



STATE OF WASHINGTON
STATE BUILDING CODE COUNCIL

May 2018
Log No. _____

1. State Building Code to be Amended:

X International Residential Code

Section(s): BL101, BL102, BL103, BL104, BL105, BL106, BL107, BL108

Title: Appendix BL - Hemp-Lime (Hempcrete) Construction (new appendix)

2. Proponent Name (Specific local government, organization or individual):

Proponent: Minority Hemp Builders Association
Title: 501(c)3 non-profit organization
Date: 02/6/2026
Contact: Ashley Stallworth
Contact Title: Code Development Director
Address: 1906 Alaska Ave E, Port Orchard, WA 98366
Phone: (928) 243-2243
E-Mail address: info@minorityhempbuilders.com

- 4. Proposed Code Amendment.** Reproduce the section to be amended by underlining all added language, striking through all deleted language. Insert new sections in the appropriate place in the code in order to continue the established numbering system of the code. If more than one section is proposed for amendment or more than one page is needed for reproducing the affected section of the code, additional pages may be attached.

Clearly state if the proposal modifies an existing amendment or if a new amendment is needed. If the proposal modifies an **existing amendment**, show the modifications to the existing amendment by underlining all added language and striking through all deleted language. If a new amendment is needed, show the modifications to the **model code** by underlining all added language and striking through all deleted language.

Code(s) _____ IRC _____ Section(s) _____ Appendices BI, BJ, BK, BL

Enforceable code language must be used.

Amend section to read as follows: See Attached

- 5. Briefly explain your proposed amendment, including the purpose, benefits and problems addressed.** Specifically note any impacts or benefits to business, and specify construction types, industries and services that would be affected. Finally, please note any potential impact on enforcement such as special reporting requirements or additional inspections required.

We are encouraging SBCC to adopt the following IRC appendices for the 2024 code adoption cycle:

Appendix BL - Hemp-Lime (Hempcrete) Construction [new appendix in the 2024 IRC]

Each one describes and regulates an alternative wall system, all of which use natural materials in various ways. In the state of Washington there are many contractors, small businesses, and individual home owners who would benefit from more accessibility to be able to build with these alternative means of construction.

All of these systems can help address the increasing need to reduce our buildings' negative impacts on the environment, including the global climate, and address the impacts of a changing climate on buildings, including increased firestorms.

All of these earthen wall systems are very fire-resistant building materials, while also having a low environmental impact. The ability to build with site- or locally-sourced materials further reduces processing and transportation impacts as well as costs.

These appendices give the building official greater flexibility to consider empirical evidence and lifecycle impacts in meeting the intent of the code while not abridging health and life-safety requirements.

The appendices are well-developed, comprehensive, tied directly to other requirements of the well-established IRC, and well vetted through the code development process. In addition to our core team, they received input from experienced design and building professionals, industry representatives, and building officials, in California and other states.

Other compelling reasons for SBCC adoption of these appendices and their building systems include:

-High resistance to fire, now a concern through much of the US due to seasonal wildfires. Cob walls earned a 2-hour fire-resistance rating with ASTM E119 tests. Light straw-clay and hemp-lime walls are inherently fire resistant by virtue of their required plaster finishes.

-Climate beneficial, with low embodied carbon and/or high carbon sequestration of the constituent materials of straw, clay, earth, hemp and lime.

-Seismic safety, by using established testing protocol such as reverse cyclic in-plane testing and out-of-plane testing in university settings (for cob construction) or by making adjustments to the IRC's lateral force-resisting system requirements by compensating for additional system weight (for light straw-clay and hemp-lime). Prescriptive structural use in Seismic Design Categories A, B, and C, and with an approved

engineered design required in SDC D. All non-structural provisions apply when an engineered design is employed. All three appendices were reviewed by and received input from multiple California civil and structural engineers and representatives of FEMA.

-Ensure safe and proper use of these (and other) building systems through plan check and inspections, especially for citizens who have been known to otherwise build without permits when faced with permitting obstacles.

-Use of low-cost, locally sourced, rapidly renewable, bio-degradable materials.

-Hemp-lime (hempcrete) is a burgeoning industry, gaining popularity and use since the cultivation of hemp was legalized in the U.S. in 2018.

-Removes impediments to greater use of these building systems.

6. Specify what criteria this proposal meets. You may select more than one.

The amendment is needed to address a critical life/safety need.

The amendment clarifies the intent or application of the code.

The amendment is needed to address a specific state policy or statute.

The amendment is needed for consistency with state or federal regulations.

The amendment is needed to address a unique character of the state.

The amendment corrects errors and omissions.

7. Is there an economic impact: Yes No

If no, state reason:

If yes, provide economic impact, costs and benefits as noted below in items a – f.

Our state has an aggressive goal of building 1.1 million homes over the next 18 years, being able to provide and integrate into construction local regional building materials that are green, fire resistant, moisture resistant and energy efficient will help bring more sustainable quality buildings for a state that spends 300 billion annually on construction. It will reduce costs, speed up construction and provide a regional material that workforce can readily and happily use atop of creating economic opportunities for our small and midsized businesses

a. **Life Cycle Cost.** Use the OFM Life Cycle Cost [Analysis tool](#) to estimate the life cycle cost of the proposal using one or more typical examples. Reference these [Instructions](#); use these [Inputs](#). Webinars on the tool can be found [Here](#) and [Here](#)). If the tool is used, submit a copy of the excel file with your proposal submission. If preferred, you may submit an alternate life cycle cost analysis.

b. **Construction Cost.** Provide your best estimate of the construction cost (or cost savings) of your code change proposal.

Cost per /square foot \$9.00 per square ft

Cost savings are reduction of usage of drywall (\$2.00), traditional insulation(\$4.50), acoustic barrier (\$10.00)

So all of those added up = \$16.50 compared to \$9.00 per square foot

- c. **Code Enforcement.** List any code enforcement time for additional plan review or inspections that your proposal will require, in hours per permit application:
We would like this to be highlighted as it will bring a lot of value to Washingtonians; awareness that this is available is critical to adoption
- d. **Small Business Impact.** Describe economic impacts to small businesses:
This will help bring economic gain for small business's especially in restoration, retrofit, remodels and new construction. A New green option that is regionally produced from our agricultural fields!
- e. **Housing Affordability.** Describe economic impacts on housing affordability:
This will help lower cost, and improve energy efficiency which will reduce consumer costs.
- f. **Other.** Describe other qualitative cost and benefits to owners, to occupants, to the public, to the environment, and to other stakeholders that have not yet been discussed:
*** This appendix utilization will bring a fire resistant, moisture resistant, pest resistant and more energy efficient product to market that fits our new energy code CI (continuous insulation protocol) to assure a proper R value is created

Please send your completed proposal to: sbcc@des.wa.gov

All questions must be answered to be considered complete. Incomplete proposals will not be accepted.

Appendix BL Hemp-Lime (Hempcrete) Construction

The provisions contained in this appendix are **adopted for use in the State of Washington not mandatory unless specifically referenced in the adopting ordinance.**

User notes:

About this appendix:

Hemp-lime, commonly referred to as hempcrete, is a nonstructural, bio-composite insulation infill material composed of hemp hurd and a lime-based binder. The benefits of hemp-lime include high thermal performance, low embodied carbon emissions in production, high carbon sequestration in service, healthy living environments and high fire-resistance. These benefits, along with the 2018 United States legalization of hemp as a commercial crop, are driving rapid growth in interest and projects across the US.

Section BL101 General

BL101.1 Scope.

This appendix shall govern the use of *hemp-lime* as a nonstructural building material and wall infill system. *Townhouses* in *Seismic Design Categories C, D0, D1 and D2* and one- and two-family dwellings in *Seismic Design Categories D0, D1 and D2* shall require an *approved* engineered design by a *registered design professional* in accordance with Section R301.1.3.

Section BL102 Definitions

BL102.1 General.

The following words and terms shall, for the purposes of this appendix, have the meanings shown herein. Refer to Chapter 2 for general definitions.

BINDER.

The material that binds the *hemp hurd* in a *hemp-lime* mix.

BONDING COAT.

The initial thin layer of binder-rich granulated *plaster* used in *lined applications* of *hemp-lime* construction to ensure adhesive and/or mechanical bonding. Also known as “gobetis.”

CASTING.

Placing wet *hemp-lime* into forms.

CAST-IN-PLACE.

Installation of *hemp-lime* mix by hand or by spraying into forms in its permanent location.

CLAY.

Inorganic soil with particle sizes less than 0.00008 inch (0.002 mm) and having the characteristics of high dry strength and medium to high plasticity, used as a *binder* of other component materials in *clay plaster*.

CLAY SUBSOIL.

Subsoil sourced directly from the earth, containing *clay*, sand and silt, and containing not more than trace amounts of organic matter.

FIBER CLUMPS.

Long fibers that are attached to *hemp hurd*, or for other reasons, cause clumping of fibrous balls when agitated.

FINISH.

Exposed surface material on the interior or exterior face of a *hemp-lime* infill wall.

FORM.

The material into which *hemp-lime* infill, panels or blocks are cast.

FORMWORK.

The system of forms, their bracing and fasteners assembled for casting of *hemp-lime* infill.

HAND-CAST.

Hemp-lime infill cast by placing *hemp-lime* mix into formwork and evenly tamping by hand or with a tool.

HEMP.

A class of the *Cannabis sativa* plant grown for industrial purposes in which the concentration of total delta-9 tetrahydrocannabinol (THC) in the flowering tops is equal to or less than the regulated maximum level established by authorities having jurisdiction.

HEMP HURD.

The chopped woody core of the stalks of the hemp plant, stripped of its surrounding *hemp* fibers. Also known as “*hemp shiv*” or “*hemp shive*.”

HEMPCRETE.

Common usage term for *hemp-lime* .

HEMP-LIME.

A bio-aggregate composite consisting of *hemp* hurd and a lime-based *binder*. Also known as “*hempcrete*.”

INFILL.

Hemp-lime placed between or around the structural or nonstructural framing of a building as insulation, thermal mass and a substrate for finish.

LIFT.

A horizontal layer of *hemp-lime* infill.

LIME.

Lime is composed of calcium hydroxide [Ca(OH)²] including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime.

LINED APPLICATION.

Installation of a vertical *hemp-lime* layer, lining a masonry or concrete wall.

NATURAL CEMENT.

Hydraulic cement made from naturally occurring limestone.

NONBEARING.

Not bearing the weight of the building other than the weight of the *hemp-lime* infill and its finish.

PLASTER.

Lime, clay, clay-lime or *hemp-lime plaster* as described in Section BL104.3, applied to the interior or exterior face of *hemp-lime* walls.

POZZOLAN.

A siliceous or alumino-siliceous material that, when finely divided and combined with hydrated lime in the presence of water, forms new chemical compounds with cementitious properties.

PRECAST.

Blocks or panels of *hemp-lime* formed and cured before installation.

REED MAT.

A mat consisting of reed, cane, bamboo or other similar plant material.

SCREEDING.

Removal of excess material to form a planar surface.

SPRAY-APPLIED.

A method of mechanical projection of *hemp-lime* applied onto or into a form using compressed air.

TADELAKT.

A lime-plaster which is compressed, polished and treated with oil-based soap to make it water-repellent.

UNIT WALL WEIGHT.

The *unit wall weight* is the calculated weight of a 1-foot by 1-foot (305 mm × 305 mm) section of wall surface area times the full wall thickness, including finishes. The *unit wall weight* is the sum of the weight of each constituent material times its volume, expressed as pounds per square foot (psf).

VOID.

Any space in a *hemp-lime* wall greater than 1/4 inch (6 mm) wide, 2 inches (51 mm) long and 2 inches (51 mm) deep.

Section BL103 Hemp-Lime Construction**BL103.1 General.**

Hemp-lime construction shall be limited to the nonstructural, solid infill mix of *hemp hurd* and its *binder* between or around structural and nonstructural wall framing. *Hemp-lime* infill shall have a density ranging from 12.5 lb/ft³ to 25 lb/ft³ (200 kg/m³ to 400 kg/m³). *Hemp-lime* walls shall be designed and constructed in accordance with Section BL103 and with Figures BL103.1(1) through BL103.1(4) or an *approved* alternative design.

FIGURE BL103.1(1)
TYPICAL HEMP-LIME WITH INTERIOR STUD FRAMING

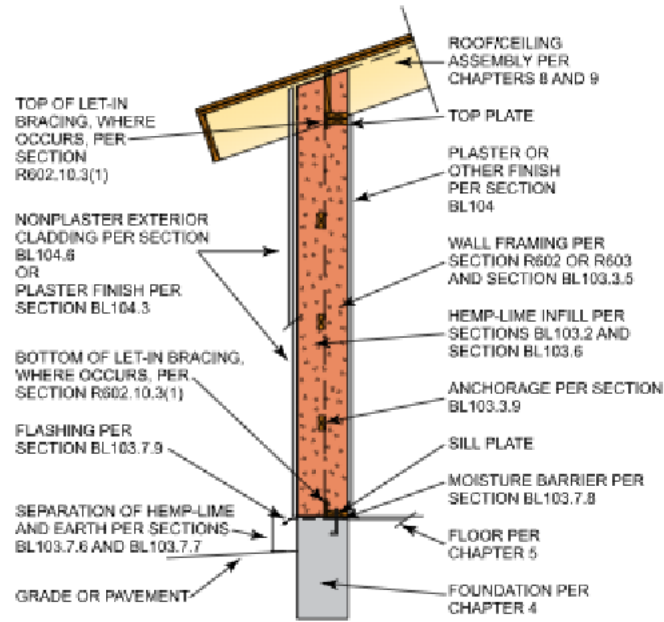


FIGURE BL103.1(2)
TYPICAL HEMP-LIME WITH CENTER STUD FRAMING

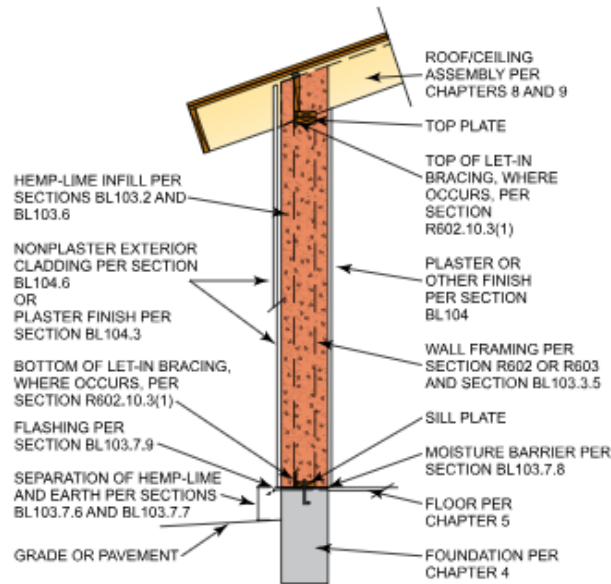


FIGURE BL103.1(3)
TYPICAL HEMP-LIME WITH EXTERIOR STUD FRAMING

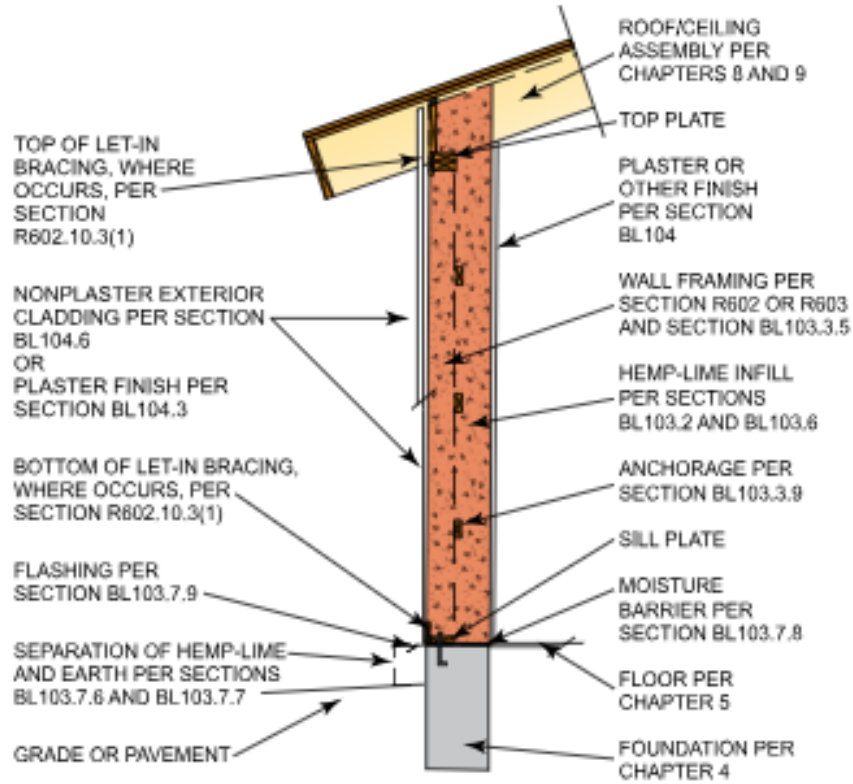
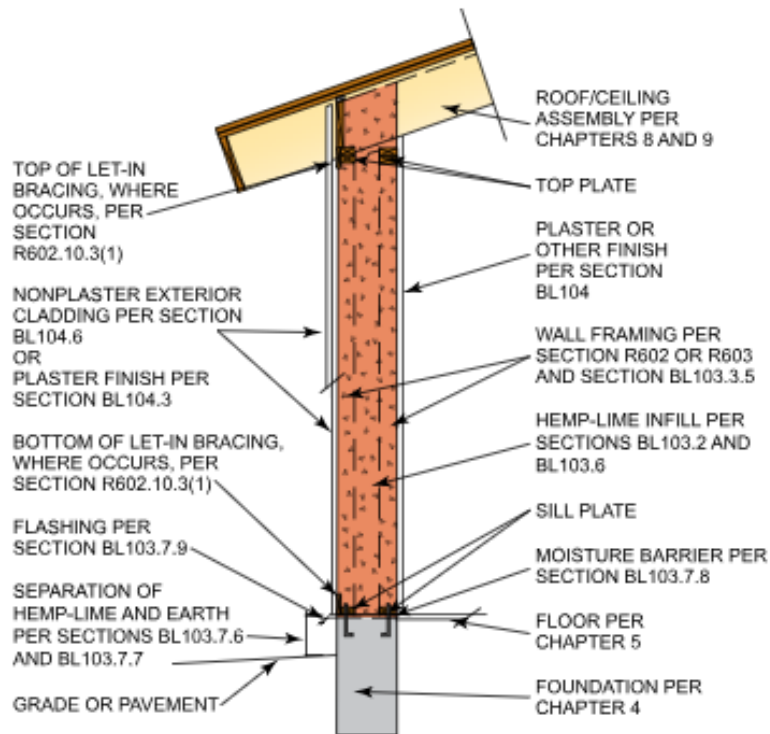


FIGURE BL103.1(4)
TYPICAL HEMP-LIME WITH DOUBLE STUD WALL FRAMING



BL103.2 Materials.

Materials to be used in *hemp-lime* construction shall be in accordance with Sections BL103.2 through BL103.2.3.

BL103.2.1 Hemp hurd.

Hemp hurd shall match the specifications of the *approved* test samples in Sections BL106.3 and BL107.1. *Hemp hurd* shall be substantially free from dust and *fiber clumps* such that the installed *hemp-lime* maintains its integrity.

BL103.2.2 Binders.

Acceptable binders, singular or in combination, include hydraulic lime, hydrated lime, *pozzolans*, *natural cements* or other binders that match the specification of the *approved* test samples in Sections BL106.3 and BL107.1.

BL103.2.3 Water and water additives.

Water and any water additives shall match the specifications of the *approved* test samples in Sections BL106.3 and BL107.1.

BL103.3 Structure.

The structure of buildings using *hemp-lime* infill shall be in accordance with this code and Sections BL103.3.1 through BL103.3.9 or with an *approved* engineered design by a *registered design professional*.

BL103.3.1 Limitations and requirements for buildings using *hemp-lime* infill.

Buildings using *hemp-lime* infill shall be subject to the following limitations and requirements:

1. Number of *stories*: not more than one *story above grade plane*.
2. The *building height* shall not be more than 25 feet (7620 mm).
3. Braced wall panel lengths: in accordance with Sections R602.10.3 and BL103.3.2.
4. *Unit wall weight*: *Hemp-lime* walls shall not exceed an average *unit wall weight* of 65 psf (317 kg/m²).

BL103.3.2 Bracing.

Bracing for buildings with *hemp-lime* infill in *Seismic Design Categories A, B and C* shall be in accordance with Section R602.10 and in accordance with the following. Walls with *hemp-lime* infill shall use Method LIB and shall not be braced with solid sheathing. *Hemp-lime* infill walls utilizing Method LIB shall not require *gypsum board* to be installed and shall use the minimum braced wall lengths listed in Section R602.10. Adjustment factors in Table R602.10.3(4) shall be used as applicable. Alternatively, *hemp-lime* infill walls shall comply with Section R301.1. Walls or wall sections without *hemp-lime* infill shall be permitted to use any bracing method allowed in Section R602.10.

BL103.3.3 Connection of light-frame walls to *hemp-lime* walls.

Light-frame walls perpendicular to, or at an angle to, a *hemp-lime* wall assembly shall be fastened to the *hemp-lime* wall in accordance with Section R602 or R603.

BL103.3.4 *Hemp-lime* thickness.

Hemp-lime infill shall be not less than 3 inches (76 mm) thick between face of framing and *finish*. Maximum *hemp-lime* wall thickness is limited by the average *unit wall weight* limit of 65 psf (317 kg/m²) in Section BL103.3.1, Item 4.

BL103.3.5 Contact with structural metal.

Structural metal members and components in contact with *hemp-lime* shall be protected in accordance with Section BL103.4.

BL103.3.6 Contact with wood members.

Hemp-lime shall be permitted to be in contact with untreated wood members.

BL103.3.7 Openings in walls.

Doors, windows and similar openings in *hemp-lime* walls shall be in accordance with the following:

1. Rough framing for doors and windows shall be part of, or be fastened to, the wall framing in accordance with this code.
2. An *approved water-resistive barrier* shall be installed at openings in *hemp-lime* walls in accordance with Sections BL103.7.4 and BL104.5.1.
3. Header size and their maximum span above openings in bearing walls with *hemp-lime* infill shall be determined with Tables R602.7(1) and BL103.3.7 or an *approved design* by a *registered design professional*.
4. Cast-in-place *hemp-lime* over and overhanging the face of a header more than 3 inches (76 mm) shall require an *approved design* of its support by a *registered design professional*.
5. *Hemp-lime* blocks overhanging headers shall require an *approved design* of their support by a *registered design professional*.

**TABLE BL103.3.7
ALLOWABLE HEADER SPAN MULTIPLIER^a**

WALL HEIGHT ABOVE HEADER	UNIT WALL WEIGHT (psf)			
	15	30	45	65
1'-0"	1.00	1.00	1.00	1.00
1'-6"	1.00	1.00	0.90	0.90
2'-0"	1.00	0.90	0.90	0.85
2'-6"	1.00	0.90	0.90	0.85
3'-0"	1.00	0.90	0.90	0.80

For SI: 1 foot = 304.8 mm, 1 pound per square foot = 4.882 kg/m².

- a. Multiply the maximum allowable spans from Table R602.7(1) by the applicable factor to determine the adjusted maximum allowable header span.

BL103.3.8 Voids.

Voids shall be filled with *hemp-lime* or other *approved* material before application of *finish*.

BL103.3.9 Anchorage of hemp-lime.

Hemp-lime for interior and exterior stud walls shall be anchored or shall be in accordance with an *approved design* by a *registered design professional*. Horizontal anchorage rails shall be installed at not more than 24 inches (610 mm) on center and in accordance with Figures BL103.1(1) and BL103.1(3). Horizontal anchorage rails shall be no less than 1 inch by 2 inches (25 mm by 51 mm). Anchorage rails shall be wood, metal per Section BL103.4, or other *approved* material. Anchorage rails should be attached to the side of the stud facing the interior of the wall with one 8d box nail to each stud and run the entire length of the wall.

BL103.4 Contact with metal.

Metal in contact with *hemp-lime* shall be stainless steel or primed and painted with a coating in accordance with Section BL103.4.1.

BL103.4.1 Protective coatings.

Metal shall be painted with an epoxy, oil, bituminous paint or other approved coating. Waterbased paints shall not be used.

Exception: Heads of pneumatically driven hot-dip galvanized nails.

BL103.5 Mechanical, electrical and plumbing in hemp-lime infill.

Electrical and telecommunication wiring, panels and boxes, mechanical ducts, plumbing pipes and other mechanical, electrical and plumbing components in or in contact with *hemp-lime* infill shall be isolated in sleeves, pipes, conduits or tubing made of plastic, or of metal in accordance with Section BL103.4, or separated from *hemp-lime* with an *approved* alkaline-resistant material.

BL103.6 Hemp-lime installation methods.

Hemp-lime shall be installed in accordance with Sections BL103.6.1 and BL103.6.2, and one of Sections BL103.6.3 through BL103.6.7.

BL103.6.1 Mix and mixing.

The materials and ratio of *hemp hurd* to *binder* to water shall match the specifications of the *approved* test samples in Sections BL106.3 and BL107.1. The water-to-*binder* ratio shall be not less than 1:1 and not greater than 2:1 by weight or by *binder* manufacturer's recommendations. The *hemp hurd*, *binder* and water shall be thoroughly and uniformly mixed by manual or mechanical means.

BL103.6.2 Formwork for hand-cast and spray-applied methods.

Forms shall be removable or permanent and shall not deform under the lateral pressure of the installed wet *hemp-lime*.

BL103.6.2.1 Permanent forms.

Permanent forms shall be permitted to be installed on only one side. Permanent forms shall be *reed mats* or other approved materials with an open weave. Sheet materials shall not be used as permanent forms. Permanent forms remain after curing as a *finish* or substrate for another *finish*.

Exception: Permanent forms of any material shall be permitted at the jambs, heads and sills of openings.

BL103.6.2.2 Removable forms.

Removable forms shall be removed within 24 hours after *hemp-lime* placement or per the binder manufacturer's specifications.

Exception: Removable forms temporarily supporting *hemp-lime* infill above wall openings shall not be removed for a minimum of 3 days or per binder manufacturer's specifications.

BL103.6.3 Hand-cast.

Hand-cast hemp-lime infill shall be installed in uniform lifts not greater than 4 inches (102 mm) in height. Each lift shall be tamped to achieve stable walls free of *voids*.

BL103.6.4 Spray-applied.

Spray-applied hemp-lime infill shall be installed in accordance with Sections BL103.6.4.1 through BL103.6.4.4.

BL103.6.4.1 Forms.

Forms shall be installed on one side in accordance with Section BL103.6.2 or BL103.6.7.2 for *lined applications*.

BL103.6.4.2 Mixing.

Mixing shall be in accordance with Section BL103.6.1 or the spray equipment manufacturer's instructions.

BL103.6.4.3 Installation.

Hemp-lime shall be sprayed from the base up and per the spray equipment manufacturer's and/or *binder* manufacturer's instructions.

BL103.6.4.4 Screeding.

Excess *hemp-lime* shall be removed by *screeding* per the spray equipment manufacturer's and/or *binder* manufacturer's instructions.

BL103.6.5 Precast blocks.

Precast hemp-lime blocks shall be cast and installed in accordance with Sections BL103.6.5.1 through BL103.6.5.5 or per manufacturer's specifications.

BL103.6.5.1 Block dimensions.

Hemp-lime blocks shall be a minimum thickness of 3 inches (76 mm) in all dimensions and shall not exceed the maximum thickness in accordance with Section BL103.3.4.

BL103.6.5.2 Casting.

Hemp-lime blocks shall be cast in accordance with Sections BL103.6.1 through BL103.6.6, as applicable, or by other means that produce *approved* blocks.

BL103.6.5.3 Mortar.

Mortar shall consist of lime and sand or other aggregate with a ratio of not less than 1:1 and not greater than 1:3, or other *approved* mortar. The lime shall be hydrated Type N or S, or hydraulic lime.

BL103.6.5.4 Installation.

Hemp-lime blocks shall be installed in a *running bond* between and around wall framing members. Mortar shall fill all *voids* between blocks and shall be not less than 1/8 inch (3 mm) thick. Spaces between blocks and framing shall be not more than 3/4 inch (19 mm) and shall be filled with mortar.

BL103.6.5.5 Hemp-lime block veneer.

Hemp-lime block veneer shall not exceed 50 psf (244 kg/m²) of veneer only *unit wall weight*, shall be limited to 5-inch (127 mm) thickness, and shall be anchored to the supporting wall studs in accordance with Section R703.8.4 or secured with *approved* ties and fasteners to an *approved* backing. Metal ties and fasteners shall be protected in accordance with Section BL103.4.

BL103.6.6 Hemp-lime panels.

Hemp-lime panels shall require an *approved* design by a *registered design professional*.

BL103.6.7 Lined application.

Interior and exterior *hemp-lime lined applications* shall be installed in accordance with Sections BL103.6.7.1 through BL103.6.7.6 and Sections BL103.6.3 through BL103.6.6, as applicable.

BL103.6.7.1 General.

Prior to installation, the concrete or masonry walls receiving the installation shall be clean and free of loose mortar. Lined installations on basement walls shall require an *approved* design by a registered design professional. Exterior applications shall be in accordance with Section BL103.7.6. Attachment of precast blocks to the receiving wall shall be in accordance with Section BL103.6.5.5. Attachment of hemp-lime panels to the receiving wall shall be in accordance with Section BL103.6.6.

BL103.6.7.2 Formwork.

Forms shall be in accordance with Section BL103.6.2. Permanent *formwork* shall not be allowed on the nonreceiving wall side.

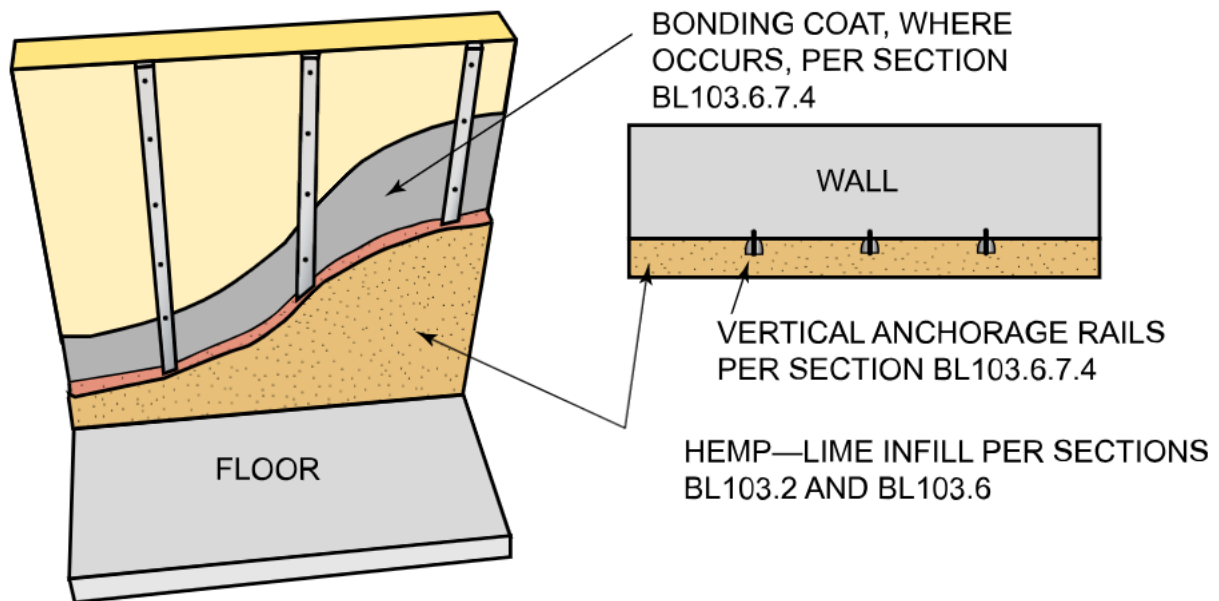
BL103.6.7.3 Thin lining.

Thin linings are from 3 inches to 4 3/4 inches (76 mm to 121 mm) thick. Hand troweled *hemp-lime* shall be installed over a *bonding coat*.

BL103.6.7.4 Medium lining.

Medium linings exceed 4 3/4 inches (121 mm) and are not greater than 6 1/2 inches (165 mm) thick. For *hand-cast* or *spray-applied*, 1 1/2-inch by 1 1/2-inch (38 mm × 38 mm) dovetail-shaped vertical anchorage rails shall be attached with the narrowest face to the receiving wall, spaced not less than 20 inches (508 mm) and not greater than 32 inches (813 mm), with fasteners not less than 2 feet (610 mm) and not greater than 3 feet (914 mm) apart. *Hand-cast* medium linings shall be installed over a *bonding coat* on the receiving wall. See Figure BL103.6.7.4.

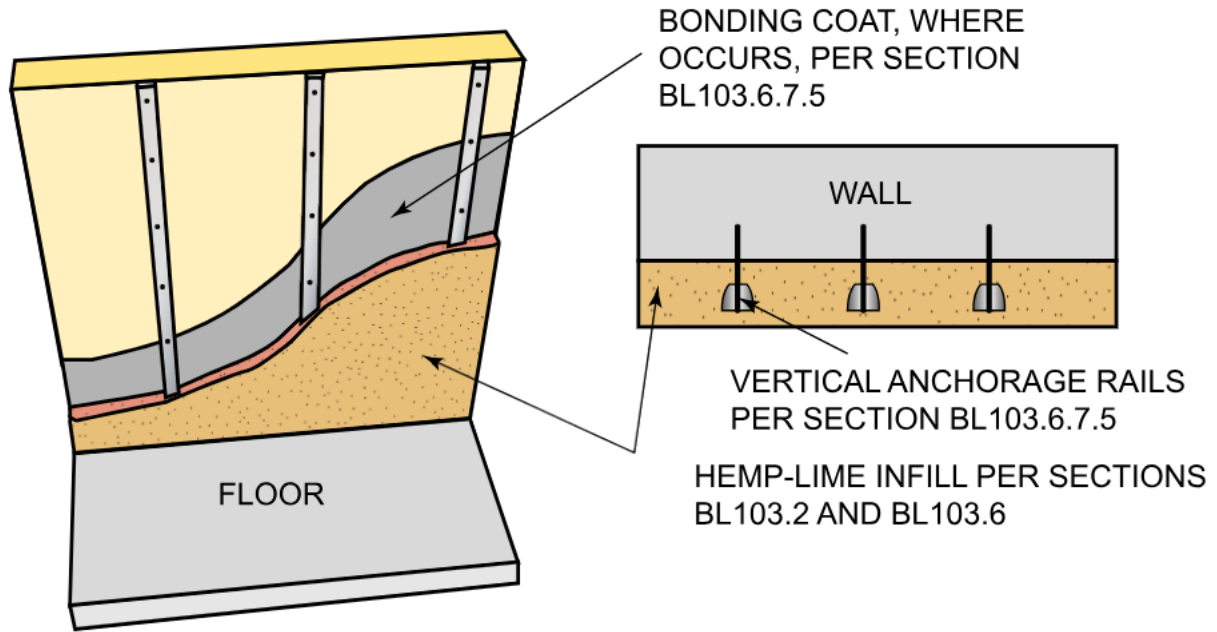
**FIGURE BL103.6.7.4
TYPICAL HEMP-LIME MEDIUM LINING**



BL103.6.7.5 Thick lining.

Thick linings exceed 6 1/2 inches (165 mm) and shall not be greater than 8 inches (203 mm) thick or per the *binder* manufacturer's specifications. For *hand-cast* or *spray-applied*, 1 1/2-inch by 2 1/2-inch (38 mm × 64 mm) vertical anchorage rails shall be attached with the 2 1/2-inch (64 mm) face parallel to the receiving wall and spaced not less than 20 inches (508 mm) and not greater than 32 inches (813 mm). The anchorage rails shall be fastened to and separated from the receiving wall with 2-inch (51 mm) spacers not less than 3 feet (914 mm) and not greater than 4 feet (1219 mm) apart. *Hand-cast* thick linings shall be installed over a *bonding coat* on the receiving wall. See Figure BL103.6.7.5.

**FIGURE BL103.6.7.5
TYPICAL HEMP-LIME THICK LINING**



BL103.6.7.6 Minimum thickness at anchorage rails.

The minimum thickness of *hemp-lime* between the exterior face of vertical anchorage rails and the finished face of *hemp-lime* shall be 3 inches (76 mm) or in accordance with the *binder* manufacturer's specifications.

BL103.7 Moisture control.

Hemp-lime assemblies shall be protected from water intrusion and damage in accordance with Sections BL103.7.1 through BL103.7.9.

BL103.7.1 Water-resistive barriers.

Water-resistive barriers are prohibited on *hemp-lime* walls, except as permitted or required elsewhere in this appendix.

BL103.7.2 Vapor retarders.

Vapor retarders are prohibited on *hemp-lime* walls, except as permitted or required elsewhere in this appendix.

BL103.7.3 Penetrations in hemp-lime walls.

Penetrations in exterior *hemp-lime* walls shall be sealed with an *approved* sealant or gasket on the exterior side of the wall in all *climate zones* and on the interior side of the wall in Climate Zones 5, 6, 7, 8 and Marine 4, as defined in Chapter 11.

BL103.7.4 Horizontal surfaces.

Hemp-lime walls and other *hemp-lime* assemblies shall be provided with a *water-resistive barrier* at weather-exposed horizontal surfaces. The *water-resistive barrier* shall be of a material and installation that will prevent water from entering the wall system. Horizontal surfaces shall include exterior window sills and sills at exterior niches. Horizontal surfaces shall be sloped not less than 1 unit vertical in 12 units horizontal (8 percent slope) and shall drain away from *hemp-lime* walls and other assemblies. Where the *water-resistive barrier* is below the *finish material*, it shall be sloped not less than 1 unit vertical in 12 units horizontal (8 percent slope) and shall drain to the exterior surface of the *hemp-lime* wall's vertical *finish*.

BL103.7.5 Air barrier.

Exterior *hemp-lime* walls shall have a *vapor-permeable air barrier* on all exterior and interior surfaces, except as permitted or required elsewhere in this appendix. *Plaster* in accordance with Section BL104.3 shall be acceptable as an *air barrier*.

BL103.7.6 Separation of hemp-lime and earth or paved areas.

Hemp-lime shall be not less than 8 inches (203 mm) above exposed earth or paved areas.

BL103.7.7 Separation of exterior plaster and earth or paved areas.

Exterior plaster applied to *hemp-lime* shall be not less than 8 inches (203 mm) above exposed earth or paved areas.

BL103.7.8 Separation of hemp-lime and exterior plaster from foundation.

Hemp-lime and exterior *plaster* shall be separated from the foundation with an *approved* moisture barrier.

BL103.7.9 Base of wall flashing.

The outer face of exterior walls shall be flashed to prevent water intrusion at the base of the wall.

Section BL104 Finishes**BL104.1 General.**

The interior and exterior surfaces of *hemp-lime* walls shall be protected with a *finish* in accordance with Section BL104. Finishes shall have a vapor permeance rating of 5 perms [285 mg/(s × m² × Pa)] or greater tested in accordance with Procedure B of ASTM E96.

BL104.2 Moisture content prior to application of finish.

Hemp-lime infill shall have an average moisture content of no more than 20 percent at a depth of 1 1/2 inches (38 mm), as measured from the face of the wall to which the *finish* will be applied for each wall. Moisture content shall be measured with a probe-style wood moisture equivalent (WME) meter.

BL104.3 Plaster finish.

Exterior plaster shall be lime *plaster*, clay *plaster* in accordance with Section BL104.3.6.3, or other *approved plaster*. Interior plasters shall be any *plaster* permitted in Sections BL104.3.1 through BL104.3.9. Plasters shall be permitted to be applied directly to the surface of the *hemp-lime* infill without reinforcement, except that the juncture of dissimilar substrates shall be in accordance with Section BL104.5. Plasters shall have a thickness of not less than 1/2 inch (13 mm) on the interior and 3/4 inch (19 mm) on the exterior and shall be installed in not less than two coats, or per *binder* manufacturer's instructions. Not less than 3/8 inch (10 mm) exterior *plaster* is permitted behind exterior *cladding* in accordance with Section BL104.6.

BL104.3.1 Membranes.

Membranes are prohibited between *plaster* and *hemp-lime*, except where a membrane is allowed or required elsewhere in this appendix.

BL104.3.2 Lath and mesh for plaster.

The surface of the *hemp-lime* functions as lath, and other lath or mesh shall not be required, except as required in Section BL104.5.

BL104.3.3 Plaster additives.

Additives shall be permitted to increase *plaster* workability, durability, strength or water resistance. Additives shall not reduce the *plaster* vapor permeance rating to less than 5 perms [285 mg/(s × m² × Pa)]. Additives containing polymers are prohibited.

BL104.3.4 Plaster reinforcing fibers.

Reinforcing fibers shall be permitted in *plaster*. Acceptable reinforcing fibers include hemp fiber, chopped straw, sisal, animal hair and fiberglass.

BL104.3.5 Lime plaster.

Lime *plaster* is any *plaster* with a binder primarily composed of calcium hydroxide [Ca(OH)²], including Type N or S hydrated lime, hydraulic lime, natural hydraulic lime or slaked quicklime. Hydrated lime shall comply with ASTM C206. Hydraulic lime shall comply with ASTM C1707. Natural hydraulic lime shall comply with ASTM C141 and CEN EN 459. Quicklime shall comply with ASTM C5. Lime *plaster* shall contain sufficient lime to fully bind the sand or other aggregate and shall be permitted to contain *pozzolans*.

BL104.3.6 Clay plaster.

Clay *plaster* shall be any *plaster* having a *clay* or *clay subsoil binder*. Such *plaster* shall contain sufficient *clay* to fully bind the sand or other aggregate.

BL104.3.6.1 Clay subsoil requirements.

The suitability of *clay subsoil* shall be determined in accordance with Figure 2, Ribbon Test, and Figure 3, Ball Test, in the appendix of ASTM E2392/E2392M.

BL104.3.6.2 Thickness and coats.

Clay *plaster* shall be not less than 3/4 inch (19 mm) thick and shall be applied in not less than two coats.

BL104.3.6.3 Rain-exposed.

Clay *plaster*, where exposed to rain, shall be finished with an *approved* erosion-resistant *finish*.

BL104.3.6.4 Prohibited finish coat.

Plaster containing Portland cement shall not be permitted as a *finish* coat over clay plasters.

BL104.3.7 Clay-lime plaster.

Clay-lime *plaster* shall be composed of refined *clay* or *clay subsoil*, sand and lime.

BL104.3.8 Hemp-lime plaster.

Hemp-lime plaster shall be composed of *hemp hurd* and lime and shall be permitted to contain sand or other aggregate, and *pozzolans*.

BL104.3.9 Hemp-clay plaster.

Hemp-clay *plaster* shall be composed of *hemp hurd* and *clay* or *clay subsoil* and shall be permitted to contain sand or other aggregate.

BL104.4 Separation of wood and plaster.

Wood framing at the exterior surface of *hemp-lime* walls shall be separated from exterior *plaster* with Grade D paper or other *approved* material, except where the wood is naturally durable.

Exception: Exterior *clay plaster* shall not be required to be separated from wood.

BL104.5 Bridging across dissimilar substrates.

Bridging shall be installed onto and across dissimilar substrates prior to the application of *plaster* on the interior or exterior. Acceptable bridging materials include expanded metal lath, woven wire mesh, welded wire mesh, fiberglass mesh, *reed mat*, burlap or other *approved* materials. Bridging shall extend not less than 3 inches (76 mm) on both sides of the juncture.

BL104.5.1 Returns on recessed openings.

Plaster or other exterior *finish* returns at recessed windows and doors shall require an *approved* design that prevents the intrusion of moisture.

BL104.6 Nonplaster exterior cladding.

Nonplaster exterior *cladding* shall be spaced not less than 1 inch (25 mm) from the face of the *water-resistive barrier* or *air barrier* to the back of the *cladding* to allow for *ventilation*. The ventilation space shall be open at the top and bottom and be provided with insect screening.

BL104.6.1 Water-resistive and air barriers.

Water-resistive barriers and air barriers, when *vapor permeable*, are permitted to be applied directly to the *hemp-lime* when exterior *cladding* is installed in accordance with Section BL104.6.

BL104.7 High moisture interior environments.

Exterior *hemp-lime* walls enclosing showers or steam rooms shall be lined on the interior side with ceramic tiles on an *approved* tile backer board, ceramic tiles on a lime plaster, or a *tadelakt finish*.

Section BL105 Fire Resistance

BL105.1 Fire-resistance rating.

Hemp-lime walls do not have a fire-resistance rating. Fire-resistance ratings for *hemp-lime* wall assemblies shall be determined by testing in accordance with ASTM E119 or UL 263.

BL105.2 Clearance to fireplaces and chimneys.

Hemp-lime surfaces adjacent to fireplaces or chimneys shall be finished with not less than $\frac{3}{8}$ inch (10 mm) thick *plaster* of any type permitted by this appendix. Clearance from the face of such *plaster* to fireplaces and chimneys shall be maintained as required from fireplaces and chimneys to combustibles in Chapter 10, or as required by manufacturer's instructions, whichever is more restrictive.

Section BL106 Thermal Performance

BL106.1 Mass walls.

Walls with *hemp-lime* infill shall be classified as mass walls in accordance with WSEC Section R402.2.5 (N1102.2.5 (R402.2.5)) and shall meet the U-factor requirements for above-grade walls in WSEC Table R402.1.2 (R value requirements for mass walls in Table N1102.1.3 (R402.1.3)), when their heat capacity (C) is greater than or equal to 6 Btu/ft² × °F (123 kJ/m² × K) in Equation BL-1.

$$\text{Equation BL-1 } C = \rho \times t \times 0.299 \text{ Btu/lb} \times \text{°F}$$

where:

C = Heat capacity (Btu/ft² × °F).

ρ = Density of *hemp-lime* infill (pounds per cubic foot).

t = Thickness of *hemp-lime* infill (feet).

BL106.2 Thermal resistance.

Hemp-lime has the unit thermal resistance values in accordance with Table BL106.2. Alternatively, the unit R -value of *hemp-lime* shall be determined with one of the following tests by an *approved* laboratory: ASTM C177, ASTM C518, ASTM C1114 or ASTM C1363. Test results from a specific *hemp-lime* mix shall be permitted to be used for multiple projects.

TABLE BL106.2
THERMAL RESISTANCE OF HEMP-LIME^a

DENSITY (pounds per cubic foot)	R-VALUE (ft ² × °F × h/Btu per inch of thickness)
12.5	R-2.10
15	R-1.86
20	R-1.54
25	R-1.20

For SI: 1 pound per cubic foot = 1.6 kg/m³.

- a. Linear interpolation is permitted. Extrapolation is not permitted.

BL106.3 Density measurement.

Hemp-lime density shall be measured based on *approved* test samples as follows:

1. Three samples of the proposed *hemp-lime* mix shall be placed moist to completely fill a 6-inch by 6-inch by 12-inch (152 mm × 152 mm × 305 mm) *form*, a 6-inch (152 mm) diameter by 12-inch (305 mm) length *form* or other *approved form*, following the application method and procedure that will be used during construction.
2. Samples shall be removed from the forms within 24 hours after *hemp-lime* placement or per the binder manufacturer's specifications.
3. Samples shall be cured/dried for a minimum of 14 days in indoor ambient conditions before density determination.
4. Density shall be determined by Equation BL-2.

Equation BL-2 $\rho = w/V$

where:

ρ = Density of hemp-lime infill (pounds per cubic foot).

w = Weight of hemp-lime infill sample (pounds).

V = Volume of hemp-lime sample (cubic feet).

BL106.4 Compliance with Section R302.10.1.

Hemp-lime infill shall meet the requirements for insulation materials in Section R302.10.1 for *flame spread index* and *smoke-developed index* as tested in accordance with ASTM E84.

Section BL107 Mechanical Performance

BL107.1 Hemp-lime infill integrity.

The integrity of *hemp-lime* infill and its ability to hold a *plaster finish* shall be demonstrated with a minimum compressive strength of 29 psi (0.2 MPa). Test results from a specific *hemp-lime* mix shall be permitted to be used for multiple projects.

BL107.1.1 Demonstration of compressive strength.

The compressive strength of the *hemp-lime* mix shall be demonstrated to the *building official* before the placement of *hemp-lime* infill, with compressive strength tests and an associated report by an *approved* laboratory tested as follows:

1. Three samples of the proposed *hemp-lime* mix shall be placed moist to completely fill a 6-inch by 6-inch by 12-inch (152 mm × 152 mm × 305 mm) *form*, a 6-inch (152mm) diameter by 12-inch (305 mm) length *form*, or other *approved form*, following the application method and procedure that will be used during construction.
2. Samples shall be removed from the forms within 24 hours after *hemp-lime* placement or per the *binder* manufacturer's specifications.
3. Samples shall be cured/dried for a minimum of 14 days in indoor ambient conditions before testing.

4. The opposite faces shall be capped with *plaster* of paris to achieve smooth and parallel faces, after which the sample shall reach ambient moisture conditions before testing.
5. The horizontal cross section of the dried sample as tested and the maximum applied load at failure shall be used to calculate the sample's compressive strength.
6. The average value of the samples shall be used to determine the mix's compressive strength.

Section BL108 Referenced Standards

BL108.1 General.

See Table BL108.1 for standards that are referenced in various sections of this appendix. Standards are listed by the standard identification with the effective date, the standard title and the section or sections of this appendix that reference this standard.

**TABLE BL108.1
REFERENCED STANDARDS**

STANDARD ACRONYM	STANDARD NAME	SECTIONS HEREIN REFERENCED
ASTM C5—10	<i>Standard Specification for Quicklime for Structural Purposes</i>	BL104.3.5
ASTM C141/C141M—14	<i>Standard Specification for Hydrated Hydraulic Lime for Structural Purposes</i>	BL104.3.5
ASTM C177—19	<i>Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus</i>	BL106.2
ASTM C206—14	<i>Standard Specification for Finishing Hydrated Lime</i>	BL104.3.5
ASTM C518—21	<i>Transmission Properties by Means of the Heat Flow Meter Apparatus</i>	BL106.2
ASTM C1114—06(2019)	<i>Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Thin-Heater Apparatus</i>	BL106.2
ASTM C1363—19	<i>Standard Test Method for Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus</i>	BL106.2
ASTM C1707—11	<i>Standard Specification for Pozzolanic Hydraulic Lime for Structural Purposes</i>	BL104.3.5
ASTM E84—21a	<i>Standard Test Method for Surface Burning Characteristics of Building Materials</i>	BL106.4
ASTM E96/E96M—21	<i>Standard Test Methods for Water Vapor Transmission of Materials</i>	BL104.1
ASTM E119—20	<i>Standard Test Methods for Fire Tests of Building Construction and Materials</i>	BL105.1
ASTM E2392/E2392M—10(2016)	<i>Standard Guide for Design of Earthen Wall Building Systems</i>	BL104.3.6.1
CEN EN 459—2015	<i>Building Lime—Part 1: Definitions, Specifications and Conformity Criteria; Part 2: Test Methods</i>	BL104.3.5
UL 263—2011	<i>Fire Test of Building Construction and Materials—with Revisions through August 2021</i>	BL105.1