6.1 HEMPRETE INSULATION BETWEEN ROOF RAFTERS

6.1.1 The Mix

<table>
<thead>
<tr>
<th>Material</th>
<th>For 1m$^3$</th>
<th>For 1m$^2$ (150mm thick insulation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Insulcore/Hemp wood</td>
<td>1000Ltr (100 kg)</td>
<td>158Ltr (15.8kg)</td>
</tr>
<tr>
<td>Insulime</td>
<td>125kg</td>
<td>20kg (0.8kg bag)</td>
</tr>
<tr>
<td>Water</td>
<td>175 - 200Ltr</td>
<td>27.5 - 31.5Ltr</td>
</tr>
</tbody>
</table>

6.1.2 Hempcrete roof mix has the following properties:
Please refer to Appendix page 54 for Weight & Thermal Properties charts.

| Density: | 150 - 200kg/m$^3$
| Elasticity: | 22.5 - 30kg/m$^2$ (150mm thickness)
| Resistance to compression: | 3 MPa after 90 days
| R rating: | 0.1 - 0.15 MPa after 90 days
|          | 2.5

<table>
<thead>
<tr>
<th>Material</th>
<th>Proportion of Aggregates (Hemp Fragments) within Total Dry Weight</th>
<th>Dry Density (For information)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal Aggregate (strong mixture)</td>
<td>10%</td>
<td>1000Kg/m$^3$</td>
</tr>
<tr>
<td>Maximum Aggregate (weak mixture)</td>
<td>50%</td>
<td>200Kg/m$^3$</td>
</tr>
</tbody>
</table>

Recommended thickness for roof insulation mix is minimum 150mm and maximum 250mm. Mechanical strength, sound and thermal insulation depend on the amount of binder in the mix. Mixing method as described in Chapter 3 - Hempcrete Installation: General.

6.1.3 Support/underpin joists

At all times, the roof structure should be engineered with consideration of the additional weight of the hempcrete insulation. Freshly mixed hempcrete weighs approx. 70% more than when dry.

**IMPORTANT:** Support the roof structure with the wet hempcrete to avoid sagging due to the additional weight. It is crucial to reinforce rafters and purlins until the roof has dried. Please refer to Appendix, Weight Properties chart.
6. Hempcrete Installation: Roof

6.1.4 Preparation and general regulations

Supporting materials / formwork affixed to the rafters or perpendicular battens:

1. **Composite wood sheets** not exceeding 12mm attached with:
   a. 10mm wide x 25mm deep galvanised / stainless flat staples;
   b. 0.35 x 25mm galvanised /stainless flat head screws at 400mm c/c; or
   c. both with the aid of a ø 40mm dot of adhesive at minimum 400mm c/c.

2. **Magnesium board** not exceeding 12mm attached with:
   a. 10mm wide x 25mm deep galvanised/ stainless flat staples at 150 c/c;
   b. 0.35 x 25 mm galvanised /stainless flat head screws at 250mm c/c; or
   c. both with the aid of a 40mm ø dot of adhesive at minimum 450mm c/c.

3. **Magnesium board** placed in between the I joists. See Figure 25.

4. **Bamboo or reed mats** attached with:
   a. 10mm wide x 25mm deep galvanised / stainless flat staples at 25mm c/c; or
   b. the aid of 20x10mm timber laths stapled with 10mm wide x 25mm deep galvanised / stainless flat staples at 50mm c/c.

5. **Formwork** securely attached.

6. **Glass fibre mesh**, attached with:
   a. 10mm wide x 25mm deep galvanised / stainless flat staples at 25mm c/c; or
   b. aid of 20x10mm timber laths stapled with 10mm wide x 25mm deep galvanised / stainless flat staples at 50mm c/c.

The mesh is fastened in an upwards direction, reinforced with battens or broad staples, rolled up and attached while filling space behind it.

When the cavities between the rafters have a volume greater then 0.2m², a key should be fitted to guarantee fixation of the volume of hempcrete insulation. That could be a 35x35mm timber batten fixed with galvanised 3.2x70mm nails at 300 c/c in the middle or closer to the underside of the joist, depending on depth and slope of roof.

To avoid condensation and spray from the roof cladding settling on the hempcrete, a weatherproof skin of impermeable sarking paper is to be placed under the roof covering, so that water flows to the gutter.

A minimum airspace of 20mm between finished insulation and the sarking paper should be maintained to ensure sufficient ventilation. Roof sarking paper will also enhance the overall thermal performance.

Hempcrete is water resistant to a certain degree, and will repel water. However any humidity present on the surfaces over a longer period of time needs to be avoided.

6.1.5 Wall / Ceiling junction

The idea is to connect the wall insulation to the ceiling insulation. This completely seals the building like no other building method is capable of doing. Drafts and air leaks are drastically reduced.

Note: this should be carefully worked out in the design phase so that the wall to ceiling connection is a monolithic insulation system.

See Figures 25 and 26.
Figure 25: Wall/ceiling configuration.
Wall insulation continues into the ceiling cavity.

Figure 26: Wall ceiling/floor configuration.
Wall insulation continues on exterior wall face.
6. Hempcrete Installation: Roof

6.3 APPLICATION

The hempcrete ceiling mix should only be moist enough to ensure the binder is mixed thoroughly.

6.3.1 Application - new build

Temporary step battens or planks should be placed on the roof to give the installer good grip.

6.3.2 Application - retrofit

Plan ahead. Make sure that a waterproof roof covering is at hand in case the hempcrete is rained on or drying too quickly.

If placing hempcrete as insulation between existing rafters, ensure the surface can withstand the additional weight of 62kg/m².

Leave a 20mm air gap between the roof sarking paper and the hempcrete insulation.

If applying hempcrete from inside the building with the roof in place, a permeable fibre mesh is stapled against the back of the rafters to prevent the hempcrete mix from being displaced during application.

In the front, formwork is gradually moved upwards while filling the cavity with the hempcrete mix.

6.3.3 Drying

If possible leave the insulated roof space open to allow drying.

Cover roof if rain is a threat.

An option is to work under roof cover i.e. install the roof and sarking paper first.

Caution:

Fast drying, which occurs when wind combines with full sun, should be carefully monitored.

Allow constant and sufficient ventilation. Do not force dry.

Partial covering/roofing might be preferential. Each situation must be assessed individually.

Please ensure all safety precautions have been met when working on heights.

Roof edge protection must be in place when working over 3 metre heights. See section 2.2 Safety.

Ensure the formwork is attached properly at the underside of the roof space. To cater for the weight of the wet mix, rafters might have to be supported until mix dries.

The mix will be spread in between the rafters using a rake. Compaction of the hempcrete should be left to a minimum.

Be sure to fill all gaps and dress the surface with a trowel.
This is a preview from the Hempcrete Australia Installation Manual 3rd Edition.

For the full version please contact Hempcrete Australia to register for the training course, or to gain further information and technical support.