

Americhanvre:
Ereasy Spray.
Applied
Hempcrete ASTM
C-518 Test Results



AMERICHAVRE
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Jacob Waddell
03.22.2023



Hemp
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Americhanvre: Eready Spray Applied Hempcrete ASTM C-518 Test Results



Overview

Americhanvre performed testing to evaluate the insulation R-value of hemp-lime samples made using the Eready spray equipment and the Erasy 120 binder. The results showed an average R-value of 2.2 per inch for samples at a density range of 14.73-15.20 lb/ft³. ASTM C518 testing was performed at R&D Services in Watertown, TN on samples produced by Americhanvre's Co-owner, Cameron McIntosh, using a procedure that Americhanvre helped develop as the proposed ASTM Practice for Creating Hemp-lime Test Samples for C518 Testing using the Spray Applied Method. These results show the impressive R value achieved by the Eready Hempcrete System and the success of the proposed sample preparation protocol. The Hemp Building Institute's President, Jacob Waddell, was brought on as a materials science expert to advise and assist in the project.



The hemp-lime industry is emerging as a viable option for home insulation. With the acceptance of the International Residential Code appendix for Hemp-lime (Hempcrete) Construction in 2022, hemp-lime's credibility as a realistic insulation material took a giant leap forward. Americhanvre contributed to the development of the IRC code language, knowing the potential of this product and market based on the success of the European hemp-lime industry. Now they are leading the way by performing the necessary testing required by the Federal Trade Commission to advertise the insulation value of a material and the requirements of the IRC code.



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ASTM C518 Test Results

Five samples were made by Americhanvre to be tested using the Eready system and the Eready 120 binder. Samples were made in three thicknesses in order to determine the representative thickness, which is explained later in this document. One sample was 2" thick and two samples were made with both 4" and 6" thicknesses. After the samples were prepared, they were weighed regularly to determine their weight fluctuations and when the samples were dry.

The test results are shown in Table 1. The 2" and 4" samples showed similar R-values and densities. The 6" samples showed lower R-values and higher densities. The average R-value with all five measurements is 2.1 with the 2" and 4" samples having an R-value around 2.2 and the 6" samples having an R-value around 1.95.

| Sample Thickness (in) | Thermal Resistivity R per in ((ft ² ·h·°F/Btu·in) | Density (lb/ft ³) |
|-----------------------|--|-------------------------------|
| 1.82 | 2.24 | 15.20 |
| 3.81 | 2.17 | 14.73 |
| 3.79 | 2.19 | 14.83 |
| 5.87 | 1.92 | 16.12 |
| 5.83 | 1.97 | 16.02 |

Table 1. Measured sample thicknesses, thermal resistivity (R per in), and density for test samples.

To try to determine why the 6" samples performed differently than the other samples we analyzed possible reasons for the density differences including the weight data. All 5 samples were made following the same procedure and should produce a relatively uniform

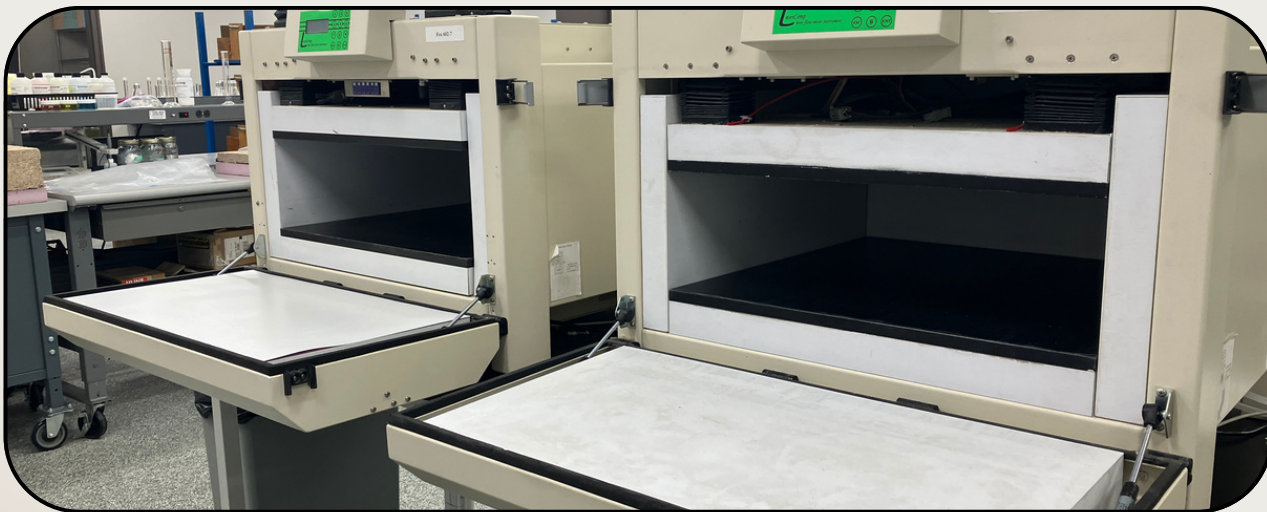
result. Since both 6" samples showed a density that was over 5% greater than the other samples, we hypothesized that the samples were not fully dry and that excess moisture within the hemp-lime increased the density and lowered the R-value.

| Sample | 2" 1 | 4" 2 | 4" 3 | 6" 4 | 6" 5 |
|---------|---------------|---------------|---------------|---------------|---------------|
| Date | % Mass change | % Mass change | % Mass change | % Mass change | % Mass change |
| 2/2/23 | -0.07 | -0.03 | -0.01 | -0.20 | -0.15 |
| 2/3/23 | 0.03 | 0.02 | 0.03 | -0.15 | -0.10 |
| 2/6/23 | -0.04 | -0.02 | -0.02 | -0.48 | -0.34 |
| 2/9/23 | 0.00 | -0.01 | -0.01 | -0.40 | -0.29 |
| 2/13/23 | 0.27 | 0.25 | 0.26 | -0.19 | -0.06 |
| 2/15/23 | -0.19 | -0.13 | -0.14 | -0.25 | -0.20 |

Table 2. Samples were weighed regularly to monitor mass change.

When we looked at the weight measurements for the samples, we noticed an interesting detail 2 days before the first run of testing. We see all samples fluctuating in weight with the 6" samples showing larger decreases in weight at each interval period. On February 13th we see there was an increase in the weights on the 2" and 4" samples, most likely caused by regular fluctuations in the moisture content in the hemp-lime as absorbed from the environment. The 6" samples continue to lose weight during this time measurement, though at a lower rate than it was losing weight on other days. This suggests that there is an excess of moisture in the 6" samples above equilibrium for the system. Due to this finding we believe the 6" samples are giving inaccurate results and should not be included in the final data for the R-value test measurements. Thus the reported R-value for the Americhanvre Eready hemp-lime samples, is R-value of 2.2.

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ASTM C518 Testing

ASTM C518 measures the thermal conductivity of a material based on a measurement of a one-dimensional heat flux. Inverting the value and using the sample thickness, this measurement is then converted into the insulation unit most often discussed in the US building industry, R-value per inch. The Federal Trade Commission Rule 460.16 restricts the test procedures that can be used to advertise an insulation product's R-value to ASTM C117, C518, C1363, or C1114. By using ASTM C518 to measure the R-value of the Eready Spray Applied Hempcrete system, Americhanvre has fulfilled this requirement and can now openly advertise their products R-value. They are the first US hemp-lime company to accomplish this important step required to compete in the mainstream insulation market.

Comparing US Measurements to European Measurements

The results that Americhanvre's samples received of 2.2 R-value per inch are in line with the measurements performed in France on Eready produced samples by ENTPE. This adds to the legitimacy of the consistency seen in these materials with samples created by two different operators in two different countries using the Eready system having the same performance measurements. This also shows that testing performed using the US test procedure ASTM C518 and the European test procedures have similar results.



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ASTM Practice for Creating Hemp-lime Test Samples

When creating samples for the test, Cameron McIntosh followed the proposed ASTM Practice for Creating Hemp-lime Test Samples for C518 Testing Using the Spray Applied Method. The goal of using this practice was two-fold: to test the procedure for feasibility and to perform ASTM C518 tests at different thicknesses to determine the representative thickness for the R-value to be added to the practice. The representative thickness is the thickness at which the samples show linear growth with the addition of more material. As you initially increase the thickness of an insulative material from a theoretical zero thickness, there is an unsteady increase in the insulative value. During this early stage you can see on Figure 1, the R-value per inch increases with thickness until you reach the representative thickness. Once the material reaches the representative thickness, the curve flattens out and there is not an increase to R-value per inch with the addition of more material. This region is where the R-value per inch measurement should be taken for a material.

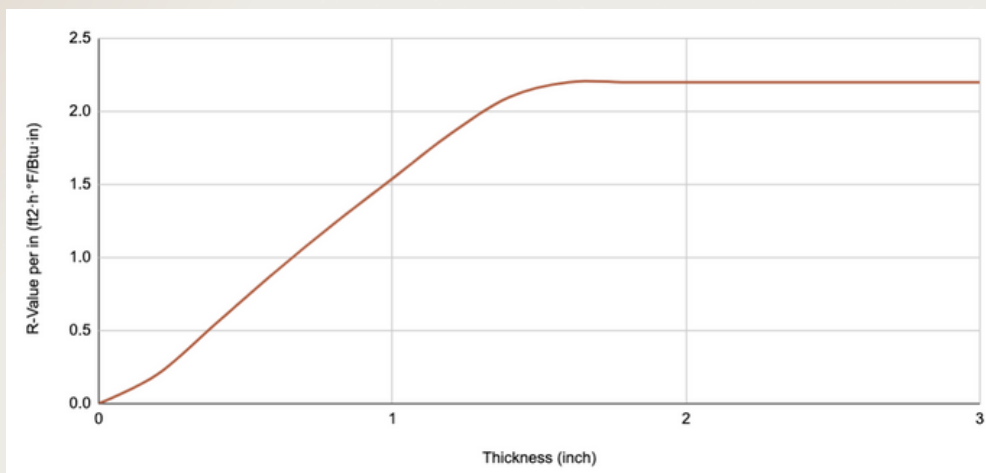


Figure 1. Relationship between R-value per inch and sample thickness (Not actual data)

The test results for measurements of samples at 2" and 4" thicknesses show no major variation between the R-value per inch measurement, showing that at 2" the hemp-lime samples have met or exceeded the representative thickness. This information is important when declaring the required thickness of a test sample for the proposed ASTM practice.

Americhanvre's work producing these samples verified the feasibility of the ASTM practice for creating hemp-lime test samples using the spray applied method and helped determine the required sample size. These were major steps to taking this document to ballot to become an official ASTM practice.

Americhanvre, with the assistance of the Hemp Building Institute, have taken another step forward in the mission to mainstream the hemp-lime building industry. Together we build a better future for all.