SECTION 09 25 23

LIME BASED PLASTERING – STRAWBALE

1. GENERAL
	1. SUMMARY
		1. Section Includes: The work specified in this Section includes a lightweight three-layer application of pure lime plaster with metal mesh embedded in the upper third plaster layer over strawbale substrate in an approved engineered design. Plaster assembly consists of one bond-base layer to establish the plaster bed, one intermediate foundation (base) layer, one bridge layer, and a finish layer of plaster with color or natural white in a fine or coarse grain, textured as desired. Specification includes limited surface preparation.
		2. Related Sections: Related sections include the following:

*Place related sections below. Examples include:*

* + - 1. Section 09 25 23 – Lime Based Plastering
			2. Section 09 91 00 – Painting
			3. Section 09 96 13 – Abrasion-Resistant Coatings
			4. Section 09 96 14 – Mold-Resistant Coatings
			5. Section 09 96 26 – Marine Coatings
			6. Section 09 96 33 – High-Temperature Resistant Coatings
			7. Section 09 96 35 – Chemical-Resistant Coatings
			8. Section 09 96 43 – Fire-Retardant Coatings
	1. REFERENCES
		1. General: The publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by the basic designation only.
		2. ASTM Standards
			1. ASTM C 78, “Standard Test Method for Flexural Strength of Concrete (Using Simple Beam with Third-Point Loading)”
			2. ASTM E 96, “Standard Test Methods for Water Vapor Transmission of Materials”
			3. ASTM C 109, “Standard Test Method for Compressive Strength of Hydraulic Cement Mortars”
			4. ASTM D 1475, “Standard Test Method for Density of Liquid Coatings, Inks, and Related Products”
			5. ASTM C 1549, “Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer”
			6. ASTM C 1583, “Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method)”
			7. ASTM D 1653, “Standard Test Methods for Water Vapor Transmission of Organic Coating Films”
			8. ASTM D 2369, “Standard Test Method for Volatile Content of Coatings”
		3. Other Standards
			1. 2015 International Residential Code (IRC) Appendix S: Strawbale Construction (model code)
			2. CE Fire Classification 1A: Non-combustible
	2. DEFINITIONS
		1. Mesh: A three-dimensional open weave self-furring glass fiber fabric to provide an anchor for the lime plaster system over a non-absorbent surface.
		2. Bond-Base Coat Plaster: The first layer of plaster.
		3. Base Coat Plaster: The second layer of plaster.
		4. Bridge Coat Plaster: The third layer of plaster.
		5. Finish Coat Plaster: The fourth layer of plaster.
	3. SYSTEM DESCRIPTION
		1. A materials-compatible highly vapor permeable lime plaster system.
			1. A four-coat lime plaster system consisting of:
				1. A minimum 3/8-inch-thick coarse-grained layer of plaster embedded into the strawbale surface to a uniformly smooth bonding coat.
				2. A minimum 1/4-inch thick coarse-grained second layer of a base layer plaster to level the surface plane and embed the metal mesh reinforcement.
				3. A minimum 1/4-inch thick coarse-grained third layer of bridge coat plaster.
				4. A minimum 1/16-inch finish layer of a fine or coarse-grained plaster with integral color or natural white applied over the bridge coat finished as directed by the Architect (finish coat).
				5. Total overall plaster system thickness will be minimum 7/8-inch.
			2. Apply plaster and mesh according to an approved engineered design.
	4. SUBMITTALS
		1. Product Data: Submit product data showing proposed material. Submit sufficient information to determine compliance with the Drawings and Specifications. Provide published documentation describing materials, characteristics, and limitations.
		2. Samples: Submit samples for verification purposes, fabrication techniques, and workmanship.
		3. Manufacturer's Instructions: Submit manufacturer’s instructions including technical data sheets, safety data sheets, mixing instructions, application requirements, special procedures, and conditions requiring special attention.
		4. LEED Submittals: Submittals that are required to comply with requirements for LEED certification include the following:
			1. Low Emitting Materials: Submit endorsement by the manufacturer confirming that products meet or are below the volatile organic compound (VOC) limits set by specific agencies or other requirements. Clearly state VOC limits in the submittal.
	5. QUALITY ASSURANCE
		1. Qualifications:
			1. Manufacturer Qualifications: Provide evidence that Manufacturer is a firm engaged in the manufacture of lime plasters of types required, and whose products have been in satisfactory use in similar service for a minimum of ten years.
			2. Applicator Qualifications:
				1. Provide evidence Applicator is a firm having a minimum of three years of successful application and craftsmanship experience with projects similar in type and scope to that required for this Project.
		2. Mockups:
			1. Prior to application of the work, fabricate and erect mockups for each type of finish and application to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.
			2. Build mockups to comply with the following requirements using materials indicated for final unit of work.
			3. Locate mockups as directed by the Architect.
			4. Demonstrate the proposed range of aesthetic effects and workmanship to be expected in the completed work.
			5. Obtain the Architect’s acceptance of mockups before start of final unit of work.
			6. Retain and maintain mockups during construction in undisturbed condition as a standard for judging completed unit of work.
			7. Maintain a record of approved mock up’s product mixing and application steps to incorporate into final unit of work to ensure color consistency and textural aesthetics.
		3. Tracking Job Progress with Daily Logs
			1. Maintain a daily record of the weather conditions, of material ordered and delivered, material used, inspections, areas of work that began, areas of work that were completed, and questions raised, and answers received.
	6. DELIVERY, STORAGE, AND HANDLING
		1. Deliver materials to the Project site in supplier’s or manufacturer’s original wrappings and containers, labeled with manufacturer’s name, material and product brand name, and manufacturing date and lot number.
		2. Store materials in their original undamaged packages and containers inside a sheltered area protected from weather, moisture, and soiling, with air temperatures between 45°F and 85°F and maximum 60 percent humidity.
	7. PROJECT CONDITIONS
		1. Environmental Requirements:
			1. Substrate temperature before, during, and after installation must be between 45°F and 86°F.
	8. WARRANTY
		1. Product is warranted to be free from manufacturing defects and to meet the technical properties when used as directed within shelf life. See complete warranty statement on product technical data sheet.
1. PRODUCTS
	1. MANUFACTURERS
		1. Basis of Design:
			1. Items specified are to establish a standard of quality for design, function, materials, compatibility, performance, warranty, and appearance.
			2. Equivalent products by listed manufacturers are acceptable with exception of lime plaster products.
			3. The Architect is the sole judge of the basis of what is equivalent.
		2. Listed Manufacturers
			1. BioLime LLC, 5427 N State Hwy 6. Suite 7, Waco, Texas. Telephone: 254-730-7130. Fax: 254-730-7133. Email: contact@biolime.com. Website: <https://biolime.com>.
	2. MATERIALS
		1. Galvanized Metal Lath: Provide metal mesh meeting or conforming to:
			1. An approved engineered design based upon the 2015 International Residential Code (IRC) Appendix S: Strawbale Construction (model code) or current version of this code.
		2. Bond Coat: Provide pure lime plaster meeting or conforming to:
			1. Premium quality lime, ground limestone, select natural pozzolans and biopolymers in a blended composition.
			2. Natural white color may be tinted with iron oxide pigments.
			3. pH Balance: Alkaline, greater than 12 pH.
			4. Density: 113 pounds per cubic foot
			5. Solar Reflectance: 0.83
			6. Vapor Permeability: 91 perms at 1/16-inch layer thickness.
			7. Fire Rating: Incombustible, Class 1A
			8. No VOC.
			9. Manufactured as sacked, ready-to-use dry aggregate; add only clean water.
			10. Basis of Design: “BioLime Bond”, BioLime LLC.
		3. Base Coat: Provide pure lime plaster meeting or conforming to:
			1. Premium quality lime, ground limestone and select natural pozzolans in a blended composition with specification-grade white quartz sand in grains from 0 to 3 mm.
			2. Natural white color may be tinted with iron oxide pigments.
			3. pH Balance: Alkaline, greater than 12 pH.
			4. Density: 113 pounds per cubic foot
			5. Solar Reflectance: 0.83
			6. Vapor Permeability: 91 perms at 1/16-inch layer thickness.
			7. Fire Rating: Incombustible, Class 1A
			8. No VOC.
			9. Manufactured as sacked, ready-to-use dry aggregate; add only clean water.
			10. Basis of Design: “BioLime Base”, BioLime LLC.
		4. Bridge Coat: Provide pure lime plaster meeting or conforming to:
			1. Premium quality lime, ground limestone and select natural pozzolans in a blended composition with specification-grade white quartz sand in grains from 0 to 2.5 mm.
			2. Natural white color may be tinted with iron oxide pigments.
			3. pH Balance: Alkaline, greater than 12 pH.
			4. Density: 113 pounds per cubic foot
			5. Solar Reflectance: 0.83
			6. Vapor Permeability: 91 perms at 1/16-inch layer thickness.
			7. Fire Rating: Incombustible, Class 1A
			8. No VOC.
			9. Manufactured as sacked, ready-to-use dry aggregate; add only clean water.
			10. Basis of Design: “BioLime Bridge”, BioLime LLC.
		5. Finish Coat: Provide pure lime plaster meeting or conforming to:
			1. Premium quality lime, limestone, select natural pozzolans and biopolymers in a blended composition in a choice of grains: from 0 to 0.1 mm (Ultra Fine) or 0 to 0.3 mm (Extra Fine) or 0 to 1 mm (Fine) or 0 to 2.5 mm (Coarse).
			2. Natural white color may be tinted with iron oxide pigments.
			3. pH Balance: Alkaline, greater than 12 pH
			4. Compressive Strength: 411 PSI
			5. Flexural Strength: 156 PSI
			6. Bonding Strength: CMU block – 67 PSI, Porcelain – 56 PSI
			7. Density: 102 pounds per cubic foot
			8. Solar Reflectance: 0.88
			9. Vapor Permeability: 122 perms at 1/16-inch layer thickness.
			10. Fire Rating: Incombustible, Class 1A
			11. No VOC.
			12. Manufactured as sacked, ready-to-use dry aggregate; add only clean water.
			13. Basis of Design: “BioLime Finish”, BioLime LLC.
	3. EQUIPMENT
		1. Tools:
			1. Plaster mixing: Handheld two-speed plaster/mortar mixer with attached helical mixing paddle.
			2. Plaster mixing: Onsite mixing station for larger projects.
			3. Plaster application by spray equipment or ordinary plastering tools and gauging rods.
	4. FINISHES
		1. Plaster: Finish as directed by Architect.
2. EXECUTION
	1. EXAMINATION
		1. Verification of Conditions: Confirm by examination the areas and conditions under which the work is to be applied for compliance with manufacturer’s instructions. Do not proceed with the work until unsatisfactory conditions have been corrected.
			1. New concrete, stucco, and masonry must be cured minimum 28 days.
			2. Verify substrate is secure, sound, dry, and absorbent, and free of construction dust and debris, grease, salts, oil‑based paints, release agents, non-mineral-based curing agents, and similar bond breakers.
			3. Obtain manufacturer’s approval for application over substrates having other pretreatments or priming materials applied.
			4. Beginning of the work shall indicate acceptance of the areas and conditions as satisfactory by the Applicator.
	2. PREPARATION
		1. Protection: Lay ground cloths and take measures as necessary to protect surfaces subject to contact by products specified by this Section.
	3. APPLICATION
		1. Conform to reviewed product data, manufacturer's written instructions, and provisions of the Contract Documents.
		2. Plan the work properly.
			1. Ensure surface is free of dust and debris before mixing plaster material.
			2. Apply to shaded surfaces in a timely manner working ahead and away from the sun. Avoid direct sun exposure onto wet plaster to ensure proper curing.
			3. Do not apply plaster in direct sun, wind, or rain, or when temperature fluctuations exceed 50°F differentials from day to night.
			4. In enclosures, provide indirect well-distributed air circulation and ventilation with protective screens to deflect concentrated or forced air onto freshly applied plaster.
			5. Moist cure plaster by flooding surfaces with clean water at 0 PSI (no pressure) over the period of days stated for each plaster coat to ensure complete chemical curing. This technique will completely hydrate the pozzolans in the plaster to prevent streaking from rainfall following project completion.
				1. Begin moisture-curing using “appearance-based determination” for each plaster layer.
				2. As applied plaster dries, the appearance of the plaster changes from dark to light. When dark, it is visibly damp. As water evaporates from the layer, it becomes lighter in contrast to the damp areas. In mid-transition between damp and dry, the surface appears mottled. Once mottling disappears, the moisture-curing cycles can begin.
				3. Weather conditions and plaster layer thickness affect how quickly the plaster transitions from damp to dry. In dry weather, moisture-curing cycles might begin the day of application while in humid weather the cycles might start the following day. Appearance-based determination ensures proper sequencing of the moisture-curing coats for each applied layer of plaster.
				4. Once moisture-curing begins, flood all surfaces including terminations at soffits, inside and outside corners, and window/door returns with clean water. This constitutes one moisture-curing cycle. Moisture-curing cycles continue for the stated number of days for each installed layer of plaster.
				5. Protect cured plaster surfaces from rain during application.
		3. Mixing Methods
			1. Bucket Mixing Method: Mix plaster with clean water using helical mixing paddle on a heavy-duty mortar mixing drill motor.
				1. Fill the plaster manufacturer’s measuring bucket with clean water to the referenced product margin line.
				2. In a clean 6-gallon plastic bucket, pour half of the measured water.
				3. While stirring the water at low RPM, add plaster from the bag at a rate to prevent clumping of the material. Continue adding water from the measuring bucket and dry plaster until bag is empty.
				4. Once the dry powder is wetted, mix for additional 3 minutes maximum. Allow to rest 5 minutes to fully hydrate and then stir to relax the batch. Over-mixing plaster will cause loss of strength. Keep bucket covered to extend working time to about 1 hour.
			2. Onsite Plaster Mixing Station Method: Follow equipment manufacturer’s recommendations. Do not mix more water than recommended by the plaster product technical data sheet.
			3. Auto-mixing and Spray Application Equipment: Follow equipment manufacturer’s recommendations. Do not mix more water than recommended by the plaster product technical data sheet.
		4. Bond Coat Plaster:
			1. Ensure surface is free of construction dust and debris.
			2. Surface Hydration: Do not prewet surfaces.
			3. Apply plaster with even distribution filling and leveling surface to a minimum 3/8-inch layer thickness.
			4. Trowel surface smooth and in plane.
			5. Broom surface to provide light mechanical key for the Bridge Coat.
			6. Moist cure for 3 days to ensure bond and proper chemical curing before applying Base Coat.
				1. As plaster dries out, its surface develops a mottled appearance.
				2. Before the plaster dries completely out, mist with clean water to re-saturate the surface.
				3. Repeat until 72 hours pass.
		5. Base Coat Plaster:
			1. Ensure surface is free of construction dust and debris.
			2. Surface Hydration: Do not prewet surfaces.
			3. Apply plaster with even distribution filling and leveling surface to a minimum 3/8-inch layer thickness.
			4. Trowel surface smooth and in plane.
			5. Broom surface to provide light mechanical key for the Bridge Coat.
			6. Moist cure for 3 days to ensure bond and proper chemical curing before applying Bridge Coat.
				1. As plaster dries out, its surface develops a mottled appearance.
				2. Before the plaster dries completely out, mist with clean water to re-saturate the surface.
				3. Repeat until 72 hours pass.
		6. Bridge Coat Plaster:
			1. Ensure surface is free of construction dust and debris.
			2. Surface Hydration: Do not prewet surface.
			3. Apply plaster in one lift with even distribution to a minimum 1/4-inch layer thickness.
			4. Trowel surface smooth and level to the surface plane.
			5. Moist cure for 3 days to ensure bond and proper chemical curing before applying Finish Coat.
				1. As plaster dries out, its surface develops a mottled appearance.
				2. Before the plaster dries completely out, mist with clean water to re-saturate the surface.
				3. Repeat until 72 hours pass.
		7. Finish Coat Plaster:
			1. Ensure surface is free of construction dust and debris.
			2. Surface Hydration: Do not prewet surface.
			3. Apply plaster to 1-1/6-inch or 1/8-inch layer thickness.
			4. Provide finish as directed in Section 2.4 Finishes.
			5. Moist cure for 2 days.
				1. As plaster dries out, its surface develops a mottled appearance.
				2. Before the plaster dries completely out, mist with clean water to re-saturate the surface.
				3. Repeat until 48 hours pass.
	4. CLEANING
		1. Clean tools, spills, and accidental drips immediately with plenty of water.
		2. Leave applications clean and premises free from residue and debris from work of this Section.

END OF SECTION