without a vapor barrier under normal conditions, it is not recommended for use in pool areas and other situations where high humidity is present without the use of a vapor barrier.

Under typical conditions—normal relative humidity—the insulation will act as an air and vapor barrier. The insulation is designed to manage the moisture that could move in to the wall cavity under normal conditions. In pool rooms and other places where unusually high humidity could be present, a vapor retarder is necessary.

Pool rooms and other high humidity areas should be designed for adequate dehumidification and ventilation. The Technical Services Department at NU-WOOL Co., Inc. can give you recommendations for equipment designed for pool areas.
Understanding Heat Transfer

Heat flows by three mechanisms: conduction, convection, and radiation. *Conduction* is the molecule-to-molecule transfer of kinetic energy (one molecule becomes energized and, in turn, energizes adjacent molecules). A cast-iron skillet handle heats up because of conduction through the metal. *Convection* is the transfer of heat by physically moving the molecules from one place to another. Hot air rises; heated water thermosiphons; or forced-air heating systems work by moving hot air from one place to another. *Radiation* is the transfer of heat through space via electromagnetic waves (radiant energy). A campfire can warm you even if there is wind between you and the fire, because radiation is not affected by air.

With buildings, we refer to heat flow in a number of different ways. The most common reference is “R-value,” or resistance to heat flow. The higher the R-value of a material, the better it is at resisting heat loss (or heat gain). U-factor (or “U-value,” as it is often called) is a measure of the flow of heat—thermal transmittance—through a material, given a difference in temperature on either side. In the inch-pound (I-P) system, the U-factor is the number of Btus (British Thermal Units) of energy passing through a square foot of the material in an hour for every degree Fahrenheit difference in temperature across the material (Btu/ft²hr°F). How about an example? If the R-value is 38 in a 1000 square foot attic, and the temperature indoors is 70 and the temperature outdoors is 30, what is the Btu loss per square foot per hour?

\[
\frac{1000}{38} = 26.31 \times \Delta t \quad \text{(Where } \Delta t \text{ is temperature in, minus temperature out)}
\]

So you are losing 1315 Btu’s per hour in a 1,000 square feet area at 50 degrees temperature difference.

R-Values are measured by testing laboratories, usually in something called a *guarded hot box*. Heat flow through the layer of material can be calculated by keeping one side of the material at a constant temperature, say 90°F (32°C), and measuring how much energy is required to keep the other side of the material at a different constant temperature, say 50°F (10°C)—all this is defined in great detail in American Society of Testing and Materials (ASTM) procedures. The result is a steady-state R-value (“steady-state” because the difference in temperature across the material is kept steady). R-value and U-factor are the inverse of one another: \( U = \frac{1}{R} \). Materials that are very good at resisting the flow of heat (high R-value, low U-factor) can serve as insulation materials.
Who says a house has to breathe?

A house has to breathe! How many times have you heard that? People breathe, their dogs breathe, houses leak. Houses leak, they don’t breathe. If you subscribe to the idea that a house has to breathe, you also must say that some days they breathe a lot, and some days they breathe a little, and some days they don’t breathe at all.

Typically, people make the “house has to breathe” statement when they are talking about getting the house too tight. The “breathe” people feel that by having a house breathe it is somehow healthier. In fact, it only leaks more. And if it leaks, it costs someone money. Remember 40% or more of the energy bill is from infiltration. You pay a lot of money to let a house breathe.

Better solution: Insulate tight, ventilate right. If you build a house so that it breathes (leaks) then some days it’s going to leak a lot. When the wind blows the house may breathe more than you planned. When the wind doesn’t blow it may breathe less than you planned. However, proper ventilation works in all kinds of weather. It makes a house healthy every day of the week.

Tight houses are also blamed for creating mold problems. Tight houses may hold moisture better than leaky houses, but removing moisture is the reason we install ventilation in bathrooms and kitchens. A water leak from plumbing or faulty construction happens in a leaky house as well as a tight house. These are the things we should pay attention to in any house to prevent molds.

Ventilation should be part of the design of every new house and should be incorporated in any existing home. This creates a healthy home that “breathes” in a controlled way and prevents problems with comfort and health issues. If someone tells you a home has to breathe, tell him or her you would rather not have a home built to leak.

DURABILITY is linked to tightness. TIGHTNESS is linked to efficiency. EFFICIENCY is easier to sell than durability.
You may have heard: Cellulose insulation contributes to mold growth.  
**FACT:** Nu-Wool Premium Cellulose Insulation contains EPA registered fungicide, which makes the insulation resistant to mold growth, even when exposed to conditions favorable to the growth of mold. EPA registration is achieved only after rigorous testing to ensure that the borate-based fungicide mold and mildew.

You may have heard: Cellulose insulation is not fire resistant.  
**FACT:** Nu-Wool Premium Cellulose Insulation contains 100% borate-based fire retardants, enabling the product to not only surpass all federal and industry fire resistance requirements (ASTM C-739, ASTM E-84, and UL 723) but also to achieve 1, 2, and 3-hour firewall ratings in at least 50 UL-approved designs.

You may have heard: Cellulose insulation costs more than fiberglass  
**FACT:** Fiberglass insulation is sometimes less costly to install than cellulose insulation. However, the initial cost savings is lost within the first 1-2 years due to higher utility bills. The cost continues to rise as home owners with fiberglass insulation pay consistently higher heating and cooling bills throughout the life of the house. Unlike fiberglass, Nu-Wool Premium Cellulose Insulation has a higher density (contributing to a higher “effective R-value”) and is proven to fill in the air pockets and voids within walls and ceilings (attics) to reduce air leakage. This not only provides a much more comfortable home, but also reduces the cost of utilities throughout the life of the building.

You may have heard: Cellulose insulation settles inside the wall  
**FACT:** Because Nu-Wool WALLSEAL is installed at a density of 3.0-3.5 pounds per cubic foot using a controlled water fog, it adheres to the studs, plates, and sheathing inside the wall cavity. When properly installed, Nu-Wool WALLSEAL will not settle over time.
U382

Two and One-Half Hour Fire Assembly

U382 is a fully load-bearing two and one-half hour assembly meeting all the requirements of ASTM-E-119 and UL 263. This wall meets the requirements of shaft wall assemblies. The independently loaded double wall assembly maintains its integrity beyond the nominal one-hour for each side, giving the wall a two-hour thirty minute rating. U382 was able to retain its integrity for a total of 2 hours 40 minutes.

Each row of studs was placed under a load of 10,932 pounds applied vertically to achieve the maximum working stress of wood studs in accordance with 2005 National Design Specification for wood studs.

STC tests were done on three configurations for this assembly: One using the wall as tested; one layer of gypsum board each side achieving an STC of 53. The second test added one-layer of gypsum board to one side and this wall achieved an STC of 58. The third test for STC added a layer of gypsum board to each side and achieved an STC of 63. Actual test data showed one point less on each wall as these walls were simply taped at the seams rather than using gypsum “mudding.” Riverbank Acoustical data shows that this method results in a one point less STC. Using this method facilitates testing.

U382 can also be viewed on the Underwriters Laboratories web site www.ul.com. Any questions concerning the assembly and use of this wall should be directed to the Technical Department of NU-WOOL Co., Inc.
Design/System/Construction/Assembly Usage Disclaimer

- Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of UL Listed or Classified products, equipment, system, devices, and materials.
- Authorities Having Jurisdiction should be consulted before construction.
- Fire resistance assemblies and products are developed by the design submitter and have been investigated by UL for compliance with applicable requirements. The published information cannot always address every construction nuance encountered in the field.
- When field issues arise, it is recommended the first contact for assistance be the technical service staff provided by the product manufacturer noted for the design. Users of fire resistance assemblies are advised to consult the general Guide Information for each product category and each group of assemblies. The Guide Information includes specifics concerning alternate materials and alternate methods of construction.
- Only products which bear UL’s Mark are considered as Classified, Listed, or Recognized.

Fire Resistance Ratings - ANSI/UL 263

See General Information for Fire Resistance Ratings - ANSI/UL 263

Design No. U382
April 22, 2009

Bearing wall rating — 2 Hr, 2-1/2 Hr or 3 Hr (See items 3, 3A and 3B)

1. Wood Studs — Double row of nominal 2 x 4 in. studs, spaced 16 in. OC and cross-braced at mid-height. Opposite rows spaced 1 in. apart, staggered 8 in. OC and joined at the top and bottom with bearing plates.

2. Bearing Plates — (not shown) Nominal 2 x 4 in. Two layers on top and one layer on bottom for each row of studs.

3. Wallboard, Gypsum* — One layer of 4 ft wide. 5/8 in. thick gypsum wallboard applied vertically and nailed to studs and bearing plates 7 in. OC with 6d cement coated nails, 1-7/8 in. long, 0.0915 in. shank diameter and 1/4 in. diameter head. Gypsum wallboard joints centered over studs.

UNITED STATES GYPSUM CO — Type C

3A. Wallboard, Gypsum* — Two layers of 5/8 inch thick, 4 ft wide gypsum wallboard applied vertically or horizontally, with the first layer of gypsum board attached with 6d cement coated nails spaced 10 in. OC., and the second layer of gypsum board attached with 8d nails spaced 7 in. OC. Vertical or horizontal joints between 1st and 2nd layer of wallboard are to be staggered. For 3 Hour Rating.

UNITED STATES GYPSUM CO — Type C

3B. Wallboard, Gypsum* — One layer of 4 ft wide. 5/8 in. thick gypsum wallboard applied horizontally and nailed to studs and bearing plates 7 in. OC with 6d cement coated nails, 1-7/8 in. long, 0.0915 in. shank diameter and 1/4 in. diameter head. For 2 Hour Rating Only.

UNITED STATES GYPSUM CO — Type C

4. Joints and Screwheads — (Not shown) — Wallboard joints taped and both joints and nailheads covered with joint compound.

5. Fiber, Sprayed* — Green Colored Spray applied cellulose material. The fiber is applied with water to completely fill the enclosed 8 in. cavity in accordance with the application instructions supplied with the product. The minimum dry density is 4.58 lbs/ft³.

NU-WOOL CO INC — Wallseal Fire and Sound Insulation

6. Mesh Netting — (Not shown) - Any thin, woven or non-woven fibrous netting material attached with staples to the outer face of one row of studs to facilitate the installation of the sprayed fiber from the opposite row.

*Bearing the UL Classification Mark

Last Updated on 2009-04-22
Nu-Wool Design Detail - U382 - 2 Hr. Full-Load Bearing Firewall

Acoustical Properties

STC 53
(Standard)

STC 58
(Double Layer of Drywall on One-Side)

STC 63
(Double Layer of Drywall on Both Sides)
Nu-Wool Design Detail - U382 - 2 Hr. Full-Load Bearing Firewall

2 Hr. Wall Section Between Units (Perpendicular Condition)

Ref.: UL - U382

SEE FOUNDATION PLAN FOR WALL DETAIL (FOUNDATION SYSTEM MAY VARY)

SEE FOUNDATION PLAN FOR FOOTING DETAIL (FOUNDATION SYSTEM MAY VARY)

NU-WOOL WALLSEAL FIRE AND SOUND INSULATION MUST BE INSTALLED BY A NU-WOOL CERTIFIED DEALER

1 1/2 HR. RATED FIRE ASSEMBLY REF. U382
Underwriter's Laboratories Inc.

5/8" GYP. BD. CEILING (TYP.)
2x BLOCKING @ MIDPOINT (5' MAX)
SECOND FLOOR
STAGGERED VERTICAL STUDS - 16"O.C.
INSULATION PER SPECS
1" CONTINUOUS SEPARATION BETWEEN STUD WALLS COMPLETELY FILLED WITH WALLSEAL FIRE AND SOUND INSULATION

SEE FRAMING PLANS FOR FLOOR SYSTEM USED (PERPENDICULAR FLOOR JOIST CONDITION SHOWN)

SEE FOUNDATION PLAN FOR WALL DETAIL (FOUNDATION SYSTEM MAY VARY)

ATTIC SYSTEM MAY VARY BY LOCALSE - THE ATTIC SYSTEM MUST BE APPROVED BY A LOCAL BUILDING OFFICIAL

FLOOR-CEILING INTERSECTION MAY VARY BY LOCALSE AND MUST BE APPROVED BY LOCAL INSPECTOR

ATTIC SYSTEM MAY VARY BY LOCALSE - THE ATTIC SYSTEM MUST BE APPROVED BY A LOCAL BUILDING OFFICIAL

ATTIC SYSTEM MAY VARY BY LOCALSE - THE ATTIC SYSTEM MUST BE APPROVED BY A LOCAL BUILDING OFFICIAL

SEE FOUNDATION PLAN FOR FOOTING DETAIL (FOUNDATION SYSTEM MAY VARY)

FLOOR-CEILING INTERSECTION MAY VARY BY LOCALSE AND MUST BE APPROVED BY LOCAL INSPECTOR

SEE FOUNDATION PLAN FOR WALL DETAIL (FOUNDATION SYSTEM MAY VARY)

SEE FOUNDATION PLAN FOR WALL DETAIL (FOUNDATION SYSTEM MAY VARY)

SEE FOUNDATION PLAN FOR FOOTING DETAIL (FOUNDATION SYSTEM MAY VARY)

FLOOR-CEILING INTERSECTION MAY VARY BY LOCALSE AND MUST BE APPROVED BY LOCAL INSPECTOR

SEE FOUNDATION PLAN FOR WALL DETAIL (FOUNDATION SYSTEM MAY VARY)

SEE FOUNDATION PLAN FOR FOOTING DETAIL (FOUNDATION SYSTEM MAY VARY)

FLOOR-CEILING INTERSECTION MAY VARY BY LOCALSE AND MUST BE APPROVED BY LOCAL INSPECTOR

SEE FOUNDATION PLAN FOR WALL DETAIL (FOUNDATION SYSTEM MAY VARY)

SEE FOUNDATION PLAN FOR FOOTING DETAIL (FOUNDATION SYSTEM MAY VARY)

FLOOR-CEILING INTERSECTION MAY VARY BY LOCALSE AND MUST BE APPROVED BY LOCAL INSPECTOR

SEE FOUNDATION PLAN FOR WALL DETAIL (FOUNDATION SYSTEM MAY VARY)

SEE FOUNDATION PLAN FOR FOOTING DETAIL (FOUNDATION SYSTEM MAY VARY)

FLOOR-CEILING INTERSECTION MAY VARY BY LOCALSE AND MUST BE APPROVED BY LOCAL INSPECTOR

SEE FOUNDATION PLAN FOR WALL DETAIL (FOUNDATION SYSTEM MAY VARY)
2 Hr. Wall Section Between Units (Parallel Condition)
Ref.: UL - U382

2 1/2 HR. RATED FIRE
ASSEMBLY REF. U382
Underwriter's Laboratories Inc.

NU-WOOL WALLSEAL FIRE AND SOUND
INSULATION MUST BE INSTALLED BY A NU-
WOOL CERTIFIED DEALER

SEE FOUNDATION PLAN FOR
FOOTING DETAIL (FOUNDATION
SYSTEM MAY VARY)

Continuous Rimboards -
See Structural Design
(Material May Vary)

5/8" GYP. BD. CEILING (TYP.)

2x BLOCKING @ MIDPOINT (5' MAX)

SECOND FLOOR

First Floor

2 Layers Type X GYP. BD.

5/8" GYP. BD. CEILING (TYP.)

Staggered Vertical Studs - 16" O.C.

1" Continuous Separation
Between Stud Walls Completely
Filled With Wallseal Fire and
Sound Insulation (Slab to Roof
Deck)

FLOOR-CEILING INTERSECTION MAY
VARY BY LOCAL AND MUST BE
APPROVED BY LOCAL INSPECTOR

See Framing Plans for Floor
System Used (Parallel
Floor Joist Condition
Shown)

Staggered Vertical Studs - 16" O.C.

NU-WOOL WALLSEAL FIRE AND SOUND
INSULATION MUST BE INSTALLED BY A NU-
WOOL CERTIFIED DEALER

1" Continuous Separation
Between Stud Walls Completely
Filled With Wallseal Fire and
Sound Insulation (Slab to Roof
Deck)

See Foundation Plan for
Footing Detail (Foundation
System May Vary)
Nu-Wool Design Detail - U382 - 2 Hr. Full-Load Bearing Firewall

2 Hr. Wall Section Between Units (Perpendicular Condition)
Ref.: UL - U382

FIND A NU-WOOL DEALER 1-800-748-0128 OR www.nuwool.com

Nu-Wool Design Detail - U382 - 2 Hr. Full-Load Bearing Firewall

1-800-748-0128
www.nuwool.com
Nu-Wool Design Detail - U382 - 2 Hr. Full-Load Bearing Firewall

2 Hr. Wall Section Between Units (Perpendicular Condition)
Ref.: UL - U382
Wood Fire Wall Assemblies
Underwriters Laboratories

Wood Studs
45 Min.

U317 Single wood studs 16" o.c.; single layer 1/4 or 3/8 type "x" gypsum board each side; WALLSEAL 3 1/2" thick.

U340 Single wood studs staggered 12" o.c. on opposite sides; single layer 5/8" type "x" gypsum board each side; WALLSEAL 5 1/4" thick.

1 Hour

U305 Single wood studs 16" o.c.; single layer 5/8" type "x" gypsum board each side; WALLSEAL 3 1/2" thick.

U341 Double layer wood studs 24" o.c.; single layer 5/8" type "x" gypsum board each side; 7/16" wood structural panels in wall with air space between; WALLSEAL in stud cavity.

U307 Single wood studs 16" o.c.; single layer 5/8" type "x" gypsum board each side; 7/16" wood particle board each side;

U342 Double layer wood studs 16" o.c.; double layer 5/8" type "x" gypsum board each side; single layer 5/8" gypsum board within wall with air space between; WALLSEAL in stud cavity.

U309 Single wood studs 24" o.c.; single layer 5/8" type "x" gypsum board each side; WALLSEAL 3 1/2" thick.

U360 Double layer wood studs 16" o.c. opposite sides; 5/8" type "x" gypsum board on outside and between stud layers; WALLSEAL in stud cavity.

U321 Single wood studs 16" o.c.; 1/4" hard board each side; 5/8" or 3/4" type "x" gypsum board each side; WALLSEAL 3 1/2" thick.

U369 (Configuration A) Double layer wood studs staggered 16" o.c. on opposite sides; double layer 5/8" type "x" gypsum board on one side; single layer 5/8" type "x" gypsum board on other side; air space within wall with single layer gypsum board on one side; WALLSEAL in stud cavity.

U333 Single wood studs 16" o.c.; single layer 5/8" type "x" gypsum board each side; WALLSEAL 3 1/2" thick.

U338 Single layer 5/8" type "x" gypsum board each side; WALLSEAL 1 1/2" thick.

U369 (Configuration B) Double layer wood studs staggered 16" o.c. on opposite sides; single layer 5/8" type "x" gypsum board on each side; single layer 5/8" type "x" gypsum board with 0" to 3 1/2" air space between gypsum board; WALLSEAL in stud cavity.

U339 Double layer wood studs flat wise 24" o.c.; double layer 5/8" type "x" gypsum board each side; plywood sheathing within wall with air space between; WALLSEAL in stud cavities.
**Steel Fire Wall Assemblies**

**Underwriters Laboratories**

<table>
<thead>
<tr>
<th>Steel Studs</th>
<th>1 Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U040</strong> Single steel studs 24&quot; o.c.; double layer 5/8&quot; type &quot;x&quot; gypsum board one side; 1/2&quot; galv. steel subgirts and insulated steel panel on other side; WALLSEAL 3 5/8&quot; thick.</td>
<td></td>
</tr>
<tr>
<td><strong>U434</strong> Single steel studs 24&quot; o.c.; single layer 5/8&quot; type &quot;x&quot; gypsum board one side; 7/8&quot; cement plaster other side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U440</strong> Single steel studs 24&quot; o.c.; steel resilient channel one or both sides; double layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U465</strong> Single steel studs 24&quot; o.c.; single layer 5/8&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U469</strong> Single steel &quot;C-T&quot; shaped studs 24&quot; o.c.; 1&quot; gypsum board between studs, single layer 5/8&quot; type &quot;x&quot; gypsum board one side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U495</strong> (1 Hour) Single steel studs 24&quot; o.c.; single layer 5/8&quot; or 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>V416</strong> Single steel studs 24&quot; o.c.; one layer 1/2&quot; type &quot;x&quot; gypsum board one side; WALLSEAL in stud cavity.</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Steel Studs</th>
<th>2 Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U403</strong> Single layer steel studs 24&quot; o.c.; double layer 5/8&quot; type &quot;x&quot; gypsum board one side; single layer of 5/8&quot;, 1/2&quot;, and 1/2&quot; gypsum board on other side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U408</strong> Single layer steel studs 24&quot; o.c.; single layer 5/8&quot; type &quot;x&quot; gypsum board one side; triple layer 5/8&quot; gypsum board with resilient channel between base layer and outer two; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U411</strong> Single layer steel studs 24&quot; o.c.; double layer 5/8&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U412</strong> Single layer steel studs 24&quot; o.c.; double layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Steel Studs</th>
<th>3 Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U435</strong> (2 Hour) Single steel studs 24&quot; o.c.; single layer 5/8&quot; or 1/2&quot; type &quot;x&quot; gypsum board and single layer 5/8&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>V410</strong> Single steel studs 24&quot; o.c.; one layer 1/2&quot; and 5/8&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Steel Studs</th>
<th>4 Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>U426</strong> Single steel studs 24&quot; o.c.; quadruple layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U435</strong> (3 Hour) Single steel studs 16&quot; or 24&quot; o.c.; triple layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U462</strong> Single steel studs 24&quot; o.c.; quadruple layer 1/6&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U463</strong> (3 Hour) Single steel studs 24&quot; o.c.; triple layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U478</strong> Single layer steel studs 24&quot; o.c.; triple layer 1/2&quot; type &quot;x&quot; gypsum board one side; double layer 1/2&quot; type &quot;x&quot; gypsum board and 1/2 or 5/8&quot; plaster on other side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U435</strong> (4 Hour) Single steel studs 16&quot; or 24&quot; o.c.; quadruple layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
<td></td>
</tr>
<tr>
<td><strong>U463</strong> (4 Hour) Single steel studs 24&quot; o.c.; quadruple layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL in stud cavity.</td>
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</tr>
</tbody>
</table>
STC Ratings of wall assemblies insulated with NU-WOOL® WALLSEAL® Insulation.

Testing done with full scale assemblies at Riverbank Acoustical Laboratories. Some walls extrapolated from other data.

The diagrams and stated STC ratings listed below are intended to serve as a guide. Construction practices have an influence on final STC ratings. Nu-Wool® Co., Inc. cannot guarantee actual STC ratings. Flanking sound patterns, the integrity of the wall, and floor and ceiling construction are important factors in effective sound control.

For more information, please contact the technical department of Nu-Wool Co., Inc. at 800.748.0128.

**WOOD STUD ASSEMBLIES**

**STC ratings for common wall assemblies**

<table>
<thead>
<tr>
<th>STC</th>
<th>Description</th>
<th>Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>66</td>
<td>Double wood studs 16&quot; o.c.; double layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® one side 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>62</td>
<td>Double wood studs 16&quot; o.c.; double layer 1/2&quot; gypsum board one side, single layer other side; both cavities WALLSEAL® to thickness</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>61</td>
<td>Double wood studs 16&quot; o.c.; single layer 1/2&quot; gypsum board each side; both cavities WALLSEAL® to thickness</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>59</td>
<td>Double wood studs 16&quot; o.c.; double layer 1/2&quot; type &quot;x&quot; gypsum board one side, single layer other side; WALLSEAL® one side 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>58</td>
<td>Double wood studs 16&quot; o.c.; single layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® one side 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>58</td>
<td>Double wood studs 16&quot; o.c.; single layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® one side 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>58</td>
<td>Double wood studs 16&quot; o.c.; resilient channel one side; double layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>56</td>
<td>Staggered wood studs 24&quot; o.c.; double layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® one side 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>54</td>
<td>Staggered wood studs 24&quot; o.c.; double layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® one side 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>54</td>
<td>Single wood studs 16&quot; o.c.; resilient channel; single layer 1/2&quot; type &quot;x&quot; gypsum board one side, double layer other side, WALLSEAL® 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>53</td>
<td>Staggered wood studs 16&quot; o.c.; single layer 1/2&quot; gypsum board each side; both cavities WALLSEAL® to thickness</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>52</td>
<td>Staggered wood studs 16&quot; o.c.; single layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® one side 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>51</td>
<td>Single wood studs 16&quot; o.c.; resilient channel one side; single layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>51</td>
<td>Single wood studs 16&quot; o.c.; double layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>47</td>
<td>Single wood studs 16&quot; o.c.; single layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>45</td>
<td>Single wood studs 16&quot; o.c.; single layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>42</td>
<td>Single wood studs 16&quot; o.c.; double layer 1/2&quot; gypsum board one side, single layer 1/2&quot; gypsum board other side; WALLSEAL® 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
<tr>
<td>41</td>
<td>Single wood studs 16&quot; o.c.; single layer 1/2&quot; type &quot;x&quot; gypsum board each side; WALLSEAL® 3 1/2&quot; thick</td>
<td>![Diagram]</td>
</tr>
</tbody>
</table>
In addition to at least 50 UL-approved firewall designs, Nu-Wool Co., Inc. has engineered two proprietary UL-approved, cost-saving firewall designs. UL design U360 is the only 2-hour, load-bearing firewall tested by UL that needs only three layers of 5/8” type X drywall - resulting in savings of 25% on drywall labor and materials. Sound-absorbing UL design U369 has a high STC rating of 58, making it the design choice for sound control.

Cost Saving Two-Hour Firewall Using Only 3 Layers 5/8 in.
Type X Gypsum Wallboard Design No. U360
Underwriters Laboratories
Bearing Wall Rating 2 Hr.

Riverbank Acoustical Laboratories
STC Rating: 51

Sound Absorbing Two-Hour Firewall Using 4 layers of 5/8 in.
Type X Gypsum Wallboard Design No. U369
Underwriters Laboratories
Bearing Wall Rating 2 Hr.

Riverbank Acoustical Laboratories
STC Rating: 58

Nu-Wool WALLSEAL is approved for use in the following UL-approved firewall designs:


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 drywall screws. One layer of wallboard is applied to each side of the wall assembly and one layer is 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** - Nu-Wool-modified 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-13773
Exterior walls, does size matter?

We live in a world where bigger is always assumed to be better. It is only natural that we would think that increasing the depth of our exterior walls would bring greater performance as well. Do the facts support this? The answer is yes and no.

In short, a higher R value exterior wall will lend itself to lower energy costs, but to what extent? To find out the answer to this we must do some energy analysis modeling. Three homes were chosen. One ranch, one 2 story and one 2 story with a bonus room. Three weather sites were: Traverse City, MI, Bowling Green, KY and Jackson, MS. By increasing wall depth, the maximum savings realized were for the two story homes. They both achieved an annual heating cost reduction of 9% in Bowling Green, KY and Jackson, MS. The home in Traverse City, MI saved 7% on their heating bill.

Next we must take into consideration the additional cost involved in make a 2x6 wall compared to a 2x4. You may be able to use Optimum Value Engineering to offset the cost of using 2x6 lumber but you still will have the added expense of window jamb extensions and deeper exterior doors. Add to that the cost of more insulation and your return on investment could be years away.

A benefit that 2x6 construction gives to the homes in Kentucky and Mississippi is a 8%-9% reduction in energy costs adding to their Energy Star credits. The Energy Star program already requires 2x6 (R-19) construction for zones 5 and above.

In the illustration above the BTU loss per square foot of wall area is 2.95 BTU/per hour for a 2x4 wall and 2.00 BTU/per hour for a 2x6 wall. Not a big difference given the temperature difference.

Increased structural integrity provided by the 2x6 walls can be a great benefit that is difficult to quantify in dollars and cents. This is especially useful in areas prone to harsh winter storms, strong winds or tornados.

Since fuel costs are out pacing construction cost the viability of 2x6 construction should continue to be looked at closely.
The Changing Picture of Vapor Retarders

The vapor retarder issue is not going away. The International Residential Code has removed vapor retarders from zones 1-4, from Florida to extreme southern Ohio. But, more change is on the way. As a result of more conferences on moisture movement and the effects of moisture in buildings, a whole new way of classifying vapor retarders is underway.

In the past, the vapor retarder rule made no allowance for location of the building and, more importantly, how it’s constructed. The fact that a “rule” has existed for the past 60 years that, one, had no real testing behind it to justify its validity, and, two, made no allowance for the materials used in construction seems like a poor rule.

The proposed changes for the building codes will have three classes of vapor retarders:

- **Class I**: 0.1 perm or less
- **Class II**: 1.0 perm or less and greater than 0.1 perm
- **Class III**: 10 perm or less and greater than 1.0 perm

Under this proposal, buildings in zones 1-4 do not require any class of vapor retarder on the interior surface of insulated assemblies. Zone 5 would require a Class III vapor retarder (10 perms) on the interior surface of insulated assemblies. This could be accomplished simply by painting the interior surface with ordinary latex paints.

The proposed changes discourage the following in building practices:
- The installation of vapor retarders on both sides of an assembly.
- The installation of polyethylene vapor retarders.
- The installation of vinyl wall coverings.
- The placement of a layer of sand between polyethylene vapor retarders and concrete slabs.
- The installation of polyethylene vapor retarders on the interior of insulated basements.

The following are encouraged:
- The construction of assemblies that is able to dry by diffusion to at least one side and in many cases to both sides.
- The ability to use insulating sheathings in cold climates without the creation of “double vapor retarders.”
- The ability to use damp spray insulations in cold climates with insulating sheathings without the creation of “double vapor retarders.”

A PDF copy of the Vapor Retarder Journal Paper is available from the NU-WOOL Co., Inc. web site.
**Noise Levels**

*(assumes normal/quiet background level - NC 35)*

<table>
<thead>
<tr>
<th>STC – Lab</th>
<th>Field STC</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>26-30</td>
<td>20-22</td>
<td>Most sentences clearly understood</td>
</tr>
<tr>
<td>30-35</td>
<td>25-27</td>
<td>Many phrases and some sentences understood without straining to hear</td>
</tr>
<tr>
<td>35-40</td>
<td>30-32</td>
<td>Individual words and occasional phrases clearly heard and understood</td>
</tr>
<tr>
<td>42-45</td>
<td>35-37</td>
<td>Medium loud speech clearly audible, occasional words understood</td>
</tr>
<tr>
<td>47-50</td>
<td>40-42</td>
<td>Loud speech audible, music easily heard</td>
</tr>
<tr>
<td>52-55</td>
<td>45-47</td>
<td>Loud speech audible by straining to hear; music normally can be heard and may be disturbing</td>
</tr>
<tr>
<td>57-60</td>
<td>50-52</td>
<td>Loud speech essentially inaudible; music can be heard faintly but bass notes disturbing</td>
</tr>
<tr>
<td>62-65</td>
<td>55</td>
<td>Music heard faintly, bass notes “thump”; power woodworking equipment clearly audible</td>
</tr>
<tr>
<td>70</td>
<td>60</td>
<td>Music still heard very faintly if played loud</td>
</tr>
<tr>
<td>75+</td>
<td>65+</td>
<td>Effectively blocks most air-borne noise sources</td>
</tr>
</tbody>
</table>
STC values for Wall Assemblies

Staggered 2x4 Wood Studs on 6 inch plate 37
Double Row Wood Studs on Separate Plates 40
Gypsum Board Per Sheet 4
Resilient Channel, 16 inch Centers* 10
3-½ inch Cellulose Material, Wood Studs 5
3-½ inch Cellulose Material, Steel Studs 8

Double Wall with Cellulose Insulation and RC
Air space in center 68 STC

Double Wall with Cellulose Insulation
On Common Plate 64 STC

*24 inch on center is slightly better for STC
Guaranteed to Perform Without A Vapor Retarder

Nu-Wool Co., Inc. advises contractors that a vapor retarder is not necessary with the Nu-Wool WALLSEAL system in walls using gypsum wallboard. This is due to the product’s unique ability to resist air movement, and therefore, the transmission of moisture. Air movement is the primary mechanism for moisture transfer. In fact, air accounts for 98% of all vapor movement in insulated cavities. Clearly, stopping air movement is the fundamental issue that builders and insulators should address. Vapor retarders on walls are not necessary or even desirable in all buildings or in all climates, because they can trap moisture. ASHRAE standards warn against the use of vapor retarders in any structure in warm climates. There is also danger with moisture problems in cold climates caused by moisture being driven into the wall in the summer. Vapor retarders are installed on the interior in cold climates to control moisture movement from inside out during the heating season, however those same vapor retarders trap the moisture contained in solar driven, warm summer air.

The Nu-Wool Guarantee

Nu-Wool Co., Inc. is the oldest manufacturer of cellulose insulation in the world. Nu-Wool Co., Inc. guarantees the proper application of Nu-Wool WALLSEAL without a vapor retarder in buildings with walls using gypsum wallboard and normal relative humidity levels. Vapor retarders are still necessary in buildings with high relative humidity levels, such as those with indoor pools. Many university research studies and building scientists have concluded that the vapor retarder provisions in building codes should be eliminated. Nu-Wool Co., Inc., along with the Environmental Protection Agency and others, is involved in work with the International Code Council to promote a change in the building codes relating to vapor retarders.
Attic Application

Attics are dry-blown at a density not less than 1.6 pounds per cubic foot (pcf). The manufacturers’ coverage chart should be used for attic application.

This insulation is applied with air during installation and will settle after it is applied. The manufacturers’ coverage chart has taken this settling factor into account in calculating coverage. The chart has a column for installed thickness and a column for the thickness after settling. All of these calculations relate to desired R-values that the installer wants to achieve. Machines that produce more air during application, e.g., gas powered blowing machines, will often increase the volume of the insulation making it appear that adequate depth has been reached. The use of the manufacturers’ coverage chart is important to ensure that regardless of application the end-user has the desired R-value. Installing bags rather than inches will achieve these results.

Examples of poor installation techniques.

Insulation should not be blown into eave spaces where the ventilation will be restricted. Care should be taken that insulation is not blown into “blind” areas that could fall into fireplace chases or other hazardous areas.

Recessed lights can be covered with insulation as long as they are rated IC (insulation contact). With all other recessed lights insulation must be kept 3 inches away from the sides. Keep insulation away from exhaust flues, space heaters, chimneys, water heaters and any other heat producing device. Refer to ASTM C-1015 for insulation guidelines.
Attic Vent Baffles

1. Vents are available for 16 and 24 inch spacing.
2. Crease sides to fit and staple in-place every 12 inches.
3. Foam baffles are bent to fit and natural pressure keeps them in-place.
4. It is important to have enough eave baffle vents to equal the prescribed ventilation for the attic assuming a split between upper and lower ventilation.
5. Insure that the baffle rests on the furthest point of the plate, the cold side.
Raised Truss/Energy Heel

Raised truss refers to any roof/ceiling construction that allows the insulation to achieve its full thickness over the plate line of exterior walls. Several constructions allow for this, including elevating the heel (sometimes referred to as an energy truss, raised-heel truss, or Arkansas truss), use of cantilevered or oversized trusses, lowering the ceiling joists, or framing with a raised rafter plate.
Blowing Pitched Assemblies

Blowing Inclines

To insure that the insulation material stays in-place, it may be necessary to install baffles to act as dams for the blown insulation. The density of the material is usually sufficient in most attic inclines to keep the insulation in-place.

An alternate method is to loosely install fabric over top of the bottom cords and fill. Much like a dense pack cathedral in reverse where the insulation is held to the ceiling, not the roof deck.
Weight of insulation on ceilings

We know that the settled density of Nu-Wool Premium Cellulose Insulation is 1.6 pounds per cubic foot but what does that really mean in relation to the weight it puts on a gypsum board ceiling?

Let’s look at what a one square foot column of insulation weighs for various R-values. If you want an R-30, or 8 inches of Nu-Wool Premium Cellulose Insulation you would have a load of just over one pound per square foot. An attic with an R-value of 38 is 10 inches deep, and weighs 1.3 pounds per square foot. Using the Department of Energy (DOE) recommendations of R-49 you would need to install 14 inches of insulation that would weigh 1.3 pounds per square foot of ceiling area.

Under most circumstances the weight of the insulation is not an issue for 1/2 inch drywall attached to trusses 16 inches on-center. It is advised that 5/8 inch drywall be used when spacing is 24 inch on center, or R-values higher than 38 are required. In all cases the gypsum board must be adequately secured with glue and screws.

What happens when we dense pack a cathedral ceiling? We now change the density from a settled density to a compacted density of 3.2 pounds per cubic foot. In a 2x10 rafter assembly the weight is 2.5 pounds per square foot, much more than the R-38 attic. At this weight it is extremely important that a proper fastening schedule and drywall type be used. A minimum of 5/8 inch gypsum board should be used for framing spacing exceeding 16 inch on center.
Placing rigid foam at the sheathing interface and using the “dense pack” method further insures a high performance structure. Having foam at the top of the insulation creates a system where the dew point is not reached and the high density foam adds more to the total R-value of the assembly. For those seeking a high performance cathedral ceiling, this method is preferred.

To further minimize the possibility of moisture flow through a “dense packed” cathedral, a heavy vapor retarder can be used. Indoor pool rooms and other high humidity areas should always have a vapor retarder in both the ceilings and walls. Ceilings are very sensitive to environments with high humidity and a vapor retarder with a “dense packed” cathedral is a design detail that lessens the likelihood of moisture migration. Cathedral ceilings with tongue and groove paneling and without gypsum board should always have a vapor retarder. Tongue and groove paneling on ceilings presents too many opportunities for air leakage (moisture) and the “dense packed” insulation, while effective for reasonable air leakage, is unable to meet this demand.

Nu-Wool Premium Cellulose Insulation has been used successfully for over 15 years in “dense packed” cathedrals without the need for the traditional air space. When installed at a density of at least 3.0 lbs./ft.⁴ and to a depth of at least 10 inches, a ceiling “dense packed” with Nu-Wool Premium Cellulose Insulation will outperform cathedral ceilings with the ventilated airspace. Product specifiers and builders should always require that this type of work be done by Certified Nu-Wool WALLSEAL Dealers. Installers should contact Nu-Wool’s Technical Services Department for advice before dense packing cathedral ceilings with unusual construction, e.g., no gypsum board, or buildings outside the normal residential use.
IC RECESSED LIGHTS

“IC” means that the recessed light can have Insulation Contact. This design also allows the light to be covered with insulation. Lights going off or flickering are symptoms of other problems—not insulation related problems.

1. Each light has a specific trim package that is designed to work with that fixture.
2. Each light has a specific bulb size.
3. Recessed lights have adjustable sockets, if they are pushed beyond the “stop” built into the light they cease to be a protected fixture.
4. Halogen lights will sometimes give problems for IC lights.
5. Halogen lights and dimmer switches give more problems than incandescent lights without dimmers. Very often, incorrect dimmers are at fault.

Please make this information available to your builders if they have experienced these problems. If you have any question regarding this information, please call the Nu-Wool Technical Services Department at (800) 748-0128.

“IP” refers to Internally Protected: This type of light is not designed to be covered with insulation. An IP fixture contains a thermal switch to shut off the light in the event the fixture becomes too hot from having a lamp installed that is a higher wattage than the fixture is designed for. The IP fixture must not have insulation contact and insulation must be kept 3 inches away from all sides.
NU-WOOL® CO., INC.
BLOW-IN-PLACE CELLULOSE INSULATION

This will confirm Elk premium roofing products are approved for use with Nu-Wool Blow-In-Place Cellulose Insulation and carry the full limited warranty, provided the installation requirements are followed.

1. All structural roof work including decking/sheathing is in place and in compliance with local codes.

2. The blow-in-place insulation is applied in accordance with Nu-Wool’s specifications and guidelines to the underside of the roof decking/sheathing and complies with local codes.

3. Apply Elk starter strip, Elk hip and ridge shingles, and Elk field shingles in accordance with the recommendations printed on each bundle wrapper. Elk hip and ridge shingles will carry the limited warranty period applicable to the Elk field shingles.

4. The Elk Corporation will not be responsible for any deficiencies or movement of the roof deck, manufacturing defects in the fasteners resulting in their failure to perform, and/or improper application of the substrate or Elk fiberglass shingles.

5. It is the responsibility of the design professional to examine the need for structural ventilation and to ensure interior air quality. For any building, construction must be in compliance with local codes.

For Elk product specifications, limited warranties, or other information regarding Elk premium roofing products, please contact the Elk location nearest you or visit our web site at www.elkcorp.com.

For information regarding the Nu-Wool Blow-In-Place Cellulose Insulation, please call 800-748-0128 or visit their web site at www.nuwool.com.

Nu-Wool® is a registered trademark of Nu-Wool Co., Inc.

TBSD-046 Date Issued: 7/19/04
Technical Support

Nu-Wool Co., Inc. makes a product that they proudly stand behind. Because of the guaranteed energy efficient qualities of this insulation, we provide technical support throughout the construction of the building. This support is offered to the architect, the building official, the builder and the insulation contractor. If there is a problem or you need help with an issue, contact the Technical Services Department and get the answers you need - 800.748.0128.

THE TECHNICAL SERVICES DEPARTMENT OFFERS THE FOLLOWING SERVICES

✓ Blower Door Testing
✓ Infrared Analysis
✓ Moisture Testing
✓ Acoustic Troubleshooting
✓ Calculating BTU Loads
✓ Energy Usage Analysis
✓ Duct Blaster Technology
✓ HVAC Sizing
✓ Resolving Building Code Issues
✓ Recommendations for Proper Installation
What Is A Blower Door?

A Blower Door is a diagnostic tool used to measure and quantify the air tightness of houses and residential duct systems. The Blower Door consists of a powerful calibrated fan, an adjustable door frame to seal the fan into an exterior doorway of a house, and gauges to measure fan flow and house pressures created by the fan. In a typical Blower Door depressurization test, the fan blows air out of the house to create a slight pressure difference between the inside and outside of the house. This pressure difference forces outside air into the house through all holes, cracks and penetrations in the building envelope.

House air tightness rates are calculated from the house pressure and fan airflow rates. In addition to determining house air tightness, the Blower Door exaggerates existing air leakage paths making them easy to locate with a smoke generator, infrared camera, or simply feeling with your hands.

Building Air tightness:

Building air tightness is a measure of how much air passes through the outside building envelope at a specified reference pressure. The house reference pressure most commonly used in Blower Door tests is 50Pa (or .2” w.c.) of pressure between the inside and outside of the house. Air tightness measurements are typically presented in two formats: Air Changes per Hour at 50 Pa (ACH50) and Cubic Feet of Air per minute at 50 Pa (CFM50). Blower Door tests are performed at a reference pressure which is significantly greater than the driving forces associated with natural infiltration in order to improve measurement accuracy and repeatability.

Why Blower Doors Make Good Sense

In New Construction:

- The air tightness of a house is key to its overall performance. Uncontrolled air leakage results in high fuel bills.
- Failure of building components and increased callbacks. A Blower Door quickly and simply lets you measure the air tightness of your houses and pinpoint problem leakage sites.
- Unknowingly building tight homes without mechanical ventilation can lead to moisture and other indoor air quality problems. A Blower Door test allows you to estimate the natural ventilation rate of a house so you can predict when mechanical ventilation is needed.
- House air tightness is an important component of combustion safety. Knowing the air tightness of a house can help you predict the likelihood of a pressure induced spillage problem from exhaust fans or other combustion appliances.

Copyright ©1999-2005 The Energy Conservatory
Minneapolis Duct Blaster

There are more than a million miles of duct work in U.S. homes. Industry experts estimate that more than two-thirds of them are leaky enough to justify sealing or repair. Leaky ducts can significantly increase air conditioning and heating bills, dramatically reduce equipment capacity and performance, as well as result in potentially dangerous indoor air quality problems. In fact, duct leakage is responsible for many of the comfort complaints experienced by homeowners today.

The Minneapolis Duct Blaster is used to directly pressure test the duct system for air leaks, much the same way a plumber pressure tests water pipes for leaks. The Duct Blaster fan is first connected to the duct system at the air handler cabinet, or a return grille. After temporarily sealing all remaining registers and grills, the Duct Blaster fan is turned on to force air through all holes and cracks in the ductwork. The fan speed is increased until a standard test pressure is achieved in the duct system. A precise duct airtightness measurement is then made using the DG-700 Digital Pressure and Flow Gauge connected to the Duct Blaster system.

Estimates of efficiency losses from duct leakage can be generated using our TECBLAST software. A theatrical fog machine can also be used to inject a non-toxic fog into the duct system to visually demonstrate the location and extent of air leakage.
Infrared Analysis

Infrared (IR) is a great way to solve building problems without doing destructive testing to a building. When a problem such as moisture, missing insulation, or air movement is impacting on the performance of a building; IR can help solve this problem.

Nu-Wool's Technical Services Department has three cameras that are available to solve problems in the field. We use Infrared Solutions IR-Insight cameras that are very sensitive to small differences in temperature. Infrared cameras can be used throughout the year as they are able to “see” in the wall or ceiling without great differences in temperature that limited earlier cameras. Below are some actual IR photos from these cameras.
Guaranteed Energy Program

Nu-Wool Co., Inc., through Certified WALLSEAL Dealers, offers a Guaranteed Energy Program for new homes insulated with Nu-Wool Premium Cellulose Insulation, at no cost to the home owner or builder. This energy guarantee not only ensures savings on fuel bills, it can help home buyers add upgrades to their home without adding costs. Under this program, a home’s heating and/or cooling bill is guaranteed for a period of three years. If the energy bills exceed the guaranteed amount, Nu-Wool Co., Inc. will reimburse the home owner 50% of the overage. Builders can use this guarantee as an attractive selling feature to home buyers.

To apply for the Guaranteed Energy Program, simply have your insulation contractor complete the one-page form that describes the characteristics and insulation levels of your building. This form is returned to the Technical Services Department at Nu-Wool Co., Inc. Based on computer analysis using the Rem/Design program from Architectural Energy Corporation, it can be determined what your home should heat and cool for based on the reduction Nu-Wool Premium Cellulose Insulation adds to the efficiency of your home.
# Energy Guarantee Form

**Insulation Contractor** ______________________________ Certificate Needed **Yes** **No**

**Homeowners Name** __________________________________________

**Job Address** _______________________________________________

**City** ______________ **State** ________ **Zip** __________

## General Information

- **Square Ft. of Home** __________ sq. ft. Include basement square feet
- **Volume of Home** ________ cu. Ft. Square feet times average wall height
- **Number of Stories** _________ Totally above grade

## Basement or Crawlspace walls

Concrete walls only (not walk out wall)
- **Wall R-Value** ________ R
- **Height Above Grade** ______ ft.
- **Depth Below Ground** ______ ft.

**Basement Floor / Slab**
- **Slab Area** ______ sq.ft.
- **Exposed Perimeter** ______ ft. on grade level
- **Edge of Slab R-Value** ______
- **Under Slab R-Value** ______

## Frame Floors Over Garage, Crawlspace or Open air

- **Area** ______ sq. ft.
  - **R-value** ______
  - **Location** __________

## Rim Band / Box Sill

- **Area** ______ sq. ft.
  - **R-Value** ______
  - **Location** __________

## Windows and Skylights

- **U Value** ______
- **SHGC Value** ________
- **Roof Pitch** ______/12

- **North** ______ sq. ft. area
  - **Include sliders and french doors with windows.**

- **East** ______ sq. ft. area

- **South** ______ sq. ft. area

- **West** ______ sq. ft. area

## Ceilings

- **Attic Area** ______ sq. ft.
  - **R-Value** ______
  - **Cathedral Area** ______ sq.ft.
  - **R-Value** ______

## Exterior Walls

- **include walk out walls here**

## Heating Unit

- **Equipment Type** __________________________
  - **Efficiency** ______
  - **Location** ______
  - **Attic / Garage / Basement**
  - **Duct Location** ______
  - **% of duct in this location** ______
  - **Duct R-Value** ______

## Cooling Unit

- **Equipment Type** __________________________
  - **Efficiency** ______
  - **Location** ______
  - **Duct Location** ______

## Fuel Cost

- **Nat. Gas** ______ CCF
- **Oil/Propane** ______ Gallon
- **Electric** ______ KWH

- **Use State Average** ______ Yes
- **Duct R-Value** ______

---

2472 Port Sheldon Street • Jenison, MI 49428
P: 800.748.0128 • F: 616.669.2370 • www.nuwool.com
### House

- **House square footage**: Add the square footage of all floors inside house including basement.

- **Volume**
  - basement floor area \(\times\) basement height = \(A\)
  - first floor area \(\times\) first floor height = \(B\)
  - second floor area \(\times\) second floor height = \(C\)
  - \(A + B + C = \text{Volume}\)

- **Number of Stories**: Number of Stories above ground level.

### Foundation

- **Concrete wall insulation**
  - R-value of insulation applied to concrete walls - **no walkout or daylight walls**.

- **Length**
  - The linear footage (length) of concrete basement walls.

- **Height above ground**
  - Height of basement wall exposed to daylight

- **Depth below ground**
  - Height of basement wall in contact with soil

### Slab Area

- Square footage of slab floor

### Full Perimeter

- The length of all sides of the slab floor added together

### Edge of Slab R-value

- R-value of insulation installed around perimeter of slab floor

### Under Slab R-value

- R-value of insulation installed under slab floor

### Basement Floor Area

- Square Footage of basement floor.

### Full Floor Perimeter

- The length of all sides of the basement floor added together

### Exposed Perimeter

- The length of basement floor along a walkout wall

### Wood Frame Floor Area

- Square footage of living area above garage, crawlspace, or outside.

### R-value

- R-value of Floor Insulation \(2\times8 = R32\) \(2\times10 = R36\) \(2\times12 = R42\)

### Nu-Wool 2x4 Area

- Total Square Footage of all 2x4 Nu-Wool side walls

### Nu-Wool 2x6 Area

- Total Square Footage of all 2x6 Nu-Wool side walls

### Other R-Value

- Used for wall insulation other than Nu-Wool 2x4 or 2x6

### Band & Rim Joist Area

- Square feet of exposed floor joists between floors

### R-value

- R-value of Rim/Band Joist Insulation

### Windows & Doors

- **u-value**
  - u-value is listed on window labels.
  - **Example u-values**: Best .32 Good .38 Average .42 Poor .55

- **Area**
  - Total square footage of glass facing North, East, South, and West.

- **Door Area**
  - Area of Doors without windows - doors with windows go under Windows

- **R-value**
  - R-value of doors - **Example: R-2 to R-5**

- **Skylight u-value**
  - u-value is found on skylight stickers.

- **Area**
  - Total square footage of skylights

- **Direction**
  - North, East, South, or West

### Attic Area

- Square Footage of Attic Floors above living space

### R-Value

- R-Value of attic floors

### Cathedral Area

- Square Footage of cathedral ceilings

### R-Value

- R-value of cathedral ceilings \(2\times8 = R32\) \(2\times10 = R36\) \(2\times12 = R42\)

### Heating

- **Type**
  - Indicate the heating system type

- **Efficiency**
  - Check appropriate box for furnace efficiency

- **Fuel Type**
  - Check appropriate box for fuel type

- **Fuel Price**
  - Cost of Heating Fuel being used. **Example: Natural Gas $.75 per therm**

- **Fireplace?**
  - Does the home have a fireplace?

### Cooling

- **Efficiency**
  - Efficiency of Air Conditioner or Heat Pump. **Example: 10 SEER A/C**

- **Electric Price**
  - Cost of Electricity. **Example: $.08 per kWh**

---

4/28/2006
GREEN Since 1949
More than 60 years ago, Nu-Wool Co., Inc. began using recycled newspaper to manufacture its environmentally safe and effective cellulose insulation. Converting recycled paper to insulation used in the walls and attics of buildings helps keep it out of landfills where it has the potential to pollute the environment. Recycling paper also reduces the number of trees used to produce new paper. The amount of Nu-Wool Premium Cellulose Insulation in an average-sized new home is the equivalent of 39 trees!

Manufacturing Process
Cellulose insulation makes efficient use of natural resources. Independent University and lab studies, as well as actual homes, show that buildings insulated with cellulose insulation are heated and cooled more efficiently, using up to 40% less energy than fiberglass insulated buildings, contributing to energy conservation and saving both homeowners and building owners up to 40%* on utility bills.

Choosing Nu-Wool Premium Cellulose Insulation can save up to 40%* on energy bills!

Nu-Wool Premium Cellulose Insulation

| Less energy to manufacture + Less fuel consumed in buildings with cellulose insulation = Lower greenhouse gas emissions |

ICC-ES SAVE™ verified GREEN Product
Nu-Wool Premium Cellulose Insulation is the first cellulose insulation product to be evaluated and verified by the ICC-ES SAVE™ Program. The Verification of Attributes Report™ (VAR™) for Nu-Wool Premium Cellulose Insulation is VAR-1005 and can be viewed at www.nuwool.com.

The Sustainable Attributes Verification and Evaluation™ Program is a program created by the ICC Evaluation Service (ICC-ES) to provide reliable information about claims made by manufacturers of sustainable products. The evaluation, based on guidelines for sustainability, includes inspection of the manufacturer’s production process and product testing at recognized laboratories, where applicable. The end result is a VAR™, which provides technically accurate product information that can be helpful to those seeking to qualify for points under major green rating systems.

Nu-Wool, leading the LEEDership movement
Because of the high post consumer recycled content and energy efficient properties of Nu-Wool Premium Cellulose Insulation, projects using Nu-Wool Premium Cellulose Insulation can earn significant points toward LEED certification.

TABLE 1 - RECYCLED CONTENT BY WEIGHT SUMMARY

<table>
<thead>
<tr>
<th>% PRE-CONSUMER RECYCLED CONTENT</th>
<th>% POST-CONSUMER RECYCLED CONTENT</th>
<th>% TOTAL RECYCLED CONTENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>65.83</td>
<td>85.83</td>
</tr>
</tbody>
</table>

* Savings vary. Find out why in the seller’s fact sheet on R-values. Higher R-values mean greater insulating power.
Printed on recycled paper. Reorder #28347 03/10
Corrosion Guarantee

NU-WOOL Premium Cellulose Insulation is warranted for all the test items currently in effect for insulation materials under ASTM Standard C 739. Included in this standard is a test for corrosion resistance.

NU-WOOL Co. Inc. warrants its insulation product, when properly installed, to be corrosion resistant to all types of metal for the life of the structure. NU-WOOL Co. Inc. has offered, since 1978, a full lifetime warranty for their products. That warranty clearly lists each test characteristic, including corrosion.

NU-WOOL Co. Inc. specifically warrants those test characteristics to metal buildings properly insulated with NU-WOOL Premium Cellulose Insulation.
The Changing Picture of Vapor Retarders

The vapor retarder issue is not going away. The International Residential Code has removed vapor retarders from zones 1-4, from Florida to extreme southern Ohio. But, more change is on the way. As a result of more conferences on moisture movement and the effects of moisture in buildings, a whole new way of classifying vapor retarders is underway.

In the past, the vapor retarder rule made no allowance for location of the building and, more importantly, how it’s constructed. The fact that a “rule” has existed for the past 60 years that, one, had no real testing behind it to justify its validity, and, two, made no allowance for the materials used in construction seems like a poor rule.

The proposed changes for the building codes will have three classes of vapor retarders:

- **Class I**  0.1 perm or less
- **Class II**  1.0 perm or less and greater than 0.1 perm
- **Class III**  10 perm or less and greater than 1.0 perm

Under this proposal, buildings in zones 1-4 do not require any class of vapor retarder on the interior surface of insulated assemblies. Zone 5 would require a Class III vapor retarder (10 perms) on the interior surface of insulated assemblies. This could be accomplished simply by painting the interior surface with ordinary latex paints.

The proposed changes discourage the following in building practices:
- The installation of vapor retarders on both sides of an assembly.
- The installation of polyethylene vapor retarders.
- The installation of vinyl wall coverings.
- The placement of a layer of sand between polyethylene vapor retarders and concrete slabs.
- The installation of polyethylene vapor retarders on the interior of insulated basements.

The following are encouraged:
- The construction of assemblies that is able to dry by diffusion to at least one side and in many cases to both sides.
- The ability to use insulating sheathings in cold climates without the creation of “double vapor retarders.”
- The ability to use damp spray insulations in cold climates with insulating sheathings without the creation of “double vapor retarders.”

A PDF copy of the Vapor Retarder Journal Paper is available from the NU-WOOL web site.
Infrared Analysis

Infrared (IR) is a great way to solve building problems without doing destructive testing to a building. When a problem such as moisture, missing insulation, or air movement is impacting on the performance of a building; IR can help solve this problem.

Nu-Wool’s Technical Services Department has three cameras that are available to solve problems in the field. We use Infrared Solutions IR-Insight cameras that are very sensitive to small differences in temperature. Infrared cameras can be used throughout the year as they are able to “see” in the wall or ceiling without great differences in temperature that limited earlier cameras. Below are some actual IR photos from these cameras.
Minneapolis Blower Door™

Today, many builders are routinely building houses that are very airtight, often without realizing it. The common use of building wraps, moisture barriers, high efficiency windows and even simple plywood sheathing all have direct effects on reducing air leakage and infiltration. An airtight house has fewer openings through which fresh air can enter. Without the addition of mechanical ventilation, a tight house can result in stagnant air, less natural ventilation and dissatisfied homeowners. On the other hand, houses with large amounts uncontrolled air leakage are equally troublesome with comfort complaints due to drafts, building failures and high energy bills. Despite the growing importance of house airtightness, few builders, architects or homeowners know how tight their houses are. Until recently, the building community has tended to rely on subjective estimates of airtightness. Unfortunately, it is impossible to accurately estimate the tightness level of a building by visual inspection alone. And without knowing the airtightness level, it is difficult or impossible to design for effective approaches to ventilation and air quality, or to accurately diagnose performance problems.

The Minneapolis Blower Door has long been recognized as the best designed and supported building airtightness testing system in the world. Combined with specialized accessories and testing procedures developed by The Energy Conservatory, the Minneapolis Blower Door is the system of choice for utility DSM programs, energy raters, HVAC contractors and weatherization professionals.
**Read this before you buy - What you should know about R-values:**

The chart shows the R-value of this insulation. R means resistance to heat flow. The higher the R-value, the greater the insulating power. Compare insulation R-values before you buy.

There are other factors to consider. The amount of insulation you need depends mainly on the climate you live in. Also, your fuel savings from insulation will depend upon the climate, the type and size of your house, the amount of insulation already in your house, and your fuel use patterns and family size. If you buy too much insulation, it will cost you more than what you’ll save on fuel.

To get the marked R-value, it is essential that this insulation is installed properly.

---

**Federal Trade Commission**  
**Fact Sheet**  
**This Is Cellulose**  
**Loose-Fill Insulation**

**NU-WOOL APPLICATION CHART**

<table>
<thead>
<tr>
<th>R-value at 75°F mean temp</th>
<th>Minimum thickness (in inches)</th>
<th>Maximum Net Coverage (no adjustment for framing)</th>
<th>Gross Coverage (based on 2” x 6” framing on 16” centers)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grueso mínimo (en pulgadas)</td>
<td>Cobertura neta máxima (ningún ajuste para enmarcar)</td>
<td>Cobertura gruesa basada en 2” x 6” que emarcan los centros del 16”)</td>
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<tr>
<th>To obtain a thermal resistance (R) of</th>
<th>Installed insulation should not be less than</th>
<th>Thickness after settling</th>
<th>Maximum sq. ft. per bag</th>
<th>Minimum bags per 1000 sq. ft</th>
<th>Minimum weight per sq. ft. (lbs)</th>
<th>Maximum sq. ft. per bag</th>
<th>Minimum bags per 1000 sq. ft</th>
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<tbody>
<tr>
<td></td>
<td>El aislamiento instalado no debe ser menos que</td>
<td>Grueso después de colocar</td>
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<tr>
<th>Wall Coverage Chart (3.3 pcf Density)</th>
<th>Gráfico de Cobertura pared (3.3 Densidad PCF)</th>
</tr>
</thead>
</table>

Coverage is based on settled density, except for sidewall application. Initial installed thickness information was derived using a Krendl K500 blowing machine at 5 for the gate (material) setting and 6.5 for the air setting. Use this chart for estimating purposes only. Application techniques, equipment, equipment settings, atmospheric conditions and hose length all affect the coverage of this product. Coverage chart based on nominal bag weight of 25 lbs / 11.34 kg. Minimum net weight 23 lbs / 10.43 kg.

---

**Manufactured by:** Nu-Wool Co., Inc.  
2472 Port Sheldon St. • Jenison, MI 49428  
616.669.0100 • 800.748.0128 • Fax: 616.669.2370  
nuwool.com

05/2016
Right-size your HVAC equipment and save!

How does Nu-Wool Premium Cellulose Insulation impact HVAC system size?

By using energy-efficient Nu-Wool Premium Cellulose Insulation, heating and cooling equipment can be “right-sized”, which saves valuable construction dollars and can extend the operating life of the HVAC system. Right-sized equipment is usually smaller and therefore, costs less. Because oversized heating and cooling units are inefficient and costly, Nu-Wool Co., Inc. provides HVAC sizing assistance. The very latest software is used to make these calculations for builders and architects.

Installing Nu-Wool Premium Cellulose Insulation, along with the right-sized HVAC system, will result in:

**IMPROVED COMFORT**
Each room in the house will feel more comfortable all year long. In the heating season, temperatures are more even and consistent throughout the home. In the cooling season, the air conditioner will control humidity better, which means greater comfort.

**IMPROVED EFFICIENCY**
Vehicles perform better and obtain better gas mileage on the highway when there are less stops and starts. Likewise, HVAC systems operate more efficiently when less cycling (turning on and off) is required to heat or cool a building.

**LONGER HVAC LIFE**
Nu-Wool Premium Cellulose Insulation reduces the load placed on the HVAC equipment. Decreased demand and less cycling means a longer life for the HVAC system.

How does Nu-Wool Premium Cellulose Insulation impact HVAC performance?

Nu-Wool reduces air infiltration better than fiberglass insulation materials. Air leakage is a primary factor in energy loss and the corresponding demand on the HVAC system. Using energy-efficient Nu-Wool Premium Cellulose Insulation enhances the performance of heating and cooling equipment better than fiberglass insulation.

What size system is right?

Using a customized software program, a qualified Nu-Wool technician can determine the correct system size needed for a home by doing a load calculation. Using Nu-Wool Premium Cellulose Insulation in combination with a right-sized system for a home will save homeowners up to 40%* on energy bills. Savings are realized immediately and for years to come.

Use the Energy Savings Calculator at www.nuwool.com to determine how much you could save!

PREMIUM CELLULOSE INSULATION GREEN Since 1949

* Savings vary. Find out why in the seller’s fact sheet on R-values. Higher R-values mean greater insulation power.

Printed on recycled paper. Reorder #28343 06/10
NU-WOOL CO., INC. WARRANTS that NU-WOOL® PREMIUM CELLULOSE INSULATION, when properly installed, will retain all the physical characteristics of the current Federal Specifications and the ASTM Test Standards relating to this product as listed below.

- Smoldering Combustion
- Critical Radiant Flux
- Permanency of Chemical Formulations
- Corrosiveness
- Fungal Growth
- Density (Settled)
- Thermal Resistance
- Moisture Absorption
- Odor Emission
- Starch Content

These characteristics are warranted according to the specifications published on the package of the product installed in the structure. If NU-WOOL® PREMIUM CELLULOSE INSULATION, when properly installed in compliance with our Recommended Installation Methods, including minimum FHA recommended ventilation and HUD Manufactured Home Construction and Safety Standards, should fail to retain any of the characteristics listed above and on the package, NU-WOOL CO., INC. will replace the insulation and repair any structural damage attributable to a defect in the insulation product manufactured by NU-WOOL CO., INC.

In order to assert any warranty rights please contact NU-WOOL CO., INC., 2472 PORT SHELDON STREET, JENISON, MICHIGAN 49428. NU-WOOL CO., INC. shall not be liable for any incidental or consequential damages resulting from a breach of this warranty or any express or implied warranty arising under state law. Some states do not allow the exclusion of limitation of consequential damages, so the above limitation or exclusion may not apply to you. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Please complete and return the attached WARRANTY REGISTRATION FORM to NU-WOOL CO., INC., 2472 PORT SHELDON STREET, JENISON, MICHIGAN 49428, in order to establish proper installation of the product. Failure to return this card will not adversely affect your warranty rights if you can otherwise establish that NU-WOOL® PREMIUM CELLULOSE INSULATION has been installed in compliance with NU-WOOL RECOMMENDED INSTALLATION PRACTICES.
Nu-Wool Insulation System is:
- Durable and always effective
- Non-corrosive
- Non-toxic
- Non-combustible
- Moisture resistant
- Asbestos free
- Sound absorbing
- Non-supportive to vermin

<table>
<thead>
<tr>
<th>FEATURE</th>
<th>CELLULOSE</th>
<th>FIBERGLASS</th>
<th>THERMATECH</th>
<th>COMPARISON</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production Process</td>
<td>Fiction-Paper is ground into a fine, dust-like consistency.</td>
<td>Sand is melted with recycled glass and spun into fine glass fiber.</td>
<td>Ore is melted and spun into long mineral fibers.</td>
<td>The fibers in cellulose are hollow to maximize R-value.</td>
</tr>
<tr>
<td>Chemical Additives</td>
<td>Fiction-Large amounts of borax and boric acid plus other additives.</td>
<td>Some dyes added.</td>
<td>None. Does not control molds or insect movement.</td>
<td>The chemical additives in cellulose are natural fungicides and preservatives.</td>
</tr>
<tr>
<td>Fire Resistance</td>
<td>Fiction-Fire resistant, but when ignited, the material will support combustion.</td>
<td>Non-combustible. Will not support combustion, but will melt at approximately 1,000°F.</td>
<td>Non-combustible. Will not support combustion and will not melt unless temperature exceeds 2,000°F.</td>
<td>Borate based cellulose is tested to 1800°F.</td>
</tr>
<tr>
<td>Settling</td>
<td>Fiction-Some tests indicate 20%-30% settling over time.</td>
<td>No significant settling when properly installed.</td>
<td>No significant settling. When properly installed.</td>
<td>All insulation manufacturers must have a chart designed and regulated by the FTC.</td>
</tr>
<tr>
<td>Moisture Absorption</td>
<td>Fiction-Organic fibers will readily absorb large amounts of moisture. Emits fire retardant chemicals while drying.</td>
<td>Inorganic fibers will not absorb moisture. Difficult to dry once wet.</td>
<td>Inorganic fibers will not absorb moisture. Difficult to dry once wet.</td>
<td>All building materials are prone to moisture. Cellulose dries naturally. Inorganic fibers remain wet longer.</td>
</tr>
<tr>
<td>Extraneous Materials</td>
<td>None.</td>
<td>None.</td>
<td>Allowed a significant amount of “shot” content. “Shot” has no insulation value.</td>
<td>No extraneous materials.</td>
</tr>
<tr>
<td>Sound Reduction</td>
<td>Resilient materials such as cellulose absorb sound more effectively. Cellulose is higher in density than other insulation materials.</td>
<td>Fair.</td>
<td>Good.</td>
<td>Sound reduction is generally related to density. Higher density gives better sound reduction.</td>
</tr>
<tr>
<td>Mold/Fungus</td>
<td>A borate formula does not support growth.</td>
<td>Does not support growth.</td>
<td>Does not support growth.</td>
<td>Mold and fungus lead to allergies.</td>
</tr>
</tbody>
</table>
Wall Cavity Insulation

NEW CONSTRUCTION:
Blown in with controlled water fog for adhesion.

DRYING TIME:
Can be covered with drywall in 24 hours. Total drying time, approximately 30 days.

SOUND CONTROL:
Airborne sounds are controlled by the product’s density and its ability to completely fill stud cavities. These properties also control air infiltration from the exterior environment.

INSPECTION:
Integrity of insulation in walls can be verified through the use of an infrared survey.

Blown-In Cellulose Insulation Standards

ASTM-C-739
ASTM-E-84
ASTM-E-119
UL-723
NFPA-225
ASA-A2-5

UL CLASSIFIED SPRAY FIBER
FLAME SPREAD 15
SMOKE DEVELOPED 5

INGREDIENTS:
RECYCLED CELLULOSE FIBERS
BORIC ACID (H₃BO₃)
SODIUM POLYBORATE (Na₂SO₄H₃BO₄)

R-VALUE: 3.8 per inch

DENSITY: 1.6 PCF settled density

Underwriters Laboratories Inc.
 Classified Loose Fill Material
Classified in accordance with the following ASTM C-739 Characteristics.

Flammability Characteristics:
- Critical Radiant Flux: Greater than or equal to 0.12w/cm²
- Smoldering Combustion: Less than or equal to 15.0%

Environmental Characteristics:
- Corrosiveness: Acceptable
- Fungal Growth: Acceptable

Physical Characteristics:
- Density (settled): 1.6pcf
- Thermal Resistance: 3.8 R (in.) (HH-I-515-E)
- Moisture Absorption: Acceptable
- Odor Emission: Acceptable
- Starch Content: Negative

Underwriters Laboratories Inc.
 Classified Spray Fiber
Classified Spray Fiber

Surface burning characteristics applied to inorganic
reinforced cement board with a maximum thickness
of 5 inches*

Flame Spread 15
Smoke Developed 5
* Must be applied with water in accordance with the application instructions.
SECTION 1 – PRODUCT AND COMPANY INFORMATION

Product Identifier: Cellulose Insulation

Product Name: Nu-Wool® Premium Cellulose Insulation
Energy Care® Cellulose Insulation

Manufacturer: Nu-Wool Co., Inc.
2472 Port Sheldon St.
Jenison, MI 49428

Emergency Phone: (800) 748-0128

Nu-Wool® and Energy Care® are Registered Trademarks of Nu-Wool Co., Inc.

SECTION 2 – HAZARDS IDENTIFICATION

Hazard Classification: Eye Irritation Hazard Category 2B

Signal Word: Warning

Hazard Statements: Causes eye irritation

Precautionary Statements: Wash hands thoroughly after handling. If in eyes, rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, seek medical attention.

Other hazards which do not result in classification: None

SECTION 3 – COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CAS #</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose fiber</td>
<td>65996-61-4</td>
<td>85-92%</td>
</tr>
<tr>
<td>Sodium polyborate</td>
<td>183290-63-3</td>
<td>5-10%</td>
</tr>
<tr>
<td>Boric acid</td>
<td>10043-35-3</td>
<td>3-5%</td>
</tr>
</tbody>
</table>

Other ingredients are present in the final product at less than 1% and do not pose a health hazard.

SECTION 4 – FIRST AID MEASURES

Eyes: For dust exposure, immediately flush eyes with plenty of water for at least 10 minutes. Seek medical attention if irritation persists.

Skin: If skin is exposed, wash with soap and large amounts of water. If irritation persists, seek medical attention.

Ingestion: Symptoms include diarrhea, nausea, and vomiting. Seek medical attention if material was ingested and symptoms persist.

Inhalation: If irritation or difficulty breathing occurs, remove to fresh air. Seek medical attention if conditions persist.

Notes to physicians or first aid providers: Exposure to dust may aggravate symptoms of persons with preexisting respiratory tract conditions and may cause skin and gastrointestinal symptoms.
SECTION 5 – FIRE-FIGHTING MEASURES

Extinguishing media: Any fire extinguishing media, including Water Spray, Foam, Dry Chemical, CO₂.

Special fire-fighting procedures: Wear self-contained breathing apparatus (pressure demand MSHA/NIOSH approved, or equivalent) and full protective gear.

Unusual fire and explosion hazards: None, CMS material is not flammable, combustible, or explosive. The product itself is a flame retardant.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

General: Boric acid may damage trees or vegetation when exposed to large quantities.

Land spill: Shovel, sweep, or vacuum product. Place in disposal container. Avoid bodies of water.

Water spill: Large quantities may cause localized contamination of surrounding waters depending on the quantity spilled. At high concentrations, may damage localized vegetation, fish, and other aquatic life.

SECTION 7 – HANDLING AND STORAGE

Precautions for Safe Handling: No special handling is required.

Conditions for safe storage, including incompatibilities: Storage of sealed bags in a dry, indoor location is recommended. To maintain product integrity, handle on a first-in-first-out basis. Use good housekeeping and controls so that dust levels are below the exposure limits listed in Section 8.

Storage temperature: Ambient

Storage pressure: Atmospheric

Special sensitivity: None

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

OSHA PEL-TWA: 15 mg/m³ total dust and 5 mg/m³ respirable dust
ACGIH TLV-TWA-OEL: 2 mg/m³ inhalable particles
ACGIH STEL: 6 mg/m³
Cal OSHA PEL-TWA: 10 mg/m³ total dust and 5 mg/m³ respirable fraction

ENGINEERING CONTROLS AND VENTILATION: Use local exhaust ventilation to keep airborne concentrations of dust below permissible exposure limits.

RESPIRATORY PROTECTION: Where airborne concentrations are expected to exceed exposure limits, NIOSH/MSHA certified respirators (e.g., N95) must be used.

EYE PROTECTION: Eye protection according to ANSI Z.87.1 or other national standards may be warranted if environment is excessively dusty.

SKIN PROTECTION: Standard work gloves (cotton, canvas or leather) may be warranted if environment is excessively dusty.

SECTION 8 NOTES: PEL: Permissible Exposure Limit, TLV: Threshold Limit Value, TWA: Time Weighted Average, STEL: Short Term Exposure Limit
SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Gray, fiber

Odor: Not applicable

Odor threshold: Not applicable

pH as supplied: 7.3

Melting point / freezing point: Not applicable

Boiling point / boiling range: Not established

Flash point: Not applicable

Evaporation rate: Not applicable

Flammability / flammability range: Not applicable

Explosive limits: Not applicable

Vapor pressure: Not applicable

Vapor density: Negligible at 20°C

Relative density: Not applicable

Solubility in water: Insoluble

Specific gravity: Not applicable

Partition coefficient: Not applicable

Auto-ignition temperature: Not applicable, not self-heating

Decomposition temperature: Not applicable

Viscosity: Not applicable

Explosive properties: Not explosive, does not contain chemical groups associated with explosivity

Oxidizing properties: Not oxidizing, does not contain chemical groups associated with oxidation

SECTION 10 – STABILITY AND REACTIVITY

Reactivity: Non-reactive

Stability: Stable

Possibility of hazardous reactions: Non-reactive

Conditions to avoid: None

Incompatible materials: None

Hazardous decomposition or by-products: None known.
**SECTION 11 – TOXICOLOGICAL INFORMATION**

**Routes of exposure:** Inhalation is the most significant route of exposure in occupational and other settings. Dermal exposure is not usually a concern as cellulose fibers are not absorbed through intact skin. Nu-Wool® Premium Cellulose Insulation and Energy Care® Cellulose Insulation are not intended for ingestion.

**Symptoms related to the physical, chemical, and toxicological characteristics:** Symptoms of cellulose fiber exposure include runny nose, sneezing, and coughing.

**Delayed and immediate effects as well as chronic effects from short and long-term exposure:** No chronic or reproductive effects from cellulose have been reported in the literature.

**Acute toxicity:**

Cellulose fiber:
- Oral LD$_{50}$ (rat): >5,000 mg/kg of body weight
- Dermal LD$_{50}$ (rabbit): >2,000 mg/kg of body weight
- Inhalation LC$_{50}$ (rat): >5.8 mg/L
- Dermal irritation/corrosivity: Nonirritating, nonsensitizing
- Eye irritation: No information found.

Sodium polyborate:
- Oral LD$_{50}$ (rat): 3,479 mg/kg of body weight
- Dermal LD$_{50}$ (rabbit): >2000 mg/kg of body weight
- Inhalation LC$_{50}$ (rat): >5.8 mg/L
- Dermal irritation/corrosivity: 0 (Zero), sodium polyborate is non-corrosive
- Eye irritation: Draize test in rabbits produced mild eye irritation effects. Many years of occupational exposure history reflects no indication of human eye injury from exposure to sodium polyborate.

Boric acid:
- Oral LD$_{50}$ (rat): 2,550 mg/kg of body weight
- Dermal LD$_{50}$ (rabbit): >2,000 mg/kg of body weight
- Inhalation LC$_{50}$ (rat): >2.01 mg/L
- Dermal irritation/corrosivity: Nonirritating, nonsensitizing
- Eye irritation: Nonirritating

**CHRONIC HEALTH HAZARDS:** No chronic effects from cellulose fiber, sodium polyborate, or boric acid have been reported in the literature. Human epidemiological studies show no increase in pulmonary disease in occupational populations with chronic exposures to inorganic borates and sodium borate dust.

**REPRODUCTIVE EFFECTS:** Borate-treated cellulose insulation contains boric acid and cellulose fiber. Borate-treated cellulose insulation was tested for purposes of hazard classification under the Occupational Safety and Health Administration’s 2012 Hazard Communication Standard.

In a study conducted under OECD Guideline 414, there were no developmental effects in rats exposed to up to 270 mg/m$^3$ (the highest exposure tested). In workers chronically exposed to high levels of borates for several years by way of inhalation, food, and drinking water, there was a clear absence of any reproductive effects.

**Classification:** No classification

**CARCINOGENICITY:** Cellulose fiber, sodium polyborate, and boric acid are not listed as a known or suspected carcinogen by OSHA, ACGIH, NTP, or IARC.
SECTION 12 – ECOLOGICAL INFORMATION

Cellulose: No information found in the literature.

Boron: No information specific to sodium polyborate or boric acid was found in the literature. The following information is based on other boron compounds and normalized for boron.
- **LC$_{50}$ (Water flea, D. magna)**: 101.2 mg/L (48-hr)
- **NOEC (Water flea, D. magna)**: 5.7 mg/L (21-d)
- **LC$_{50}$ (Rainbow trout, O. mykiss)**: 351.7 mg boron/L (96-hr)
- **LC$_{50}$ (Bluegill, L. macrochirus)**: 4.6 mg boron/L (24-hr)

**PHYTOTOXICITY:** Boron is an essential micronutrient for healthy growth of plants. It can be harmful to boron sensitive plants in higher quantities. Care should be taken to minimize the amount of borate product released to the environment.

**PERSISTENCE AND DEGRADABILITY:** Biodegradation is not an applicable endpoint since the product is an inorganic substance.

**BIOACCUMULATIVE POTENTIAL:** This product will undergo hydrolysis in water to form undissociated boric acid. Boric acid will not biomagnify through the food chain. Octanol/Water partition coefficient: Log Pow = -0.7570 @ 25°C (based on boric acid).

**MOBILITY IN SOIL:** The product is soluble in water and is leachable through normal soil. Adsorption to soils or sediments is insignificant.

**OTHER EFFECTS:** None.

SECTION 13 – DISPOSAL CONSIDERATIONS

**Waste disposal method:** Dispose as a non-hazardous waste.

**RCRA Hazard Class:** This product is a non-hazardous waste when spilled or disposed of as defined in the Resource Conservation and Recovery Act (RCRA) regulations (40 CFR 261).

SECTION 14 – TRANSPORT INFORMATION

May be shipped as a non-hazardous material.

SECTION 15 – REGULATORY INFORMATION

**TSCA NO.:** Nu-Wool® Premium Cellulose Insulation and Energy Care® Cellulose Insulation do not appear on the EPA TSCA inventory list. Boric acid does appear on the EPA TSCA inventory list (10043-35-3)

**RCRA:** Nu-Wool® Premium Cellulose Insulation and Energy Care® Cellulose Insulation are not listed as a hazardous waste under any sections of the Resource Conservation and Recovery Act or regulations (40 CFR 261 et seq.).

**SUPERFUND: CERCLA/SARA.** Nu-Wool® Premium Cellulose Insulation and Energy Care® Cellulose Insulation are not listed under CERCLA (the Comprehensive Environmental Response Compensation and Liability Act) or its 1986 amendments, SARA, (the Superfund Amendments and Reauthorization Act), including substances listed under Section 313 of SARA, Toxic Chemicals, 42 USC 11023, 40 CFR 372.65; Section 302 of SARA, Extremely Hazardous Substances, 42 USC 11002, 40 CFR 355; or the CERCLA Hazardous Substances list, 42 USC 9604, 40 CFR 302.
SAFE DRINKING WATER ACT: Nu-Wool® Premium Cellulose Insulation and Energy Care® Cellulose Insulation are not regulated under the SDWA, 42 USC 300g-1, 40 CFR 141 et seq. Consult state and local regulations for possible water quality advisories regarding boron.

Clean Water Act (Federal Water Pollution Control Act): 33 USC 1251 et seq.
   a.) Nu-Wool® Premium Cellulose Insulation and Energy Care® Cellulose Insulation are not itself a discharge covered by any water quality criteria of Section 304 of the CWA, 33 USC 1314
   b.) It is not on the Section 307 List of Priority Pollutants, 33 USC 1317, 40 CFR 129
   c.) It is not on the Section 311 List of Hazardous Substances, 33 USC 1321, 40 CFR 116.

OSHA/CAL OSHA: This SDS document meets the requirements of both OSHA (29 CFR 1910.1200) and Cal OSHA (Title 8 CCR 5194(g)) hazard communication standards. Refer to Exposure Control/Personal Protection for regulatory exposure limits.

SECTION 16 – OTHER INFORMATION

Other information: This SDS was finalized on June 1, 2015 and is compliant with OSHA HCS/HazCom 2012 Final Rule. This replaces the previous version dated May 2010.

Information presented herein has been compiled from sources considered dependable and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Nothing herein is to be construed as recommending any practice or any product in violation of any patent or in violation of any law or regulation. The user is responsible to determine the suitability of any material for a specific purpose and adopt necessary safety precautions. We make no warranty as to results to be obtained in using any material and, since conditions or use are not under our control, we must necessarily disclaim all liability with respect to use of any material supplied by us.
SECTION 1 – PRODUCT AND COMPANY INFORMATION

Product Identifier: Cellulose Insulation
Product Name: Nu-Wool® Fire and Sound Cellulose Insulation
Manufacturer: Nu-Wool Co., Inc.
2472 Port Sheldon St.
Jenison, MI 49428

Emergency Phone: (800) 748-0128

Nu-Wool® is a Registered Trademark of Nu-Wool Co., Inc.

SECTION 2 – HAZARDS IDENTIFICATION

Hazard Classification: Eye Irritation Hazard Category 2B

Signal Word: Warning

Hazard Statements: Causes eye irritation

Precautionary Statements: Wash hands thoroughly after handling. If in eyes, rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, seek medical attention.

Other hazards which do not result in classification: None

SECTION 3 – COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CAS #</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose fiber</td>
<td>65996-61-4</td>
<td>85-92%</td>
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<tr>
<td>Sodium polyborate</td>
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</tr>
<tr>
<td>Boric acid</td>
<td>10043-35-3</td>
<td>3-5%</td>
</tr>
</tbody>
</table>

Other ingredients are present in the final product at less than 1% and do not pose a health hazard.

SECTION 4 – FIRST AID MEASURES

Eyes: For dust exposure, immediately flush eyes with plenty of water for at least 10 minutes. Seek medical attention if irritation persists.

Skin: If skin is exposed, wash with soap and large amounts of water. If irritation persists, seek medical attention.

Ingestion: Symptoms include diarrhea, nausea, and vomiting. Seek medical attention if material was ingested and symptoms persist.

Inhalation: If irritation or difficulty breathing occurs, remove to fresh air. Seek medical attention if conditions persist.

Notes to physicians or first aid providers: Exposure to dust may aggravate symptoms of persons with preexisting respiratory tract conditions and may cause skin and gastrointestinal symptoms.
SECTION 5 – FIRE-FIGHTING MEASURES

Extinguishing media: Any fire extinguishing media, including Water Spray, Foam, Dry Chemical, CO₂.

Special fire-fighting procedures: Wear self-contained breathing apparatus (pressure demand MSHA/NIOSH approved, or equivalent) and full protective gear.

Unusual fire and explosion hazards: None, CMS material is not flammable, combustible, or explosive. The product itself is a flame retardant.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

General: Boric acid may damage trees or vegetation when exposed to large quantities.

Land spill: Shovel, sweep, or vacuum product. Place in disposal container. Avoid bodies of water.

Water spill: Large quantities may cause localized contamination of surrounding waters depending on the quantity spilled. At high concentrations, may damage localized vegetation, fish, and other aquatic life.

SECTION 7 – HANDLING AND STORAGE

Precautions for Safe Handling: No special handling is required.

Conditions for safe storage, including incompatibilities: Storage of sealed bags in a dry, indoor location is recommended. To maintain product integrity, handle on a first-in-first out basis. Use good housekeeping and controls so that dust levels are below the exposure limits listed in Section 8.

Storage temperature: Ambient

Storage pressure: Atmospheric

Special sensitivity: None

SECTION 8 – EXPOSURE CONTROLS / PERSONAL PROTECTION

OSHA PEL-TWA: 15 mg/m³ total dust and 5 mg/m³ respirable dust
ACGIH TLV-TWA-OEL: 2 mg/m³ inhalable particles
ACGIH STEL: 6 mg/m³
Cal OSHA PEL-TWA: 10 mg/m³ total dust and 5 mg/m³ respirable fraction

ENGINEERING CONTROLS AND VENTILATION: Use local exhaust ventilation to keep airborne concentrations of dust below permissible exposure limits.

RESPIRATORY PROTECTION: Where airborne concentrations are expected to exceed exposure limits, NIOSH/MSHA certified respirators (e.g., N95) must be used.

EYE PROTECTION: Eye protection according to ANSI Z.87.1 or other national standards may be warranted if environment is excessively dusty.

SKIN PROTECTION: Standard work gloves (cotton, canvas or leather) may be warranted if environment is excessively dusty.

SECTION 8 NOTES: PEL: Permissible Exposure Limit, TLV: Threshold Limit Value, TWA: Time Weighted Average, STEL: Short Term Exposure Limit
SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Green, fiber

Odor: Not applicable

Odor threshold: Not applicable

pH as supplied: 7.3

Melting point / freezing point: Not applicable

Boiling point / boiling range: Not established

Flash point: Not applicable

Evaporation rate: Not applicable

Flammability / flammability range: Not applicable

 Explosive limits: Not applicable

Vapor pressure: Not applicable

Vapor density: Negligible at 20°C

Relative density: Not applicable

Solubility in water: Insoluble

Specific gravity: Not applicable

Partition coefficient: Not applicable

Auto-ignition temperature: Not applicable, not self-heating

 Decomposition temperature: Not applicable

Viscosity: Not applicable

Explosive properties: Not explosive, does not contain chemical groups associated with explosivity

Oxidizing properties: Not oxidizing, does not contain chemical groups associated with oxidation

SECTION 10 – STABILITY AND REACTIVITY

Reactivity: Non-reactive

Stability: Stable

Possibility of hazardous reactions: Non-reactive

Conditions to avoid: None

Incompatible materials: None

Hazardous decomposition or by-products: None known.
**SECTION 11 – TOXICOLOGICAL INFORMATION**

**Routes of exposure:** Inhalation is the most significant route of exposure in occupational and other settings. Dermal exposure is not usually a concern as cellulose compounds are not absorbed through intact skin. Nu-Wool® Fire and Sound Cellulose Insulation is not intended for ingestion.

**Symptoms related to the physical, chemical, and toxicological characteristics:** Symptoms of cellulose exposure include runny nose, sneezing, and coughing.

**Delayed and immediate effects as well as chronic effects from short and long-term exposure:** No chronic or reproductive effects from cellulose have been reported in the literature.

**Acute toxicity:**

**Cellulose:**
- Oral LD$_{50}$ (rat): >5,000 mg/kg of body weight
- Dermal LD$_{50}$ (rabbit): >2,000 mg/kg of body weight
- Inhalation LC$_{50}$ (rat): >5.8 mg/L
- Dermal irritation/corrosivity: Nonirritating, nonsensitizing
- Eye irritation: No information found.

**Sodium polyborate:**
- Oral LD$_{50}$ (rat): 3,479 mg/kg of body weight
- Dermal LD$_{50}$ (rabbit): >2000 mg/kg of body weight
- Inhalation LC$_{50}$ (rat): >5.8 mg/L
- Dermal irritation/corrosivity: 0 (Zero), sodium polyborate is non-corrosive
- Eye irritation: Draize test in rabbits produced mild eye irritation effects. Many years of occupational exposure history reflects no indication of human eye injury from exposure to sodium polyborate.

**Boric acid:**
- Oral LD$_{50}$ (rat): 2,550 mg/kg of body weight
- Dermal LD$_{50}$ (rabbit): >2,000 mg/kg of body weight
- Inhalation LC$_{50}$ (rat): >2.01 mg/L
- Dermal irritation/corrosivity: Nonirritating, nonsensitizing
- Eye irritation: Nonirritating

**CHRONIC HEALTH HAZARDS:** No chronic effects from cellulose, sodium polyborate, or boric acid have been reported in the literature. Human epidemiological studies show no increase in pulmonary disease in occupational populations with chronic exposures to inorganic borates and sodium borate dust.

**REPRODUCTIVE EFFECTS:** Borate-treated cellulose insulation contains boric acid and cellulose fiber. Borate-treated cellulose insulation was tested for purposes of hazard classification under the Occupational Safety and Health Administration’s 2012 Hazard Communication Standard.

In a study conducted under OECD Guideline 414, there were no developmental effects in rats exposed to up to 270 mg/m$^3$ (the highest exposure tested). In workers chronically exposed to high levels of borates for several years by way of inhalation, food, and drinking water, there was a clear absence of any reproductive effects.

**Classification:** No classification

Nu-Wool® Fire and Sound Cellulose Insulation contains C.I. Basic Green 4 which is a suspected reproductive toxicant (Category 2) but is present at less than 0.1% by weight in the final product.
CARCINOGENICITY: Cellulose, sodium polyborate, boric acid, and other ingredients are not listed as a known or suspected carcinogen by OSHA, ACGIH, NTP, or IARC.

SECTION 12 – ECOLOGICAL INFORMATION

Cellulose: No information found in the literature.

Boron: No information specific to sodium polyborate or boric acid was found in the literature. The following information is based on other boron compounds and normalized for boron.

- **LC₅₀ (Water flea, *D. magna*):** 101.2 mg/L (48-hr)
- **NOEC (Water flea, *D. magna*):** 5.7 mg/L (21-d)
- **LC₅₀ (Rainbow trout, *O. mykiss*):** 351.7 mg boron/L (96-hr)
- **LC₅₀ (Bluegill, *L. macrochirus*):** 4.6 mg boron/L (24-hr)

PHYTOTOXICITY: Boron is an essential micronutrient for healthy growth of plants. It can be harmful to boron sensitive plants in higher quantities. Care should be taken to minimize the amount of borate product released to the environment.

PERSISTENCE AND DEGRADABILITY: Biodegradation is not an applicable endpoint since the product is an inorganic substance.

BIOACCUMULATIVE POTENTIAL: This product will undergo hydrolysis in water to form undissociated boric acid. Boric acid will not biomagnify through the food chain. Octanol/Water partition coefficient: Log Pow = -0.7570 @ 25°C (based on boric acid).

MOBILITY IN SOIL: The product is soluble in water and is leachable through normal soil. Adsorption to soils or sediments is insignificant.

OTHER EFFECTS: None.

SECTION 13 – DISPOSAL CONSIDERATIONS

Waste disposal method: Dispose as a non-hazardous waste.

RCRA Hazard Class: This product is a non-hazardous waste when spilled or disposed of as defined in the Resource Conservation and Recovery Act (RCRA) regulations (40CFR 261).

SECTION 14 – TRANSPORT INFORMATION

May be shipped as a non-hazardous material.

SECTION 15 – REGULATORY INFORMATION

TSCA NO.: Nu-Wool® Fire and Sound Cellulose Insulation does not appear on the EPA TSCA inventory list. Boric acid does appear on the EPA TSCA inventory list (10043-35-3)

RCRA: Nu-Wool® Fire and Sound Cellulose Insulation is not listed as a hazardous waste under any sections of the Resource Conservation and Recovery Act or regulations (40 CFR 261 et seq.).

SUPERFUND: CERCLA/SARA. Nu-Wool® Fire and Sound Cellulose Insulation is not listed under CERCLA (the Comprehensive Environmental Response Compensation and Liability Act) or its 1986 amendments, SARA, (the Superfund Amendments and Reauthorization Act), including substances listed under Section 313 of SARA, Toxic Chemicals, 42 USC 11023, 40 CFR 372.65; Section 302 of SARA, Extremely Hazardous Substances, 42 USC 11002, 40 CFR 355; or the CERCLA Hazardous Substances list, 42 USC 9604, 40 CFR 302.
SAFE DRINKING WATER ACT: Nu-Wool® Fire and Sound Cellulose Insulation is not regulated under the SDWA, 42 USC 300g-1, 40 CFR 141 et seq. Consult state and local regulations for possible water quality advisories regarding boron.

Clean Water Act (Federal Water Pollution Control Act): 33 USC 1251 et seq.
   a.) Nu-Wool® Fire and Sound Cellulose Insulation is not itself a discharge covered by any water quality criteria of Section 304 of the CWA, 33USC 1314
   b.) It is not on the Section 307 List of Priority Pollutants, 33 USC 1317, 40 CFR 129
   c.) It is not on the Section 311 List of Hazardous Substances, 33 USC 1321, 40 CFR 116.

OSHA/CAL OSHA: This SDS document meets the requirements of both OSHA (29 CFR 1910.1200) and Cal OSHA (Title 8 CCR 5194(g)) hazard communication standards. Refer to Exposure Control/Personal Protection for regulatory exposure limits.

SECTION 16 – OTHER INFORMATION

Other information: This SDS was finalized on June 1, 2015 and is compliant with OSHA HCS/HazCom 2012 Final Rule. This replaces the previous version dated May 2010.

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