SECTION 07550
MODIFIED KEE MEMBRANE ROOFING

1.GENERAL

1.1. SECTION INCLUDES

A. Includes all labor, materials, and equipment to install a Cold Applied 2-Ply Thermoplastic Hybrid Roof System roof (KEE-Stone FB 60) over the properly prepared substrate.

B. Includes removal and disposal of existing roofing system(s), insulation board, gutters, flashings, sheet metal items, copings, etc. for a complete prepared roof surface to receive the new roofing system.

C. Includes a new cold applied 2-ply hybrid roofing system with all accessories as needed for a complete warrantable roofing system.

D. See section 011100 Summary of Work for a detailed scope of work.

1.2. RELATED SECTIONS

A. Section 01110 – Summary of Work

B. Section 06100 - Rough Carpentry

C. Section 073100 - Asphalt Shingles

D. Section 07220 - Insulation Board

E. Section 07563 - Roofing Restoration

F. Section 07620 - Sheet Metal Flashing and Trim

1.3. REFERENCES

A. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.

B. ASTM D 312 - Standard Specification for Asphalt used in Roofing.

C. ASTM D 451 - Standard Test Method for Sieve Analysis of Granular Mineral Surfacing for Asphalt Roofing Products.

D. ASTM D 1970 - Specification for Sheet Materials, Self-Adhering Polymer Modified Bituminous, Used as Steep Roofing Underlayment for Ice Dam Protection.

E. ASTM D 1079 Standard Terminology Relating to Roofing, Waterproofing and Bituminous Materials.

F. ASTM D 1227 Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.

G. ASTM D 1863 Standard Specification for Mineral Aggregate Used as a Protective Coating for Roofing.

H. ASTM D 2178 Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.

I. ASTM D 2822 Standard Specification for Asphalt Roof Cement.

J. ASTM D 2824 Standard Specification for Aluminum-Pigmented Asphalt Roof Coating.

K. ASTM D 4601 Standard Specification for Asphalt Coated Glass Fiber Base Sheet Used in Roofing.

L. ASTM D 5147 Standard Test Method for Sampling and Testing Modified Bituminous Sheet Materials.

M. ASTM D 6754 Standard Specification for Ketone Ethylene Ester (KEE) Sheet Roofing

N. ASTM D 6162 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements.

O. ASTM D 6163 Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements.

P. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.

Q. ASTM E 108 - Standard Test Methods for Fire Test of Roof Coverings

R. Factory Mutual Research (FM): Roof Assembly Classifications.

S. National Roofing Contractors Association (NRCA): Roofing and Waterproofing Manual.

T. Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) - Architectural Sheet Metal Manual.

U. Underwriters Laboratories, Inc. (UL): Fire Hazard Classifications.

V. Warnock Hersey (WH): Fire Hazard Classifications.

W. ANSI-SPRI ES-1 Wind Design Standard for Edge Systems used with Low Slope Roofing Systems.

X. ASCE 7, Minimum Design Loads for Buildings and Other Structures

Y. UL - Fire Resistance Directory.

Z. FM Approvals - Roof Coverings and/or RoofNav assembly database.

AA. California Title 24 Energy Efficient Standards.

1.4. DESIGN / PERFORMANCE REQUIREMENTS

A. Perform work in accordance with all federal, state and local codes.

B. Exterior Fire Test Exposure: Roof system shall achieve a UL, FM or WH Class rating for roof slopes indicated on the Drawings as follows:
   1. Factory Mutual Class A Rating.
   2. Underwriters Laboratory Class A Rating.
   3. Warnock Hersey Class A Rating.

C. Design Requirements:
   1. Uniform Wind Uplift Load Capacity
      a. Installed roof system shall withstand negative (uplift) design wind loading pressures complying with the following criteria.
         1. Design Code: ASCE 7, Method 2 for Components and Cladding.
         2. Importance Category:

a. III.
3. Importance Factor of:
a. 1.0
4. Wind Speed: 100 mph
5. Exposure Category:
a. C
6. Design Roof Height: 150 feet.
7. Minimum Building Width: 30 feet.
8. Roof Pitch: 0.5 :12.
9. Roof Area Design Uplift Pressure:
a. Zone 1 - Field of roof 14.3 psf
b. Zone 2 - Eaves, ridges, hips and rakes 24 psf
c. Zone 3 - Corners 36 psf

2. Snow Load: N/A psf.
3. Live Load: 20 psf, or not to exceed original building design.
4. Dead Load:
a. Installation of new roofing materials shall not exceed the dead load capacity of the existing roof structure.

D. Energy Star: Roof System shall comply with the initial and aged reflectivity required by the U.S. Federal Government's Energy Star program.

E. LEED: Roof system shall meet the reflectivity and emissivity criteria to qualify for one point under the LEED credit category, Credit 7.2, Landscape & Exterior Design to Reduce Heat Island - Roof.

F. Roof System membranes containing recycled or bio-based materials shall be third party certified through UL Environment.

G. Roof system shall have been tested in compliance with the following codes and test requirements:
1. Miami-Dade County:
a. Self-Adhered Membrane Systems Over:
1. Wood Decks N.O.A.
b. Torch and Mop Membrane Systems Over
1. Wood Decks N.O.A.
c. Roofing Underlayments
1. Garland Underlayments N.O.A.
d. Roofing Cements and Coatings
1. Garland Coatings and Mastics N.O.A.
2. Cool Roof Rating Council:
a. CRRC Directory CRRC 077-0028
3. International Code Council Evaluation Service (ICC-ES):
a. Membrane Systems
1. ESR-_____
4. Underwriters Laboratories:
a. Certification TGFU.R_____
5. Warnock Hersey
a. ITS Directory of Listed Products
6. FM Approvals:
a. RoofNav Website

1.5. SUBMITTALS

A. Submit under provisions of Section 01300.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.

3. Installation instructions.

C. Shop Drawings: Submit shop drawings including installation details of roofing, flashing, fastening, insulation and vapor barrier, including notation of roof slopes and fastening patterns of insulation and base modified bitumen membrane, prior to job start.

D. Design Pressure Calculations: Submit design pressure calculations for the roof area in accordance with ASCE 7 and local Building Code requirements. Include a roof system attachment analysis report, certifying the system's compliance with applicable wind load requirements before Work begins. Report shall be reviewed by a Professional Engineer registered in the State of the Project who has provided roof system attachment analysis for not less than 5 consecutive years.

E. LEED Submittals: Provide documentation of how the requirements of Credit will be met:
1. List of proposed materials with recycled content. Indicate post-consumer recycled content and pre-consumer recycled content for each product having recycled content.
2. Product data and certification letter indicating percentages by weight of post-consumer and pre-consumer recycled content for products having recycled content.
3. Product reflectivity and emissivity criteria to qualify for one point under the LEED credit category, Credit 7.2, Landscape & Exterior Design to Reduce Heat Island - Roof.

F. Recycled or Bio-Based Materials: Provide third party certification through UL Environment of roof System membranes containing recycled or bio based materials

G. Verification Samples: For each modified bituminous membrane ply product specified, two samples, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

H. Provide written certification from the roofing system manufacturer certifying the applicator is currently authorized to install the specified roof system and ability to provide the specified warranty.

I. Sample Warranty: Provide an unexecuted copy of the warranty specified for this project clearly stating the terms required of the owner, contractor, and manufacturer.

J. Manufacturer's Certificates: Provide to certify products meet or exceed specified requirements.

K. Test Reports: Submit test reports, prepared by an independent testing agency, for all modified bituminous sheet roofing, indicating compliance with ASTM D5147.

L. Manufacturer's Fire Compliance Certificate: Certify that the roof system furnished is approved by Factory Mutual (FM), Underwriters Laboratories (UL), Warnock Hersey (WH) or approved third party testing facility in accordance with ASTM E108, Class A for external fire and meets local or nationally recognized building codes.

M. Closeout Submittals: Provide manufacturer's maintenance instructions that include recommendations for periodic inspection and maintenance of all completed roofing work. Provide product warranty executed by the manufacturer. Assist Owner in preparation and submittal of roof installation acceptance certification as may be necessary in connection with fire and extended coverage insurance on roofing and associated work.

1.6. QUALITY ASSURANCE

A. Perform Work in accordance with NRCA Roofing and Waterproofing Manual.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified with documented ISO 9001 certification and minimum of twelve years of documented experience and must not have been in Chapter 11 bankruptcy during the last five years.

C. Installer Qualifications: Company specializing in performing Work of this section with minimum five years documented experience and a certified Pre-Approved Garland Contractor.

D. Installer's Field Supervision: Maintain a full-time Supervisor/Foreman on job site during all phases of roofing work while roofing work is in progress.

E. Product Certification: Provide manufacturer's certification that materials are manufactured in the United States and conform to requirements specified herein, are chemically and physically compatible with each other, and are suitable for inclusion within the total roof system specified herein.

F. Source Limitations: Obtain all components of roof system from a single manufacturer. Secondary products that are required shall be recommended and approved in writing by the roofing system Manufacturer. Upon request of the Architect or Owner, submit Manufacturer's written approval of secondary components in list form, signed by an authorized agent of the Manufacturer.

1.7. PRE-INSTALLATION MEETINGS

A. Convene minimum two weeks prior to commencing Work of this section.

B. Review installation procedures and coordination required with related Work.

C. Inspect and make notes of job conditions prior to installation:
1. Record minutes of the conference and provide copies to all parties present.
2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
3. Installation of roofing system shall not begin until all outstanding issues are resolved to the satisfaction of the Owner and Architect.

1.8. DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in manufacturer's unopened packaging with labels intact until ready for installation.

B. Store all roofing materials in a dry place, on pallets or raised platforms, out of direct exposure to the elements until time of application. Store materials at least 4 inches above ground level and covered with "breathable" tarpaulins.

C. Stored in accordance with the instructions of the manufacturer prior to their application or installation. Store roll goods on end on a clean flat surface except store KEE-Stone FB 60 rolls flat on a clean flat surface. No wet or damaged materials will be used in the application.

D. Store at room temperature wherever possible, until immediately prior to installing the roll. During winter, store materials in a heated location with a 50 degree F (10 degree C) minimum temperature, removed only as needed for immediate use. Keep materials away from open flame or welding sparks.

E. Avoid stockpiling of materials on roofs without first obtaining acceptance from the Architect/ Engineer.

F. Adhesive storage shall be between the range of above 50 degree F (10 degree C) and below 80 degree F (27 degree C). Area of storage shall be constructed for flammable storage.

1.9. COORDINATION

A. Coordinate Work with installing associated metal flashings as work of this section proceeds.

1.10. PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.11. WARRANTY

A. Upon completion of the work, provide the Manufacturer's written and signed NDL Warranty, warranting that, if a leak develops in the roof during the term of this warranty, due either to defective material or defective workmanship by the installing contractor, the manufacturer shall provide the Owner, at the Manufacturer's expense, with the labor and material necessary to return the defective area to a watertight condition.
   1. Warranty Period:
      a. 30 years from date of acceptance.

B. Installer is to guarantee all work against defects in materials and workmanship for a period indicated following final acceptance of the Work.
   1. Warranty Period:
      a. 3 years from date of acceptance.

2.PRODUCTS

2.1. MANUFACTURERS

A. Acceptable Manufacturer: The Garland Company, Inc.; 3800 E. 91st St., Cleveland, OH 44105. Local Representative: Zak Esqueda Phone: (559) 304-7606. zesqueda@garlandind.com Web Site: www.garlandco.com.

B. Requests for substitutions will not be considered for this project.

C. The Products specified are intended and the Standard of Quality for the products required for this project. If other products are proposed the bidder must disclose in the bid the manufacturer and the products that they intend to use on the Project. If no manufacturer and products are listed, the bid may be accepted only with the use of products specified.
   1. Bidder will not be allowed to change materials after the bid opening date.
   2. If alternate products are included in the bid, the products must be equal to or exceed the products specified. Supporting technical data shall be submitted to the Architect/ Owner for approval prior to acceptance.
   3. In making a request for substitution, the Bidder/Roofing Contractor represents that it has:
      a. Personally investigated the proposed product or method, and determined that it is equal or superior in all respects to that specified.
      b. Will provide the same guarantee for substitution as for the product and method specified.
      c. Will coordinate installation of accepted substitution in work, making such changes as may be required for work to be completed in all respects.
      d. Will waive all claims for additional cost related to substitution, which consequently become apparent.
      e. Cost data is complete and includes all related cost under his/her contract or other contracts, which may be affected by the substitution.
      f. Will reimburse the Owner for all redesign cost by the Architect for accommodation of the substitution.
   4. Architect/ Owner reserves the right to be the final authority on the acceptance or rejection of any or all bids, proposed alternate roofing systems or materials that has met ALL specified requirement criteria.
   5. Failure to submit substitution package, or any portion thereof requested, will result in

immediate disqualification and consideration for that particular contractors request for manufacturer substitution.

2.2. COLD APPLIED 2-PLY ROOF SYSTEM

A. Rosin Sheet: One ply of mechanically attached to the prepared substrate.
   1. Red Rosin Paper:

B. Insulation: As specified in Section 07220;
   1. Full tapered insulation system, 1/2" per foot sloped Polyiso Insulation System.
   2. One layer of six side primed ½" woodfiber insulation board at the field of the roof and 1/4" dens dek at all walls, curbs, and crickets.

C. Base (Ply) Sheet: One ply bonded to the prepared substrate with Interply Adhesive (1):
   1. Stress Base 80 Base Sheet (80 mil):

D. Thermoplastic Sheet: One ply bonded to the prepared substrate with Interply Adhesive (2):
   1. KEE Stone FB 60:

E. Interply Adhesive (1):
   1. Green Lock Plus Membrane Adhesive:

F. Interply Adhesive (2):
   1. KEE-Lock Foam:

G. Flashing Membrane Sheet: One ply bonded to the prepared substrate with Solar Bright Low VOC Adhesive:
   1. KEE Stone FB 60 Flashing:

H. Flashing Membrane Adhesive:
   1. SolarBright Low VOC Adhesive

2.3. ACCESSORIES:

A. Roof Insulation Walls, Curbs, Crickets Layer: Provide and install one layer of 1/4" Dens Dek Prime Roof Board. ASTM C 473

B. Roof Insulation Field layer: Provide and install a full tapered insulation system with 1/2" slope to drain.

C. Roof Insulation Field Layer: Provide and install one layer of ½" six side primed Blue Ridge Structodek High Density Fiberboard Roof Insulation. ASTM C 208, Type II.

D. Vapor Retarder: Red Rosin Paper; Install layer rosin sheet shingled uniformly to achieve one ply over the entire prepared substrate. Shingle in direction of slope of roof to shed water on each area of roof.
   1. Red Rosin Paper by WR Meadows
      a. Weight – 12 lb./roll
      b. Size – 500 square feet p/roll
      c. 36" wide by 167' long

E. Nails and Fasteners: Non-ferrous metal or galvanized steel, except that hard copper nails shall be used with copper; aluminum or stainless steel nails shall be used with aluminum; and stainless steel nails shall be used with stainless steel, Fasteners shall be self-clinching type of penetrating type as recommended by the deck manufacturer. Fasten nails and fasteners flush-driven through flat metal discs not less than 1 inch (25 mm) diameter. Omit metal discs when one-piece composite nails or fasteners with heads not less than 1 inch (25 mm) diameter are used.

F. Walkway Pads - As recommended and furnished by the membrane manufacturer adhered to control foot traffic on roof top surface and provide a durable system compliant non-slip walkway.
   1. SolarBright Walkway Roll by Viking Products Group
      a. 30” x 60’ walk way roll
      b. Install walk way pads in a path from all roof access points to and around all HVAC and serviceable mechanical equipment, to and around roof hatches, and as designated by the owner.

G. Urethane Sealant Hybrid - Tuff-Stuff MS: One part, non-sag sealant as approved and furnished by the membrane manufacturer for moving joints.
   1. Tensile Strength, ASTM D 412: 250 psi
   2. Elongation, ASTM D 412: 450%
   3. Hardness, Shore A ASTM C 920: 35
   4. Adhesion-in-Peel, ASTM C 92: 30 pli

H. Sealant - Green-Lock Structural Adhesive: Single component, 100% solids structural adhesive as furnished and recommended by the membrane manufacturer.
   1. Elongation, ASTM D 412: 300%
   2. Hardness, Shore A, ASTM C 920: 50
   3. Shear Strength, ASTM D 1002: 300 psi

I. Butyl Tape: 100% solids, asbestos free and compressive tape designed to seal as recommended and furnished by the membrane manufacturer.

J. Glass Fiber Cant - Glass Cant: Continuous triangular cross Section made of inorganic fibrous glass used as a cant strip as recommended and furnished by the membrane manufacturer.

2.4. EDGE TREATMENT AND ROOF PENETRATION FLASHINGS

A. Pre-Manufactured Edge Metal Finishes:
   1. Exposed and unexposed surfaces for mill finish flashing, fascia, and coping cap, as shipped from the mill
   2. Exposed surfaces for coated panels:
      a. Steel Finishes: fluorocarbon finish. Epoxy primer baked both sides, .2-.25 mils thickness as approved by finish coat manufacturer.
         Weathering finish as referred by National Coil Coaters Association (NCCA). Provided with the following properties.
         1. Pencil Hardness: ASTM D3363, HB-H / NCCA II-2.
         2. Bend: ASTM D-4145, O-T / NCCA II-19
         3. Cross-Hatch Adhesion: ASTM D3359, no loss of adhesion
         4. Gloss (60 deg. angle): ASTM D523, 25+/-5%
         5. Reverse Bend: ASTM D2794, no cracking or loss of adhesion
         6. Nominal Thickness: ASTM D1005
            a. Primer: 0.2 mils
            b. Topcoat, 0.7 mils min
            c. Clear Coat (optional, only used with 22 ga. steel) 0.3 mils
         7. Color: Provide as specified. (Subject to minimum quantities)

B. Flashing Boot - SolarBright Flashing Boot: KEE pipe boot for sealing single or multiple pipe penetrations adhered in approved adhesives as recommended and furnished by the membrane manufacturer.

C. Vents and Breathers: Heavy gauge aluminum and fully insulated vent that allows moisture and air to escape but not enter the roof system as recommended and furnished by the membrane manufacturer.

D. Pitch pans, Rain Collar 24 gauge stainless or 20oz (567gram) copper. All joints should be

welded/soldered watertight. See details for design.

E. Drain Flashings should be 4lb (1.8kg) sheet lead formed and rolled.

F. Plumbing stacks are too have SolarBright Flashing Boots. Caulking and banding will be required with the specified sealant.

G. Liquid Flashing - Tuff-Flash: An asphaltic-polyurethane, low odor, liquid flashing material designed for specialized details unable to be waterproofed with typical modified membrane flashings.
   1. Tensile Strength, ASTM D 412: 400 psi
   2. Elongation, ASTM D 412: 300%
   3. Density @77 deg. F 8.5 lb/gal typical

H. Fabricated Flashings: Fabricated flashings and trim are specified in Section 07620.
   1. Fabricated flashings and trim shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the CDA Copper Development Association "Copper in Architecture - Handbook" as applicable.

I. Manufactured Roof Specialties: Shop fabricated copings, fascia, gravel stops, control joints, expansion joints, joint covers and related flashings and trim are specified in Section 07.
   1. Manufactured roof specialties shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the NRCA "Roofing and Waterproofing Manual" as applicable.

3.EXECUTION

3.1. EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Inspect and approve the deck condition, slopes and fastener backing if applicable, parapet walls, expansion joints, roof drains, stack vents, vent outlets, nailers and surfaces and elements.

C. Verify that work penetrating the roof deck, or which may otherwise affect the roofing, has been properly completed.

D. If substrate preparation and other conditions are the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2. PREPARATION

A. General: Clean surfaces thoroughly prior to installation.
   1. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
   2. Fill substrate surface voids that are greater than 1/4 inch wide with an acceptable fill material.
   3. Roof surface to receive roofing system shall be smooth, clean, free from loose gravel, dirt and debris, dry and structurally sound.
   4. Wherever necessary, all surfaces to receive roofing materials shall be power broom and vacuumed to remove debris and loose matter prior to starting work.
   5. Do not apply roofing during inclement weather. Do not apply roofing membrane to damp, frozen, dirty, or dusty surfaces.
   6. Fasteners and plates for fastening components mechanically to the substrate shall provide a minimum pull-out capacity of 300 lbs. (136 k) per fastener. Base or ply sheets attached with cap nails require a minimum pullout capacity of 40 lb. per nail.
   7. Prime decks where required, in accordance with requirements and recommendations

of the primer and deck manufacturer.

B. Wood Deck:
   1. Dimensional wood deck shall be minimum 1 inch (25 mm) thick, knotholes and cracks larger than 1/4 inch shall be covered with sheet metal. All boards shall be appropriately nailed and have adequate end bearing to the centers of beams/rafters. Lumber shall be kiln dried.
   2. Plywood shall be a minimum 15/32 inch (11.9 mm) thick and conform to the standards and installation requirements of the American Plywood Association (APA).
   3. If no roof insulation is specified, provide a suitable dry sheathing paper, followed by an approved base sheet nailed appropriately for the specified roof system, with 1 inch (25 mm) diameter caps and annular nails unless otherwise required by the applicable Code or Approval agency.
   4. Insulation is to be mechanically attached in accordance with the insulation manufacturer's recommendations unless otherwise required by the applicable Code.
   5. In all retrofit roof applications, it is required that deck be inspected for defects. Any defects are to be corrected per the deck manufacturer's recommendations and standards of the APA/Engineered Wood Association prior to new roof application.
   6. Light metal wall ties or other structural metal exposed on top of the wood deck shall be covered with one ply of a heavy roofing sheet, such as HPR Glasbase Base Sheet, extending 2 inches to 6 inches (51 mm to 152 mm) beyond the metal in all directions. Nail in place before applying the base ply.

3.3. INSTALLATION - GENERAL

A. Install modified bitumen membranes and flashings in accordance with manufacturer's instructions and with the recommendations provided by the National Roofing Contractors Association's Roofing & Waterproofing Manual, the Asphalt Roofing Manufacturers Association, and applicable codes.

B. General: Avoid installation of modified bitumen membranes at temperatures lower than 40-45 degrees F. When work at such temperatures unavoidable use the following precautions:
   1. Take extra care during cold weather installation and when ambient temperatures are affected by wind or humidity, to ensure adequate bonding is achieved between the surfaces to be joined. Use extra care at material seam welds and where adhesion of the applied product to the appropriately prepared substrate as the substrate can be affected by such temperature constraints as well.
   2. Unrolling of cold materials, under low ambient conditions must be avoided to prevent the likelihood of unnecessary stress cracking. Rolls must be at least 40 degrees F at the time of application. If the membrane roll becomes stiff or difficult to install, it must be replaced with roll from a heated storage area.

C. Commence installation of the roofing system at the lowest point of the roof (or roof area), working up the slope toward the highest point. Lap sheets shingle fashion so as to constantly shed water

D. All slopes greater than 2:12 require back-nailing to prevent slippage of the ply sheets. Use ring or spiral-shank 1 inch cap nails, or screws and plates at a rate of 1 fastener per ply (including the membrane) at each insulation stop. Place insulation stops at 16 ft o.c. for slopes less than 3:12 and 4 feet o.c. for slopes greater than 3:12. On non-insulated systems, nail each ply directly into the deck at the rate specified above. When slope exceeds 2:12, install all plies parallel to the slope (strapping) to facilitate backnailing. Install 4 additional fasteners at the upper edge of the membrane when strapping the plies.

3.4. INSTALLATION COLD APPLIED ROOF SYSTEM

A. Base Ply: Cut base ply sheets into 18 foot lengths and allow plies to relax before installing. Install base sheet in Interply Adhesive: applied at the rate required by the manufacturer.

Shingle base sheets uniformly to achieve one ply throughout over the prepared substrate. Shingle in proper direction to shed water on each large area of roofing.

1. Lap ply sheet ends 8 inches. Stagger end laps 12 inches minimum.
2. Solidly bond to the substrate and adjacent ply with specified cold adhesive at the rate of 2 to 2-1/2 gallons per 100 square feet.
3. Roll must push a puddle of adhesive in front of it with adhesive slightly visible at all side laps. Use care to eliminate air entrapment under the membrane.
4. Install subsequent rolls of modified across the roof as above with a minimum of 4 inch side laps and 8 inch staggered end laps. Lay modified membrane in the same direction as the underlayers but the laps shall not coincide with the laps of the base layers.
5. Extend plies 2 inches beyond top edges of cants at wall and projection bases.
6. Install base flashing ply to all perimeter and projection details.
7. Allow the one ply of base sheet to cure at least 30 minutes before installing the KEE membrane.
8. Thermoplastic Cap Ply: Allow the membrane to relax before installing. Install in interply adhesive applied at the rate required by the manufacturer. Shingle sheets uniformly over the prepared substrate to achieve the number of plies specified. Shingle in proper direction to shed water on each large area of roofing.
9. All field seams exceeding 10 feet in length shall be welded with an approved automatic welder.
10. All field seams must be clean and dry prior to initiating any field welding. Remove foreign materials from the seams (dirt, oils, etc.) with acetone or authorized alternative. Use CLEAN WHITE COTTON cloths and allow approximately five minutes for solvents to dissipate before initiating the automatic welder. Do not use denim or synthetic rags for cleaning.
11. Contaminated areas within a membrane seam will inhibit proper welding and will require a membrane patch or strip.
12. All welding shall be performed only by qualified personnel to ensure the quality and continuity of the weld. The lap or seam area of the membrane may be intermittently tack welded to hold the membrane in place.
13. The back interior edge of the membrane shall be welded first, with a thin, continuous weld to concentrate heat along the exterior edge of the lap during the final welding pass.
14. Follow local code requirements for electric supply, grounding and surge protection. The use of a dedicated, portable generator is highly recommended to ensure a consistent electrical supply, without fluctuations that can interfere with weld consistency.
15. Properly welded seams shall utilize a 1.5 inch wide nozzle, to create a homogeneous weld, a minimum of 1.5 inches in width.

B. Fibrous Cant Strips: Provide non-combustible perlite or glass fiber cant strips at all wall/curb detail treatments where angle changes are greater than 45 degrees. Cant may be set in approved cold adhesives, hot asphalt or mechanically attached with approved plates and fasteners.

C. Wood Blocking, Nailers and Cant Strips: Provide wood blocking, nailers and cant strips as specified in Section 06114.

1. Provide nailers at all roof perimeters and penetrations for fastening membrane flashings and sheet metal components.
2. Wood nailers should match the height of any insulation, providing a smooth and even transition between flashing and insulation areas.
3. Nailer lengths should be spaced with a minimum 1/8 inch gap for expansion and contraction between each length or change of direction.
4. Nailers and flashings should be fastened in accordance with Factory Mutual "Loss Prevention Data Sheet 1- 49, Perimeter Flashing" and be designed to be capable of resisting a minimum force of 200 lbs/lineal foot in any direction.

D. Metal Work: Provide metal flashings, counter flashings, parapet coping caps and thru-wall

flashings as specified in Section 07620 or Section 07710. Install in accordance with the SMACNA "Architectural Sheet Metal Manual" or the NRCA Roofing Waterproofing manual.

E. Termination Bar: Provide a metal termination bar or approved top edge securement at the terminus of all flashing sheets at walls and curbs. Fasten the bar a minimum of 8 inches (203 mm) o/c to achieve constant compression. Provide suitable, sealant at the top edge if required.

F. Flashing Base Ply: Install flashing sheets by the same application method used for the base ply.
   1. Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
   2. Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
   3. Adhere to the underlying base ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
   4. Solidly adhere the entire flashing ply to the substrate. Secure the tops of all flashings that are not run up and over curb through termination bar fastened at 6 inches (152 mm) O.C. and sealed at top.
   5. Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
   6. Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work.
   7. Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.

G. Flashing Cap Ply:
   1. Seal curb, wall and parapet flashings with an application of mastic and mesh on a daily basis. Do not permit conditions to exist that will allow moisture to enter behind, around or under the roof or flashing membrane.
   2. Prepare all walls, penetrations, expansion joints and where shown on the Drawings to be flashed with required primer at the rate of 100 square feet per gallon. Allow primer to dry tack free.
   3. Adhere to the underlying base flashing ply with specified flashing ply adhesive unless otherwise specified. Nail off at a minimum of 8 inches (203 mm) o.c. from the finished roof at all vertical surfaces.
   4. Coordinate counter flashing, cap flashings, expansion joints and similar work with modified bitumen roofing work as specified.
   5. Coordinate roof accessories, miscellaneous sheet metal accessory items with the roofing system work.
   6. All stripping shall be installed prior to flashing cap sheet installation.
   7. Heat and scrape granules when welding or adhering at cut areas and seams to granular surfaces at all flashings.
   8. Secure the top edge of the flashing sheet using a termination bar only when the wall surface above is waterproofed, or nailed 4 inches on center and covered with an acceptable counter flashing.

H. Roof Walkways: Provide walkways in areas indicated on the Drawings or at a minimum;
   a. Install walk way pads in a path from all roof access points to and around all HVAC and serviceable mechanical equipment, to and around roof hatches, and as designated by the owner.

3.5. INSTALLATION EDGE TREATMENT AND ROOF PENETRATION FLASHING

A. Fabricated Flashings: Fabricated flashings and trim are provided as specified in Section

07620.

1. Fabricated flashings and trim shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the Copper Development Association "Copper in Architecture - Handbook" as applicable.

B. Metal Edge:
1. Inspect the nailers to assure proper attachment and configuration.
2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at 8 inches (203 mm) o.c.
3. Install continuous cleat and fasten at 6 inches (152 mm) o.c.
4. Install new Clad Metal edge hooked to continuous cleat. Fasten flange to wood nailers every 3 inches (76 mm) o.c. staggered.
5. Strip in flange with KEE Stripping Membrane with 6 inches (152 mm) on to the field of roof. Assure ply laps do not coincide with metal laps.

C. Roof Edge With Gutter:
1. Inspect the nailer to assure proper attachment and configuration. Increase slope at metal edge by additional degree of slope in first board.
2. Run one ply over the edge. Assure coverage of all wood nailers. Fasten plies with ring shank nails at 8 inches (203 mm) o.c.
3. Install gutter and strapping.
4. Install continuous cleat and fasten at 6 inches (152 mm) o.c.
5. Install new Clad Metal metal edge hooked to continuous cleat and Fasten flange to wood nailer every 3 inches (76 mm) o.c. staggered.
6. Strip in flange with KEE Membrane Stripping ply covering entire flange. Assure ply laps do not coincide with metal laps.

D. Scupper Through Wall (Overflow):
1. Inspect the nailer to assure proper attachment and configuration.
2. Run one ply over nailer up the overflow, into the scupper hole and up flashing as in typical wall flashing detail. Assure coverage of all wood nailers.
3. Install scupper box in a 1/4 inch (6 mm) bed of mastic. Assure all box seams are soldered and have a minimum 4 inch (101 mm) flange. Make sure all corners are closed and soldered.
4. Fasten flange of scupper box every 3 inches (76 mm) o.c. staggered.
5. Strip in flange scupper box with KEE Stripping ply covering entire area with 6 inch (152 mm) overlap on to the field of the roof and wall flashing.

E. Coping Cap:
1. Minimum flashing height is 8 inches (203 mm) above finished roof height. Maximum flashing height is 24 inches (609 mm).
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Attach tapered board to top of wall.
4. Install base flashing ply covering entire wall and wrapped over top of wall and down face with 6 inches (152 mm) on to field of roof and set in cold adhesive. Nail membrane at 8 inches (203 mm) o.c.
5. Install continuous cleat and fasten at 6 inches (152 mm) o.c. to outside wall.
6. Install new metal coping cap hooked to continuous cleat.
7. Fasten inside cap 24 inches (609 mm) o.c. with approved fasteners and neoprene washers through slotted holes, which allow for expansion and contraction.

F. Surface Mounted Counterflashing:
1. Minimum flashing height is 8 inches (203 mm) above finished roof height. Maximum flashing height is 24 inches (609 mm). Prime vertical wall at a rate of 100 square feet per gallon and allow to dry.
2. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
3. Install base flashing ply covering wall set in bitumen with 6 inches (152 mm) on to field of the roof.
4. Install KEE Membrane ply in adhesive over the base flashing ply, 9 inches (228 mm)

on to the field of the roof.
5. Apply butyl tape to wall behind flashing. Secure termination bar through flashing, butyl tape and into wall. Alternatively use caulk to replace the butyl tape.
6. Secure counterflashing set on butyl tape above flashing at 8 inches (203 mm) o.c. and caulk top of counterflashing.

G. Curb Detail/Air Handling Station:
1. Minimum curb height is 8 inches (203 mm) above finished roof height. Set cant in bitumen. Run all field plies over cant a minimum of 2 inches (50 mm).
2. Install base flashing ply covering curb set in bitumen with 6 inches (152 mm) on to field of the roof.
3. Install a KEE Membrane ply in adhesive over the base flashing ply, 9 inches (228 mm) on to the field of the roof.
4. Install pre-manufactured counterflashing with fasteners and neoprene washers or per manufacturer's recommendations.
5. Set equipment on neoprene pad and fasten as required by equipment manufacturer.

H. Roof Drain:
1. Plug drain to prevent debris from entering plumbing.
2. Taper insulation to drain minimum of 24 inches (609 mm) from center of drain.
3. Install base flashing ply (40 inch square minimum) in bitumen.
4. Set lead/copper flashing (30 inch square minimum) in 1/4 inch (6 mm) bed of mastic. Run lead/copper into drain a minimum of 2 inches (50 mm). Prime lead/copper at a rate of 100 square feet per gallon and allow to dry.
5. Run roof system plies over drain. Cut out plies inside drain bowl.
6. Install modified membrane (48 inch square minimum) in bitumen.
7. Install clamping ring and assure that all plies are under the clamping ring.
8. Remove drain plug and install strainer.

I. Plumbing Stack:
1. Minimum stack height is 12 inches (609 mm).
2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.
3. Set lead/copper flashing in 1/4 inch (6 mm) bed of mastic.
4. Caulk the intersection of the membrane with elastomeric sealant.
5. Install KEE Membrane Boot, clamp and seal the top with urethane sealant.

J. Heat Stack:
1. Minimum stack height is 12 inches (609 mm).
2. Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.
3. Prime flange of new sleeve. Install properly sized sleeves set in 1/4 inch (6 mm) bed of roof cement.
4. Install base flashing ply in bitumen.
5. Install modified membrane in bitumen.
6. Caulk the intersection of the membrane with elastomeric sealant.
7. Install new collar over cape. Weld collar or install stainless steel draw brand.

3.6. CLEANING

A. Clean-up and remove daily from the site all wrappings, empty containers, paper, loose particles and other debris resulting from these operations.

B. Remove asphalt markings from finished surfaces.

C. Repair or replace defaced or disfigured finishes caused by Work of this section.

3.7. PROTECTION

A. Provide traffic ways, erect barriers, fences, guards, rails, enclosures, chutes and the like to protect personnel, roofs and structures, vehicles and utilities.

B. Protect exposed surfaces of finished walls with tarps to prevent damage.

C. Plywood for traffic ways required for material movement over existing roofs shall be not less than 5/8 inch (16 mm) thick.

D. In addition to the plywood listed above, an underlayment of minimum 1/2 inch (13 mm) recover board is required on new roofing.

E. Special permission shall be obtained from the Manufacturer before any traffic shall be permitted over new roofing.

3.8. FIELD QUALITY CONTROL

A. Inspection: Provide manufacturer's field observations at start-up and two (2) days per week through project completion. Provide a final inspection upon completion of the Work.
   1. Warranty shall be issued upon manufacturer's acceptance of the installation.
   2. Field observations shall be performed by a representative employed full-time by the manufacturer and whose primary job description is to assist, inspect and approve membrane installations for the manufacturer.
   3. Provide observation reports from the representative indicating procedures followed, weather conditions and any discrepancies found during inspection.
   4. Provide a final report from the representative, certifying that the roofing system has been satisfactorily installed according to the project specifications, approved details and good general roofing practice.

3.9. SCHEDULES

A. Base (Ply) Sheet:
   1. StressBase 80: 80 mil SBS (Styrene-Butadiene-Styrene) rubber modified roofing base sheet reinforced with a fiberglass scrim, performance requirements according to ASTM D 5147.
      a. Tensile Strength, ASTM D 5147
         1. 2 in/min. @ 0 +/- 3.6 deg. F MD 100 lbf/in XD 100 lbf/in
         2. 50mm/min. @ -17.78 +/- 2 deg. C MD 17.5 kN/m XD 17.5 kN/m
      b. Tear Strength, ASTM D 5147
         1. 2 in/min. @ 73.4 +/- 3.6 deg. F MD 110 lbf XD 100 lbf
         2. 50mm/min. @ 23 +/- 2 deg. C MD 489 N XD 444 N
      c. Elongation at Maximum Tensile, ASTM D 5147
         1. 2 in/min. @ 0 +/- 3.6 deg. F MD 4 % XD 4 %
         2. 50mm/min@ -17.78 +/- 2 deg. C MD 4 % XD 4 %
      d. Low Temperature Flexibility, ASTM D 5147, Passes -40 deg. F (-40 deg. C)
      Thermoplastic/Modified Cap (Ply) Sheet:
   2. KEE-Stone FB 60: 60 mil thermoplastic, ketone ethylene ester (KEE) roofing membrane with polyester scrim. ASTM D6754
      a. Breaking Strength, ASTM D 751, Proc. B, strip
         1. 375 lbf. (1,668 N)
      b. Tear Strength ASTM D 751
         1. 120 lbf. min. (534 N)
      c. Elongation at Break (%), ASTM D 751, Proc. B, Strip
         1. 40.0%

B. Interply Adhesive (1 & 2):
   1. Green-Lock Plus Membrane Adhesive: Cold applied solvent free membrane adhesive: zero V.O.C. compliant performance requirements:

a. Non-Volatile Content ASTM D 4586 100%
b. Density ASTM D 1475 11.4 lbs./gal. (1.36 g/m3)
c. Viscosity Brookfield 20,000-50,000 cPs.
d. Flash Point ASTM D 93 400 deg. F min. (232 deg. C)
e. Slope: up to 3:12

2. KEE-Lock Foam: Dual component, single bead (ribbon applied) urethane insulation/ membrane adhesive.
   a. Tensile Strength (ASTM D 412) 250 psi
   b. Density (ASTM D 1875) 8.5 lbs./gal.
   c. Viscosity (ASTM D 2556) 22,000 - 60,000 cP
   d. Peel Strength (ASTM D 903) 17 lb./in.
   e. Flexibility (ASTM D 816) Pass @ -70 deg. F (-56.7 deg. C)

C. Flashing Ply Adhesive:
1. Green-Lock Plus Flashing Adhesive: Cold applied solvent free flashing adhesive: zero V.O.C.
   a. Non-Volatile Content ASTM D 4586 100%
   b. Density ASTM D 1475 11.8 lbs./gal. (1.17 g/cm3)
   c. Viscosity Brookfield 400,000 cPs.
   d. Flash Point ASTM D 93 400 deg. F min. (232 deg. C)
   e. Surfacing:
2. Flashing Cap (Ply) Sheet:
   a. KEE-Stone FB 60 Flashing: 60 mil thermoplastic, ketone ethylene ester (KEE) roofing membrane with polyester scrim. ASTM D 6754.
      1. Breaking Strength, ASTM D 751, Proc. B, strip
         a. 378 lbf
      2. Tear Strength ASTM D 751
         a. 120 lbf. minumum.
      3. Elongation at Break (%), ASTM D 751, Proc. B, Strip
         a. 40.0%

END OF SECTION