

## SECTION 07 31 25 - AUTOCLAVED AERATED CONCRETE BERMUDA ROOFING

### PART 1 - GENERAL

#### 1.1 STANDARDS AND CERTIFICATIONS

- A. General: The roof system specified in this section shall meet or exceed the following standards.
- B. American Society for Testing and Materials (ASTM).
  - 1. ASTM 1386 – Standard Specification for Precast Autoclaved Aerated Concrete (AAC)
  - 2. ASTM E8 / E8M - 08 Standard Test Methods for Tension Testing of Metallic Materials
  - 3. ASTM C109 / C109M - 08 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
  - 4. ASTM C1371-04—Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emisometers (.85)
  - 5. ASTM C1549 - 04 Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer (.75)
  - 6. ASTM D-6083 - Standard Specification for Liquid Applied Acrylic Coating
- C. Florida Building Code High Velocity Hurricane Zone
  - 1. TAS 125 standard requirements for metal roofing systems
  - 2. TAS 123 standard requirements for mortar used in mortar set slate systems
- D. Underwriters Laboratory
  - 1. UL 580 - Tests for Uplift Resistance of Roof Assemblies **Class 90**
  - 2. UL 1897 - Uplift Tests for Roof Covering Systems **232 lbs** using one clip per SF
  - 3. UL 1897 - Uplift Tests for Roof Covering Systems **262 lbs** using two clips per SF
  - 4. UL 790 Standard Test Methods for Fire Tests of Roof Coverings **Class A**
  - 5. UL 2218 UL Standard for Safety Impact Resistance of Prepared Roof Covering Materials **Class 4**
- E. Architectural Sheet Metal Manual - Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
- F. The NRCA Roofing and Waterproofing Manual - National Roofing Contractors Association (NRCA), Fifth Edition.
- G. Factory Mutual Research Corporation - Loss Prevention Data Sheets 1-7; 1-28; 1-28R; 1-29; 1-29R; 1-49; Approval Guide - Roof Coverings; Standard 4470 - Approval Standard for Class I Roof Covers.

#### 1.2 RELATED SECTIONS

A. General:

1. Coordinate with trades completing structural work to ensure required conditions are provided necessary for the proper sequencing and installation of the roofing system specified within this section.
2. Coordinate with trades completing work that penetrates or rises from roofing to ensure sequencing for proper completion of flashing.
3. Coordinate with trades to ensure damage to completed roofing is prevented.

A. Structural Requirements

1. General: Roof framing shall be installed according to governing building codes.
2. Where wooden framing members are used they shall align accurately to form the planes and intersections of planes as shown on drawings.
3. Roof structure – capable of design loads with less than  $L / 360$  deflection.
4. Decking must provide a surface to support and hold the waterproofing membrane.
5. Typically set rafters 16 inches on center.
6. Where rafters or trusses are set wider than 16 inches on center decking will provide anchorage for the batten system providing it can support design loads with less than  $L / 360$  deflection.
7. Kaidisen™ Bermuda Roofing System is typically installed over a solid deck. Where wood framing is used, the system is anchored to the rafters through the decking.
8. Decking shall be stable and solid in order to support the Roofing System.
9. Decking shall be plywood, OSB, cement board, structural gypsum or concrete.

- B. Rising sidewalls shall be constructed to allow for water tight connection to roof. Typical details will involve concealed flashing connections at concealed primary drainage plane and secondary surface seals where exposed roof and wall surfaces intersect.

## 1.3 QUALITY ASSURANCE

A. Submittals::

1. Shop drawing(s) showing critical flashing intersection(s)
2. Data sheets and Samples:
  - a. AAC units
  - b. Mortar
  - c. Clips
  - d. Coating
  - e. Sealants

- B. Set the standard for acceptance of construction quality and appearance early in the project with a mock-up. That is reviewed by all parties to the project.

- 1.4 WARRANTIES: Provide standard manufacturer's written warranty, signed by manufacturer agreeing to promptly repair or replace roof slates that fail in materials [ **or workmanship**] within **<Insert number>** years from date of Substantial Completion.
- 1.5 QUALITY CONTROL
- A. Periodic inspections and tests to ensure consistency of installed system.
- 1.6 DESCRIPTION OF WORK IN THIS SECTION: This specification is written utilizing Kaidisen™ Bermuda Roofing System, which is an elastomeric coated unit masonry assembly forming an enhanced version of the traditionally constructed Bermuda roof. The resulting assembly will have a cross section consisting of liquid applied elastomeric coating covering shingled layers of masonry units that are adhered together with mortar and are clip-anchored to a cross batten system forming a vented cavity above drainage plane. The system comprises the following elements:
- A. Underlayment: Decking shall be covered with contiguous waterproof underlayment membrane forming a drainage plane. Metal flashing shall be used at all plane transitions.
- B. Wood Battens: installed vertically 16 inches on center typically, these are crossed by a second layer of battens set 9 inches on center. Cross battens shall be mechanically attached to rafters with screws.
- C. Masonry Assembly: AAC slabs (slates) layered in a shingle pattern set in full beds of proprietary mortar. Each unit shall be fastened to the battens with embedded stainless steel clips.
- D. Cavity Ventilation (to be designed as required by climate to allow cavity to dry and to diminish wind uplift).
- E. Coating: The AAC assembly shall then be sealed with elastomeric base coat and then coated with two 15 dry mil applications of a white elastomeric coating.

## PART 2 - PRODUCTS`

### 2.1 UNDERLAYMENT

- A. SBS self adhering granular surface sheet 40 mils minimum.
1. ASTM D 1970 Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection.
  2. Mastic and sealants conform to ASTM D 6152 Specification for SEBS-Modified Asphalt Used in Roofing.

3. Mesh to reinforce mastic: 4 inch wide rolls of 4.5 oz fiberglass mesh made of multi-strand, interwoven alkali resistant glass fibers

## 2.2 FLASHING MATERIALS

- A. At all membrane perimeters and transitions: Sheet metal flashing shall be 304 or 316 stainless steel. (refer to Section 07 62 00)

## 2.3 AAC MASONRY UNITS

- A. Kaidisen™ AAC masonry units (“slates”) 1 inch thick by 18 inches high by 12 inches wide, conforming to ASTM E-119.

Compressive Strength	580 psi (lb/in <sup>2</sup> )	4.00 N/mm <sup>2</sup>
Dry Density	37.5 pcf (lb/ft <sup>3</sup> )	600 kg/mm <sup>3</sup>
Design Weight (allowing for reinforcement and normal equilibrium moisture content)	45.0 pcf (lb/ft <sup>3</sup> )	750 kg/mm <sup>3</sup>
Thermal Conductivity	1.1 Btu in/ft <sup>2</sup> h °F	0.16 W/m K
Specific Heat Capacity	0.25 Btu/lb °F	1.05 kj/kg K
Coefficient of Thermal Expansion	4.4 x 10 <sup>-6</sup> /°F	8 x 10 <sup>-6</sup> /K

- A. Starter units:

1. Kaidisen AAC Starters. Preformed or milled AAC block shaped to accommodate architectural style of eave and provide starting angle for masonry assembly.
2. Alternate: Kaidisen™ Precast Concrete Starters dry-pack reinforced concrete pieces 18 to 24 inches wide by 12 to 16 inches tall with turned down exterior faces having typical compressive strength of 6,000 PSI.

- B. Gutter units: Where Bermuda style guttering is built into the roofing system use prefabricated triangular cross sectioned units either of AAC or of 4,000 PSI pea-stone aggregate concrete.

## 2.4 MORTAR AND CEMENTIOUS COATINGS

- A. Mortar:

1. Kaidisen™ Mortar - proprietary light weight mortar.

2. Kaidisen™ Fiber Bond - proprietary fiber reinforced mortar used primarily for patching and as a cementitious slurry coating to reinforce areas where tensile strength may be needed.

### 2.5 ACCESSORIES

#### A. Wooden furring (vertical and cross battens)

1. Grade and Species: No. 1 grade southern yellow pine S4S, 19 percent maximum moisture content pressure treated with wood preservatives meeting building code compliance either by reference to American Wood Protection Association (AWPA – formerly the American Wood-Preservers' Association) standards or through the product evaluation process of the International Code Council (ICC) Evaluation Service.
2. Dimensions: 1 inch actual thickness x 2 inch actual width. NOTE: Do not use nominally dimensioned lumber.

#### B. Screws and plates for starter course and to secure slates not possible to secure clip— #8 Type W bugle head coarse thread screws, 2 in. to 3 in. long with 0.355 in. head diameter with fluorocarbon coating and 1-3/4 in. diameter plastic cap

#### C. Securement Clips: Kaidisen™ Clips:

1. Material: Type 304 Stainless Steel full spring temper meets ASTM E8 and ASTM A313-03.
2. Thickness: (0.135 inch).
3. Tensile Strength: 223.4 KSI.

#### D. Reinforcing Mesh / mortar catching net: multi-strand, interwoven alkali resistant glass fibers. NOTE: for roofs designed for enhanced impact resistance, mesh quality, size and weight may vary.

#### E. Venting at eaves: 304 stainless steel mesh or 4 inch wide strips made of recycled high density polyethylene (HDPE), nylon, or polyester ½ inch thick.

#### F. Kaidisen™ Vents set in the mortar bed to conduct air from the cavity to the exterior: 12 inch long x 4 inches wide x ½ inch thick corrugated plastic blocks.. See drawings for placement.

## 2.6 COATING SYSTEM

- A. Kaidisen™ Acrylic Base Coat with Portland cement additive.
- B. Finish coat – Kaidisen™ Elastomeric Roof Coating, alkali resistant, acrylic exterior latex finish containing proprietary non-toxic fungicide.
  - 1. Reflective White. Low sheen
  - 2. Nonvolaslate - By weight -  $65.7 \pm 1.0\%$
  - 3. By volume -  $49.1 \pm 1.0\%$
  - 4. VOC (Calculated) - 0.6 lbs./gal.
  - 5. 71 grams/liter
  - 6. Flash Point -  $>250^{\circ}\text{F}$  (Setaflash)Weight per gallon -  $12.0 \pm 0.2$  lbs.Light
  - 7. Reflectance Value - 92
  - 8. Elongation -  $300\%$  @  $75^{\circ}\text{F}$ ,  $275\%$  @  $32^{\circ}\text{F}$ ,  $150\%$  @  $0^{\circ}\text{F}$
  - 9. Tensile Strength - 200 psi @  $75^{\circ}\text{F}$ , 365 psi @  $32^{\circ}\text{F}$ , 815 psi @  $0^{\circ}\text{F}$
  - 10. Flexibility (ASTM D1737) - passes, 1/8 inch mandrel
  - 11. Recommended Film Thickness- Two coats for a total of 15-20 mils dry
  - 12. Theoretical Coverage @ 15 mils dry - 50 sq. ft./gal.
  - 13. Method - Brush, roll, airless spray
  - 14. Thinner – Water
  - 15. Dry time @  $75^{\circ}\text{F}$  - To touch - 1 hour
  - 16. To handle - 3 - 4 hours
  - 17. To recoat - 24 hours
  - 18. Consists of - 1 Gallon Unit 5 Gallon Unit
  - 19. Unit Shipping Weight 13 lbs 63 lbs
  - 20. Shelf Life - 12 months minimum from date of manufacture when maintained in
  - 21. Protected storage @  $40-100^{\circ}\text{F}$  (subject to reinspection thereafter).

## EXECUTION

### 2.7 GENERAL

- A. Handle and store materials carefully and prevent damage to installed system, provide temporary protection if necessary.
- B. When stocking roof, load areas safely to avoid overloading structure. Place stock on roof securely to prevent accidental dislodging of stored materials.
- C. Layout and install roofing system components neatly and accurately achieving level courses that run contiguously across hips and valleys.

### 2.8 FIELD QUALITY CONTROL

- A. Owner may engage the Architect or a qualified independent consultant or testing agency to perform full time construction monitoring or periodic inspection or field or laboratory analysis of the stored material or constructed work.
- B. Provide only trained and experienced mechanics to install roofing system.

### 2.9 INSTALLATION OF UNDERLAYMENT

- A. Install self-adhering sheets according to waterproofing manufacturer's written instructions and recommendations in ASTM D 6135.
- B. Clean, prepare, and treat substrates. Prepare, fill, prime, and treat joints and cracks in substrates. Remove dust and dirt from joints and cracks. Provide clean, dust-free, and dry substrates for waterproofing application.
- C. Remove ridges and projections; fill holes, and other voids to make substrate smooth before installing membrane.
- D. Bridge and cover movable deck-to-wall and deck-to-deck joints with bond breaker strip and overlapping sheet strips. Invert and loosely lay first sheet strip over center of joint. Firmly adhere second sheet strip to first and overlap to substrate.
- E. Layout membrane so that it sheds water to the exterior of the roof or to drains where it shall be connected according to approved shop drawing.
- F. Apply and firmly adhere sheets. Accurately align sheets and maintain uniform 2-1/2-inch- minimum lap widths and end laps. Overlap and seal seams and stagger end laps. All laps shall shed water; laps bucking water will be rejected.
- G. Prepare, prime, and seal inside and outside corners, vertical and horizontal surfaces. terminations, penetrations and drains according to ASTM D 6135.

- H. Seal bucking water laps with two plies of mastic and mesh.
- I. Maintain contiguous membrane. Patch any holes, seal around penetrations. Wherever fasteners penetrate the waterproofing and are subsequently withdrawn, patch resulting holes with modified asphalt sealant.

## 2.10 FLASHING

- A. All metal flashing shall be concealed and installed at the underlayment level of the system. Typically metal flashing shall be installed at transitions and edges of underlayment.
- B. Install flashing to allow free downward flow of water. Secure metal flashing with fasteners made of similar or compatible metals.
- C. Seal top edges of metal flashing with two plies of mastic and mesh.

## 2.11 BATTENS

- A. General:
  - 1. The AAC masonry roofing is supported by and attached to horizontal battens supported by vertical battens both of which are well anchored to the rafters or frame of the building to provide a wind uplift resistant load path through the structure to the ground.
  - 2. The vertical battens keep the horizontal battens off of the roof deck allowing the waterproofing membrane to drain freely to the eave. Do not allow wood, mortar or debris to drop into or block the drainage path within cavity.
  - 3. Set horizontal battens to establish course lines aligning them so tops of battens support tops of slates.
  - 4. Carry horizontal battens level across adjacent hips and valleys. Carefully layout horizontal battens so that they maintain level courses and meet at hips and valleys since their intersection will form the lines of the hips and valleys.
  - 5. Do not nail battens through sheet metal valley flashing
  - 6. Do not allow battens to block invert of valley
- B. Install battens over waterproofing membrane to provide secure support for the AAC roof system in two layers:
  - 1. Install the bottom layer aligning battens vertically locating each one over a rafter.

2. Install the top layer horizontally in nine inch on center courses up the roof locating the top of each batten to support the top of each course of slate .
- C. Set one vertical batten on surface of water proofing membrane so that there is one over each rafter. Vertical battens may be tacked into place with a few 10 d galvanized nails driven through battens decking and into rafters (as horizontal battens are installed, both horizontal and vertical battens will be fastened with screws into the rafters through the deck).
- D. Set first course of horizontal battens to accommodate and support the particular precast starter pieces used on the project. *(If there is a rabbet made into the underside of the starter the batten shall be placed to fit into it aligning the exposed low edge to run straight and equidistant from the fascia or other architectural lines of the eave.)*
- E. Set horizontal (cross) battens level at nine inches on center up the roof so that the top edge of each nine inch course of AAC will rest on the top edge of each batten. Fasten each cross batten into frame of roof with 3 ½ inch long screws (one for each intersection) so that the rate of fastening is a minimum of one fastener into structural framing every 16 inches on center horizontally and every nine inches on center vertically. (NOTE for roof frame and deck design other than 16 inch on center framing consult with manufacturer for fastening schedule and method.)
- F. Align horizontal battens to continue at the same level to adjacent planes of roofing providing they are of equal slope. Where adjacent slopes are of unequal slopes, maintain level courses of 9 inches to the weather and do not carry courses lines from slope to slope.

### 2.12 AAC MASONRY ROOFING

- A. General:
  1. Apply over solid decking covered with waterproof underlayment.
  2. All metal flashing should be installed at the underlayment drainage plane.
  3. Wash off all dust from slate and starters with water before installation.
  4. Install slate and starters in Saturated Surface Dry (SSD) condition.
  5. Saw cut slate, do not break with impact.
  6. Mix mortar with slump range for optimal adhesion and cured compressive strength.
  7. Optimal adhesion of slate to mortar is critical to the performance of this system.
  8. Do not install system if ambient temperature is below 40 degrees F.

9. Protect completed work from freezing temperatures for 28 days.
10. Wet cure with plastic and burlap if completed work is exposed to excessively hot dry weather during the 28 day curing period. Monitor completed work for shrinkage during curing
11. Do not allow excessive amounts of mortar to block drainage path at underlayment.
12. Do not allow mortar to block invert of valley
- 13. For steep sloped application:**
  - a. Align slate courses typically to the top edge of the horizontal battens.
  - b. Stagger vertical joints a minimum of 4 inches.
  - c. Courses shall be laid straight and level and spaced 9 inches to the weather including the weather.
  - d. Where adjacent slopes are equal and maintain courses contiguously across valleys and hips.
- 14. For low sloped application:**
  - a. Lay out slates on battens so that horizontal edges are fully supported staggering vertical joints a minimum of 4 inches. Mechanically fasten bottom layer.
  - b. Fully embed succeeding layer in a one inch thick layer of Kaidisen™ Mortar.
  - c. Slope to drain can be made with framing or by use of mortar as light weight fill applied above slate.

**B. Starters:**

1. Place starters at eaves aligning vertical edges on centers of vertical battens. Space from fascia to allow for drainage of the cavity.
2. Fully conceal the cavity and any metal flashing. Fasten each piece to the battens with four stainless steel screws and washers through predrilled holes.
3. Lay units with tops aligned to tops of battens.

**C. At typical field of steep roof: Lay slate in straight and level courses in a shingle fashion providing a maximum exposure between courses of 9 inches including the weather.**

Set each successive course in a full bed of mortar (*3/4 inch to 1 inch thick depending on architect's direction.*). Employ the following Sequence of installation on steep sloped installation:

1. Clean off slates with a hose as they are unpacked removing particles and soaking them thoroughly to produce a Saturated Surface Dry (SSD) condition before installing them.
2. Mix mortar by machine mixer or drill in bucket making only enough mortar that will be used within one hour. Mix 1 bag (1.1 CF) with approximately 3.5 gallons of clean potable water depending on the weather conditions and the temperature. Do not retemper mortar once it is begun to set up.
3. Smear mortar onto the new mating surface of each slate covering the concealed portion of each course working the mortar into the surface.
4. Place mortar to form bed on upper half of slate to be covered. Finished bed once next slate is set shall be  $\frac{3}{4}$  inch to 1 inch thick.
5. Embed reinforcing mesh into the smeared mortar allowing the mesh to overhang the top of the slate extending up the roof to the next batten. Staple the top edge of the mesh to the batten to prevent mortar from pushing the mesh down into the cavity.
6. Back-butter each slate with fresh mortar coating the lower mating surface and sides just before laying it into the mortar bed.
7. Apply mortar bed to upper half of slate below and set slate aligning it with the top of the next batten. Seat slates in mortar bed by moving them from side to side as they are pressed into the bed.
8. Lay each slate with its upper bottom edge directly over the upper top edge of its supporting batten ensuring full support of each slate by the battens.
9. If one edge of the slate is chipped or out of square, place the factory finished or still square edge on the batten leaving the broken end to rest on the mortar bed over the slate below. This ensures the slate will be firmly and fully supported by the batten. Fill in with mortar to compensate for the missing AAC.
10. Allow a minimum head joint width of  $\frac{3}{16}$  inch between laterally adjacent slates when seating the slate in to the bed joint and ensure head joints are fully packed with mortar.
11. After embedding the slate into the mortar bed insert a Kaidisen Clip over the upper edge of each slate. (If enhanced uplift requirements are indicated follow schedule provided on drawing). NOTE: *Typically the field of the roof will require one clip per slate; edges and ridges may require additional clips.*

12. Apply mortar to butts of AAC units and strike smooth with a trowel to form a fillet fully sealing off the butt end to form the traditional feature of the Bermuda Roof known as “The Weather”.
13. Smooth the exposed mortar of the “The Weather” with a steel trowel sealing surface with cement paste brought to the surface by the action of the trowel.

- D. Keep cavities clean of mortar droppings and other materials during construction.
- E. Stopping and Resuming Work: Rack back units; do not tooth. Do not retemper mortar with water once it has begun to set up. When resuming work ensure mating surfaces of slates and starters receiving fresh mortar are SSD.
- F. Clean masonry as work progresses. Remove mortar fins and smears before tooling joints.
- G. As the mortar sets, finish exposed mortar surfaces smoothing to achieve an even appearance.
- H. After mortar has set, grind or cut away rough edges fins and other protrusions from the surface using trowels and rasps to achieve a visually smooth surface.

## 2.13 VENTING

- A. Place eave vents behind starters closing off cavity to animals and insects but allowing air to flow into the cavity.
- B. Place cavity vents as indicated on drawings in mortar beds during AAC assembly construction. Fully embed tops and sides of vent blocks in mortar keeping the ends open to allow air flow in and out of the cavity.
- C. Attic ventilation (if required) shall be separated from cavity ventilation by stainless steel sheet metal flashing. Kaidisen vent materials may be used in this separated system to vent attic. Cavity ventilation shall be separated from attic ventilation.

## 2.14 COATING

- A. Apply coating system only after installed masonry system has cured for 28 Days.
- B. Preparation:
  1. Grind off fins and protrusions, rub surfaces smooth with rasp and brushes.
  2. Remove dust and particles from surface of assembly.

3. Temporarily plug drain leaders (this is especially important for those feeding potable water tanks) prior to application of coating; remove plugs only after coating is thoroughly dry.
- C. Apply 1 coat of Base coat:
    1. Application & Clean Up:
      - a. Apply Kaidisen Base Coat generously (approximately 1 gal per 100 SF minimum coverage) to prepared surfaces brushing it vigorously into the surface of the roof to optimize adhesion between the AAC, mortar and coating system.
      - b. Allow 4 hours before recoating.
      - c. Clean brushes and other equipment promptly with warm soapy water.
  - D. Apply 2 coats of Kaidisen™ Elastomeric Roof Coating.
    1. Apply each coat to a wet film coat of 15 mils achieving a final two coat dry film of 15 to 20 mils.
    2. Allow coating to fully dry between coats.
      - a. Apply coatings only to dry surfaces and only when weather shall remain dry and above 50 degrees F for 24 hours. Do not begin coating just before or during wet weather or if temperatures are expected to fall below 50 degrees F within 24 hours.
      - b. Clean up - Clean brushes, rollers and other equipment promptly with warm soapy water.
- 2.15 SEALANTS
- A. Apply sealant to coated surfaces only.
  - B. Fill sealant joints with backer rod to form properly proportioned sealant cross section.

END OF SECTION