1.0 GENERAL

All provisions of the Contract Documents, including the General Conditions and Supplementary Conditions shall govern work under this division.

2.0 SCOPE OF WORK

2.1 GENERAL: Work under this division of the specifications includes all labor, materials, equipment, and all necessary appurtenances and incidental work to provide a complete and serviceable reroofing project at the following buildings. The intent of the Base Bid is to provide spray polyurethane foam roof repairs, built-up roof replacement, and fluid applied roof restoration systems with materials and labor of the same Like Kind and Quality as the existing roof system.

2.2 DESCRIPTION OF WORK:

2.2.1 The Base Proposal includes all work necessary to provide a complete and serviceable reroofing system on the following buildings:

Prothro-Yeager-Beauwood-O’Donohoe – No. 53

The scope of work includes but is not limited to the following:

- Completely removing all existing up roofing down to the deck
- Properly preparing the roof deck
- Repairing or replacing damaged or deteriorated decking in accordance with the unit price provisions
- Installing 2 layers of rigid board insulation
- Installing all new sheet metal flashings
- Installing all new membrane and sheet metal flashings
- Installing a new 4-ply, fiberglass felt and modified bitumen roof system
- Providing a 20 year Limited Material and Labor warranty

2.2.2 The Base Proposal includes all work necessary to provide a complete and serviceable spray polyurethane foam (SPF) roof repair system on the following buildings:

Fain Fine Arts Center – No. 11
Bolin Hall – No. 23
Pierce Hall – No. 29

The scope of work includes but is not limited to the following:

- Providing an infrared scan of the roof and identifying any wet roofing
- Replacing all wet roofing in accordance with the unit price provisions
- Scarifying the existing roof surface
- Installing all new membrane and sheet metal flashings
Installing a restoration coating system
Providing a 10 year Limited Material and Labor warranty

2.2.3 The Base Proposal includes all work necessary to provide a complete and serviceable fluid applied roof restoration system on the following buildings:

- **Dillard College of Business Administration – No. 2** (modified bitumen)
- **Fain Fine Arts Center – No. 11** (modified bitumen)
- **McGaha Hall – No. 18** (EPDM)
- **Clark Student Center – No. 24** (EPDM and modified bitumen)
- **Residence Hall Mechanical – No. 27** (modified bitumen)
- **Counseling Center – No. 31** (modified bitumen)
- **University Police Headquarters – No. 54** (modified bitumen)
- **Seismometer Building – No. 57** (modified bitumen)
- **2510 Hampstead Lane – No. 62** (modified bitumen)

The scope of work includes but is not limited to the following:

- Replacing all wet roofing according to the unit price schedule
- Properly preparing the roof membrane
- Applying pre-treatment and priming roof membrane
- Installing reinforcement and finish coat
- Installing all new membrane and sheet metal flashings
- Providing a 10 year Limited Material and Labor warranty

2.2.4 The Base Proposal includes all work necessary to provide miscellaneous roof repairs on the following buildings:

- **Dillard College of Business Administration – No. 2**
- **D.L. Ligon Coliseum – No. 34**
- **Fain Instrumental Music Hall – No. 81**

The scope of work includes but is not limited to the following:

- Replacing power ventilator covers as designated
- Replacing metal coping cap
- Replacing TPO base flashing under the terms of the existing manufacturer’s warranty

2.3 ROOF REPLACEMENT WORK INCLUDED (BUT NOT LIMITED TO):

SURFACE PREPARATION/TEAR OFF: Completely remove and lawfully dispose of all existing roofing materials, membrane flashings, and sheet metal flashings down to the structural deck; clean, dry, and properly prepare the deck. Contractor must receive approval from the Owner prior to any demolition.

EXISTING ROOFING MATERIALS: **Prothro-Yeager-Beauwood-O’Donohoe – No. 53**

The existing roofing materials located on the building are as follows (from deck up): Contractor shall field verify all existing site conditions and all restrictions. The following information and assumed existing conditions are provided to assist the contractor, but
this information does not relieve the contractor from the responsibility to field verify general conditions.

Roof Area 1:
- Wood Deck
- Base sheet
- 2.5” polyisocyanurate insulation
- ½” perlite insulation
- Fiberglass felts set in asphalt
- Granular surfaced Cap Sheet

Roof Area 2:
- Metal Deck
- 2.5” polyisocyanurate insulation
- ½” perlite insulation
- Fiberglass felts set in asphalt
- Granular surfaced Cap Sheet

PERFORMANCE REQUIREMENTS FOR NEW ROOF SYSTEM (WIND UPLIFT):
Provide a roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist uplift pressure calculated according to ASCE 7.

1. Design Uplift Pressures: 90 mph Wind Speed / 35 ft. Design Roof Height
   a. Field Uplift Pressure: -29.26 PSF (1-60)
      "The uplift pressure includes a safety factor of two (2x)."
   b. Perimeter Uplift Pressure: -49.10 PSF (1-105)
   c. Corner Uplift Pressure: -73.91 PSF (1-150)

2. On Wood Decks: Provide prescriptive increases in perimeter fastening of 70%. Provide prescriptive increases in corner fastening of 160%.

3. On Metal Decks: Provide prescriptive increases in perimeter fastening of 50%, but not less than 1 fastener per 2 square foot. Provide corner fastening of 1 fastener per 1 square foot.

4. Roof Perimeter width shall be established as 10'-0" wide. Roof Corner shall be established as 10'-0" in size.

DECK REPAIRS: Contractor must document via a written description and photographs any damaged or deteriorated decking that needs to be replaced. Replacement cannot proceed until MSU provides written approval. Deck replacement will be paid in accordance with the Unit Price provisions of the Contract Documents and become a part of the contract.

CONTRACTOR’S WARRANTY: A 2-year Roofing Contractor’s Warranty is required.
2.4 ALTERNATES:

ADDITIVE ALTERNATE PROPOSAL 1: In addition to the Base Proposal, the Bidder agrees to execute all of the Work described in the Drawings, Specifications and other Contract Documents, for installation of new overflow scuppers on the **Seismometer Building, McGaha Hall, and Fain Fine Arts Center** as shown on the drawings and Detail 4/R2.1.

ADDITIVE ALTERNATE PROPOSAL 2: In addition to the Base Proposal, the Bidder agrees to execute all of the Work described in the Drawings, Specifications and other Contract Documents, for installation of new overflow drains on the **Pierce Hall Building** as shown on the drawings and Detail 2/R2.1.

2.5 APPLICABLE STANDARDS

- National Roofing Contractors Association (NRCA)
- Sheet Metal and Air Conditioning Contractor’s National Association (SMACNA)
- American Society of Testing and Materials (ASTM)
- American National Standards Institute (ANSI)
- FM Global (FM)
- Underwriters Laboratory (UL), Class A

3.0 GENERAL REQUIREMENTS:

3.1 WORKING HOURS: The contractor can work from 7:00 a.m. until one (1) hour prior to sunset, Monday through Saturday. The contractor may access the site prior to daylight, but no work causing any noise can take place prior to 7:00 a.m. No work shall be performed on Sunday. Working hours will be restricted after the contractual substantial completion date, and the contractor must have Owner approval to establish new working hours.

3.2 DUMPSTERS: Contact the Owner prior to dumpster placement for approval. If the dumpster must be placed on the street, barricades and lights will be required.

3.3 CONSTRUCTION SCHEDULE: The contractor agrees to be substantially complete with the scope of work (all buildings) by **March 11, 2016**. There may be work restrictions on the following buildings due to occupant and campus activities (testing periods, academic activities, events). Repair schedules must be approved by MSU, including any accelerations or slippages. For all buildings, procedures shall be implemented to minimize the entry of fumes into the building.

- Dillard College of Business Administration – No. 2
- Fain Fine Arts Center – No. 11
- Bolin Hall – No. 23
- Clark Student Center – No. 24
- Pierce Hall – No. 29
- Prothro-Yeager-Beauwood-O’Donohoe – No. 53
3.4 SUBMITTALS: The Contractor shall provide complete submittals. They shall be provided to the Architect in accordance with Section 7.0.

3.5 PRECONSTRUCTION CONFERENCE: The Contractor, job site Superintendent, and Foreman shall attend a Preconstruction Conference as scheduled prior to the performance of any roofing work.

3.6 PROGRESS MEETINGS: The Contractor will be required to attend weekly progress meetings with the Owner. An updated 2 week Look Ahead schedule must be provided at each meeting.

3.7 CONTRACTOR PARKING: The Contractor will be allowed two (2) parking spaces at each building. All other employee parking will be available on the west side of the Museum parking lot.

3.8 FOREMAN REQUIREMENTS: An English speaking Foreman will be required on site all day. Superintendent must make daily inspections.

3.9 PHOTOGRAPHS: The contractor must take their own photographs of the site prior to any work beginning in order to document any broken items or dead landscaping. The Owner must be provided this documentation at the Preconstruction Conference.

3.10 ADDITIONAL SUBMITTAL REVIEW, OBSERVATIONS OR INSPECTIONS BY ARCHITECT:

3.10.1 In the event that the Contractor exceeds the contractual Substantial Completion date for whatever reason, they shall be responsible for reimbursing the Owner through authorized change order for all costs of the Architect’s staff and expenses to carry on inspection duties at the rate performed during the project prior to that date.

3.10.2 In the event that more than two (2) submittal reviews are required for each section or item, the Contractor shall be responsible for reimbursing the Architect for all costs of submittal review for the third and all subsequent submittal reviews prior to each. The Architect shall inform the Contractor of the anticipated time required for such review and the Contractor shall provide payment in the form of a check made payable to the Architect for the anticipated time and expenses required prior to the third and/or other subsequent reviews. All submittals, which are found to be unacceptable, shall be returned to the Contractor at the Contractor’s expense by common courier.

3.10.3 The rate of reimbursement shall be as follows:

<table>
<thead>
<tr>
<th>Role</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Architect</td>
<td>$150.00 per hour</td>
</tr>
<tr>
<td>Registered Roof Consultant</td>
<td>$150.00 per hour</td>
</tr>
<tr>
<td>Project Manager</td>
<td>$150.00 per hour</td>
</tr>
<tr>
<td>CAD Operator</td>
<td>$ 95.00 per hour</td>
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<tr>
<td>Construction Observer</td>
<td>$ 75.00 per hour</td>
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<tr>
<td>Clerical</td>
<td>$ 60.00 per hour</td>
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<tr>
<td>Mileage</td>
<td>$ current rate</td>
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<tr>
<td>Travel Expenses (lodging, meals, etc.)</td>
<td>Cost plus 10%</td>
</tr>
<tr>
<td>Architect’s Consultant Expenses</td>
<td>Cost plus 10%</td>
</tr>
</tbody>
</table>
3.10.4 The above costs, if necessary, may be deducted from any payments remaining due to the Contractor upon completion of the work by duly authorized change order.

3.11. SUBSTANTIAL COMPLETION INSPECTION: The Contractor shall notify the Owner when they are substantially complete with the project. The Architect will perform an inspection and provide a punch list in writing to the contractor.

3.12. FINAL INSPECTION: The Architect and/or Owner shall inspect the work on each building to determine if the punch list has been completed and the project is complete. All buildings must be substantially complete by dates listed in Section 3.3, Construction Schedule above. The Contractor must give the Architect a five (5) calendar day written notice that the punch list documented on the Substantial Completion Inspection Report has been completed and request a Final inspection.

4.0 ROOFING CONTRACTOR QUALIFICATIONS AND SELECTION PROCESS:

4.1 QUALIFICATIONS: The Contractor must have the following qualifications:

4.1.1 Five (5) years of experience as a Roofing Contractor approved for the installation of the designated roof systems

4.1.2 Previous experience with similar replacement / repair projects of same size and historical significance.

4.1.3 Contractor’s permanent company location must be within 200 miles of the MSU campus.

4.2 SELECTION PROCESS: The proposals will be reviewed and evaluated by a Selection Team. The Owner will select the contractor that provides the best value to the university. The Owner has the option to request further information in order to complete the evaluation if necessary. The following criteria rating system will be used:

- General organization of bid package……………………………..………5 points
- Experience completing projects of similar size and type………………10 points
- Experience completing higher education projects……………………5 points
- Experience completing MSU projects……………………………….……5 points
- References on similar projects…………………………………….…..….5 points
- Proposed project schedule…………………………………………….......5 points
- Pricing………………………………………………………………..…..…65 points

4.3 SUBMITTALS TO PROVIDE WITH BID: The Contractor must submit the following documents with their bid sheet:

4.3.1 Documentation verifying that the Contractor has five (5) years of experience as a Roofing Contractor approved for the installation of asphalt built-up roof systems

4.3.2 Documentation verifying that the Contractor has five (5) years of experience as a Roofing Contractor approved for the installation of sprayed polyurethane foam roof repair systems

4.3.3 Documentation verifying that the Contractor has five (5) years of experience as a
4.3.4 Documentation of similar projects, including contact name and number.

4.3.5 Documentation verifying that the Contractor’s permanent company location is within 200 miles of the MSU campus.

4.3.6 Progress Schedule: A bar chart showing the proposed construction schedule for the entirety of the project broken down by building showing when construction will start and end on each building in order to complete the project according to schedule.

4.3.7 Submit a written summary describing what means and methods will be undertaken to complete the project according to schedule.

5.0 MATERIALS (ALL MATERIALS SHALL BE ASBESTOS FREE)

5.1 APPROVED PRIMARY ROOFING MATERIAL MANUFACTURERS ARE:

5.1.1 Basis of Design, The Garland Company: Materials, manufacturer’s product designations, and/or manufacturer’s names specified herein shall be regarded as the minimum standard of quality required for work of this section. The Garland Company, Inc., 3800 East 91st Street, Cleveland, OH 44105, phone: 216.641.7500, www.garlandco.com

5.1.2 Substitutions: Or equal. Substitution request must be submitted with bid proposal for review and approval.

5.2 MEMBRANE ROOFING MATERIALS:

Roofing Felt shall be three (3) plies of glass fibered felt meeting ASTM D 2178, Type IV, bonded to the prepared substrate and qualifying for the warranty required.

Field Ply shall be one (1) ply 60 mil SBS modified membrane with woven, fiberglass scrim reinforcement meeting ASTM D 5147 and qualifying for the warranty required.

Hot Bitumen shall be a special steep asphalt meeting ASTM D312, Type IV with Softening Point of 210-225 degrees F, Flash Point 500 degrees F, Penetration @ 77 degrees F, 15-25 units, and Ductility @ 77 degrees F, 1.5 cm.

Base Flashing Ply shall be one (1) ply 40 mil SBS base flashing ply covered by an additional layer of modified bitumen membrane in bitumen and qualifying for the warranty required.

Modified Membrane shall be one (1) ply 135 mil SBS mineral surfaced, rubber modified roofing membrane with dual fiberglass reinforced scrim and qualifying for the warranty required.

Surfacing shall consist of flood coat and nominal ¾” to #4 hard, clean, opaque gravel aggregate meeting ASTM D 1863 – Type 67A

Hot Surfacing Bitumen shall be a special steep asphalt meeting ASTM D312, Type IV with Softening Point of 210-225 degrees F, Flash Point 500 degrees F, Penetration @ 77 degrees F, 15-25 units, and Ductility @ 77 degrees F, 1.5 cm.
Membrane Flashing at Metal Flanges shall consist of 1 ply of Field Base Ply and 1 ply of Field Cap Ply installed over the flange.

Plastic Cement shall be an asbestos-free modified asphalt roof cement as approved by the Primary Roofing Material Manufacturer meeting ASTM D 4586, Type II.

Flashing Cement shall be an asbestos free modified asphalt cement as approved by the Primary Roofing Material Manufacturer.

Fiberglass Membrane shall be a woven glass membrane meeting ASTM D 1668.

Primer shall be an asphalt primer as approved by the Primary Roofing Material Manufacturer meeting ASTM D 41.

Rigid Board Insulation at Roof Area 1 shall be 2 layers consisting of the following:

The first layer shall be 1 layer of 3.3” polyisocyanurate meeting ASTM C 1289 and FS HH-I-1972/2 and be classified for use in UL Class A and FM Class I approved systems and covered under the Primary Roofing Material Manufacturer’s Warranty. The maximum board size of Polyisocyanurate shall be 4’-0” x 4’-0”.

The second layer shall be 1 layer of 1/2” high density fiberboard meeting ASTM C 208 and FS LL-1-535-B and be classified for use in UL Class A and FM Class I approved systems and covered under the Primary Roofing Material Manufacturer’s Warranty. The maximum board size shall be 4’-0” x 8’-0”.

Rigid Board Insulation at Roof Area 2 shall be 2 layers consisting of the following:

The first layer shall be 1 layer of 3.3” polyisocyanurate meeting ASTM C 1289 and FS HH-I-1972/2 and be classified for use in UL Class A and FM Class I approved systems and covered under the Primary Roofing Material Manufacturer’s Warranty. The maximum board size of Polyisocyanurate shall be 4’-0” x 8’-0”.

The second layer shall be 1 layer of 1/2” high density fiberboard meeting ASTM C 208 and FS LL-1-535-B and be classified for use in UL Class A and FM Class I approved systems and covered under the Primary Roofing Material Manufacturer’s Warranty. The maximum board size shall be 4’-0” x 8’-0”.

Cant Strip shall be a nominal 4” and cut from perlite insulation meeting ASTM C 728.

Tapered Insulation for Crickets shall be factory cut from polyisocyanurate insulation and of sufficient slope to achieve a minimum net slope of 1/4” per foot to the drains. No field tapering shall be allowed.

Liquid Flashing shall be 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 degrees F 8.5 lb/gal typical

Rosin Sized Sheathing shall be standard brand rosin sized sheathing paper.
5.3 SHEET METAL:

Galvanized Sheet Metal shall be 24-gauge (unless otherwise noted in the drawings) and shall be hot dipped galvanized, meeting ASTM A 653.

Prefinished Sheet Metal shall be 24-gauge (unless otherwise noted in the drawings) G-90 hot dipped galvanized metal (meeting ASTM A525 and ASTM A446) coated on one side with a Kynar 500 Fluoropolymer coating (.95 to 1.25 dry mil thickness including prime coat) and coated on the reverse side with a primer coating (.25 dry mil thickness). Color to be selected from Manufacturer’s standard colors. A strippable film shall be applied to the top-side of the Prefinished Sheet Metal to protect the finish during fabrication. Acceptable manufacturers shall be Vincent Metals, Peterson Aluminum, and MBCI, or equal.

Stainless Steel Sheet Metal shall be a minimum 24-gauge (unless otherwise noted in the drawings) soft annealed stainless steel sheet metal meeting FS #3042B and ASTM A 167. Finish to be a mill finish, "2-B".

"Paint Grip" Sheet Metal shall be 24-gauge (unless otherwise noted in the drawings) shall be hot dip galvanized, lock forming quality, and shall be factory phosphatized at the factory to bond paint without further treatment.

Solder for galvanized sheet metal shall be alloy grade 50A meeting ASTM B-32.

Flux for galvanized sheet metal shall be an approved standard brand.

Bituminous Coating shall be an asphaltic coating meeting FS TT-C-494.

Leads for Stack Flashings shall be a seamless 4-pound lead and have a minimum 4” flange.

5.4 FASTENERS

Nails for attaching Roofing to Wood shall be galvanized annular threaded (or) ring shank nails with integrally capped heads (minimum 1" in diameter) or through tin caps.

Nails for attaching Galvanized Sheet Metal to Wood shall be large headed (3/8" - 7/16" diameter) hot dip galvanized roofing nails.

Nails for Wood Blocking and rough carpentry shall be galvanized 16d common nails.

Exposed Sheet Metal Screws (with Weatherproof Gaskets) shall be hex head self-tapping screws (galvanized for galvanized metal, stainless for stainless steel or copper metal, and color matching/coated for prefinished metal). The screws shall have EPDM sealing gaskets. The gaskets shall be protected with a metal jacket (weather guard).

Sheet Metal Screws (Not Exposed to Weathering) shall be hex head or pancake head self-tapping screws (galvanized for galvanized metal, stainless for stainless steel or copper metal).

Rivets for attaching galvanized sheet metal shall be hot dipped galvanized. Rivets for stainless steel sheet metal shall be stainless. Rivets for copper sheet metal shall be copper. Rivets for the Prefinished Sheet Metal shall be color matching.

Anchors for attaching sheet metal to masonry, concrete, stucco, or other non-wood
substances shall be of similar metal and of sufficient strength to securely hold sheet metal. Anchors shall be Hilti "Metal Hit", or an approved equal. No plastic or nylon anchors shall be permitted.

Concrete Anchors for attaching structural steel supports to concrete shall be Hilti "Drop In" or Hilti "Self Drilling" anchors, or an approved equal.

Insulation Fasteners/Plates for Metal Decks shall be a minimum #12 screw type fastener/plate assembly with a minimum 3" diameter metal plate. The screw shall be of appropriate length to penetrate the metal deck a minimum of ¾". The fastener/plate assembly shall meet the Performance Requirements for Wind Uplift, be approved by the Primary Roofing Material Manufacturer, and shall be coated for protection from corrosion.

Anchors for attaching Wood Blocking/Nailers to Metal Deck shall be minimum #12 screw type fastener (similar to insulation screw) with 5/8" o.d. galvanized steel washers under the screw head. The screw shall be coated for protection from corrosion.

Nails for Attaching Copper Sheet Metal to Wood – Not exposed to weathering: shall be a minimum No. 12 stubs gauge (0.109") copper or hardware bronze nail of sufficient length to penetrate a minimum of 3/4" into the wood.

Screws for Attaching Copper Sheet Metal to Wood shall be copper, bronze, or brass. All exposed fasteners shall have neoprene washers.

Rivets for attaching copper sheet metal shall be hard copper, brass or bronze.

5.5 WOOD AND PLYWOOD

Lumber for Nailers, Curbing, and Blocking shall be #2 yellow pine and shall be Fire Treated. Minimum width of 5-1/2" shall be provided.

Plywood shall be nominal 3/4" thick or as shown on the drawings, shall be exterior type with exterior glue grade C-D or better, shall be Fire Treated, and shall bear either APA or TECO trademarks.

5.6 ACCESSORIES

General Sealant for Sheet Metal shall be a one-component gun-grade, moisture-curing high performance polyurethane sealant, conforming to ASTM C 920, Type S.

Pourable Sealant shall be a one-part self-leveling polyurethane sealant, conforming to ASTM C 920, Type S.

Tape Sealant shall be gray pressure sensitive tape blended of butyl and EPDM rubbers with not less than 50% butyl.

30# Felt shall be an asphalt saturated organic plain (no perforated) felt meeting ASTM D 226, Type II.

Neoprene Pads shall be Type “A”, 3/8" thick cross ribbed molded neoprene with alternately raised and lowered ribs providing uniform deflection over a load range of 25 psi to 75 psi with 1/8" minimum deflection at a recommended load rating of 50 psi. Pads shall be NeoFLEX series NNP.

Flexible Vapor Retarder shall be a HT (High Temperature) cold applied, self-adhering 30-mil thick rubberized membrane. The membrane shall be composed of high strength
polyethylene film coated on one side with adhesive consistency rubberized butyl with a release sheet as manufactured by Grace Construction Products (Grace Ultra), GAF, or W.R. Meadows.

Termination Bar shall be a standard, pre-punched aluminum termination bar as required for anchoring the top of base flashings (min. 8” o.c.) to non-nailable substrates.

5.7 METAL DECK REPAIRS (UNIT PRICING)

Metal Decking shall be 22 gauge, galvanized narrow rib deck (or to match the existing in shape, thickness, and size) in accordance with the Steel Deck Institute.

Screws for the attachment of Metal Deck to the steel structure shall be 12-24 x 7/8” hex washer head TEK/4 cadmium plated screws by Building Fasteners Inc., Buildex, or an approved equal.

Screws for stitching ribs of Metal Deck shall be 12-14 x 3/4” TEK/1 cadmium plated screws by Building Fasteners Inc., Buildex, or an approved equal.

5.8 WOOD DECK REPAIRS (UNIT PRICING)

Lumber For Decking shall match the existing.

Framing Lumber shall be number 2 yellow pine or number 2 Douglas fir of the same dimension as the existing.

Lumber for Nailers, Curbing, and Blocking shall be #2 yellow pine and shall be Fire Treated. Minimum width of 5-1/2” shall be provided.

Plywood shall be nominal 3/4” thick or as shown on the drawings, shall be exterior type with exterior glue grade C-D or better, shall be Fire Treated, and shall bear either APA or TECO trademarks.

Bolts shall conform to ASTM A325.

6.0 QUALITY CONTROL

6.1 OWNER may employ a testing laboratory as deemed necessary to perform specified services and testing. Employment of the laboratory shall in no way relieve the contractor’s obligation to perform work and provide materials in accordance with the contract documents.

6.2 The testing laboratory, if other than Rooftech, is not authorized to approve or accept any portion of the work, perform any of the contractor’s duties, or alter the contract documents in any way.

6.3 Should testing reveal any failure of the work performed to comply with the contract documents, the Contractor shall bear the cost of any additional testing (as deemed necessary by the Architect/Engineer) required to verify that the failure was the responsibility of the contractor.

6.4 Contractor will run a magnet on the ground at the end of every day in the area of construction or put up construction fence in the work area to avoid flat tires of landscaping equipment.
7.0 SUBMITTALS

7.1 Shop Drawings shall be presented in a clear and thorough manner to clearly illustrate the work and that work to be performed will be in conformance to the Contract Documents. **Shop Drawings are only necessary if the contractor is proposing a detail change to the drawings.**

7.2 All submittals shall contain the date of submission, project title, names of contractor, supplier, and manufacturer, applicable specification section, identification of deviations from Contract Documents, and clearly identified field dimensions where applicable.

7.3 All shop drawings, product data, samples, and resubmittals shall be submitted to the Architect in sufficient time for adequate review. They will be reviewed within a minimum of five (5) working days from receipt of submittal.

7.4 Samples shall be submitted in sufficient size to clearly illustrate its function and utility. Sheet metal samples of each condition shall be used in conjunction with Shop Drawings.

7.5 Product Data shall clearly illustrate compliance with the Contract Documents.

7.6 The Submittals shall include, but not be limited to the following

7.6.1 List of all materials described in Section 5.0 and any other materials to be used on the project

7.6.2 A Product Safety Data Bulletin on each applicable product.

7.6.3 A sample copy of all warranties required on the project including the Primary Roofing Manufacturer Warranty and the Contractor’s Warranty.

7.6.4 Certificate of Insurance for all insurance listed in the Owner’s bidding documents.

8.0 PERFORMANCE

8.1 Any damages resulting from failure of the contractor to maintain the work area, including areas under construction, areas of storage, and areas used for access, in a water tight condition shall be the full responsibility of the contractor, and the costs resulting from this, including time required by the owner's employees shall be charged to the Contractor.

8.2 Material, debris, equipment, and other requirements for completion of this project **shall not be scattered over the roof deck.** Contractor assumes full responsibility for any damage occurring during roof repair operations.

8.3 Contractor **shall not transport** materials across the finished roof surface. Extreme care shall be taken to prevent damage to any roofing surfaces. Contractor shall make permanent repairs to damaged areas of the existing roofing and flashing where workers have damaged the existing roofing or flashings.

8.4 Contractor shall note the building will be occupied and operated as an on-going business and will restrict his activities to the areas specified by the Owner.

8.5 Contractor shall maintain the job site in a safe, clean, and orderly fashion at all times. All doors and exits shall be made safe and secure from any possibility of falling debris or danger from any work associated with this project. **PROPER AND ADEQUATE ACCESS AND EGRESS TO AND FROM THE BUILDING SHALL BE MAINTAINED AT ALL TIMES.**
8.6 Upon completion of the roofing work the contractor shall thoroughly clean the area of all trash, debris, dust, dirt, etc. resulting from the contractor's work.

8.7 Contractor shall provide latrines and other necessary facilities, as is required. Contractor's employees will not be allowed to use building facilities. Location must be approved by the Owner.

8.8 Except for modifications as called for in the details and specifications, the contractor shall return all items attached or affixed to the roof to their approximate original position, and said items shall be in the same condition as at commencement of work.

8.9 The Contractor shall furnish all required storage enclosures, safeguards, and comply with all safety standards. Storage areas where hazardous or potentially hazardous products or equipment is stored shall be restricted to general access. Location must be approved by the Owner.

8.10 Rooftop hoisting equipment shall be properly assembled and maintained. Only persons that are thoroughly familiar with hoisting equipment shall operate such equipment. All such equipment shall be erected and supported so that it will not damage the existing structural deck or new roofing.

8.11 Debris shall be removed in a safe and orderly manner by appropriate means, and all roof debris becomes the property of the roofing contractor. Contractor shall be responsible for the lawful removal and disposal of all trash and debris.

8.12 Contractor shall maintain sufficient equipment, materials (including but not limited to roofing, sheet metal, and lumber), and man power on the job site so as to reroof and replace any rotted decking, curbing, or make repairs required to bring decking up to the recommendations of the primary roofing material manufacturer and these specifications.

8.13 Contractor shall employ only orderly and competent workers, skillful in the performance of the type work required.

8.14 All workers are restricted from interacting with students in any manner. Any interaction will be considered inappropriate and the Owner will take action to have the workers removed from the project.

8.15 Contractor must provide the Owner with a two (2) MSU work day notice if any landscaping or equipment needs to be removed by the Owner. MSU working hours are Monday through Friday, 8:00 am to 5:00 pm, except for from 5/18 through 8/14 when MSU working hours are Monday through Thursday, 7:00 am to 6:00 pm.

8.16 Contractor shall erect all required roof barriers and safety lines as required by OSHA and comply with OSHA regulations for safety.

8.17 Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Work included in the Construction Documents. The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to:

8.17.1 Employees on the Work and other persons who may be affected thereby;

8.17.2 The Work and materials and equipment to be incorporated therein; and
8.17.3 Other property at the site or adjacent thereto.

The Contractor shall give notices and comply with applicable laws, ordinances, rules, regulations, and lawful orders of public authorities bearing on safety of persons and property and their protection from damage, injury, or loss. The Contractor shall promptly remedy damage and loss to property at the site caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible.

8.18 Contractor shall comply with the most current (Occupational Safety and Health Administration) OSHA requirements as to the proper implementation of safety equipment as deemed necessary by such requirements for all employees of the Contractor working on the Site, Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible. In addition, the Contractor shall provide at all times a minimum of three (3) complete additional safety equipment units, i.e. harnesses, rigging gear, hardhats, etc., as deemed necessary by the OSHA requirements for all workers. The three- (3) additional units are for the use by the Owner, Owners’ Representatives, Architect, Engineer, and A/E Inspectors.

8.19 Fire Extinguishers – Contractor shall provide one (1) fire extinguisher for each kettle on the project plus one (1) additional fire extinguisher per every 100 squares of roofing area. All fire extinguishers shall be a minimum of 25 lbs.

8.20 Landscaping – Upon completion of the project, the Contractor shall repair all damage to the existing landscaping resulting from the Contractor’s work. The repair shall include all damaged plants, trees, sod, sprinkler heads/lines, concrete sidewalks/curbs, asphalt pavement, etc. The repair shall restore the damaged area to match the existing condition prior to the commencement of the project.

9.0 ENVIRONMENTAL

9.1 No roofing work shall be performed below 40 degrees, when the wind chill factor is below 40 degrees, or when rain is eminent (30% chance or greater). No roofing shall be performed when the average wind is above 25 mph without written permission from the Architect/Engineer. No roofing work shall be performed 30 minutes prior to sundown. The roof deck shall be dry and free from any moisture, ice, or other deleterious materials prior to roofing.

9.2 All materials susceptible to moisture shall be protected in dry, above ground, watertight storage. Materials must be properly palleted, tarped with breathable tarps, and properly secured against the wind. Plastic “shrink-wrapped” materials are not considered properly protected.

9.3 Any materials becoming wet or damaged will be rejected and shall be removed from the job site immediately. Asphalt shall not be heated above 500 degrees Fahrenheit.

9.4 Kettles shall be thermostatically controlled and equipped with a working, readable thermometer. An additional calibrated thermometer shall be maintained at the job site to periodically test the kettle thermometer.

9.5 Remove no more roofing than can be replaced during the work day.
10.0 DECK REPAIRS:

10.1 General: The entire roof deck shall conform to the requirements of the Primary Roofing Material Manufacturer, the National Roofing Contractors Association, the Local Building Code, and these Contract Documents, the most restrictive applying. Any damaged or deteriorated decking shall be replaced.

10.2 STEEL DECKS: All damaged or deteriorated steel decking shall be neatly covered with new steel decking matching the existing profile and overlapping onto sound steel decking a minimum of 12" and secured by means of appropriate mechanical fasteners. No deflection will be allowed.

10.3 WOOD DECKS: Loose or void knot holes and cracks greater than 3/8" shall be neatly covered with 24-gauge sheet metal. Any loose boards or unsupported boards shall be securely nailed. All decking shall be inspected and any rotten or damaged decking shall be removed for a minimum of 2 spans and replaced with new decking matching the existing and securely nailed using a minimum 2 nails at each rafter. Extreme care shall be taken to insure the ends are tightly secured so there is no differential movement between boards. In addition, securely nails all loose decking and verify the decking conforms to the manufacturer’s recommendations. All damaged rafters shall be repaired by securely bolting another rafter of the same dimension onto the existing so the new rafter extends at least 2' in both directions beyond the damaged area and spans across a support or replace the damaged rafter.

11.0 INSULATION INSTALLATION:

11.1 General: The Base Sheet and Insulation shall be installed in strict accordance with the recommendations and requirements of the Primary Roofing Material Manufacturer, the recommendations of the National Roofing Contractor Association (NRCA), the Performance Requirements for Wind Uplift, and these Contract Documents, the most restrictive applying. All roofing materials shall be as described in Section 4.0 MATERIALS and shall be provided and/or approved by the Primary Roofing Material Manufacturer. Phased application is not acceptable. No more roofing, flashing, or insulation shall be removed than can be completely replaced within the same day.

11.2 Metal Decks: Insulation shall be installed in 2 layers, the first layer (Tapered Polysiocyanurate or Flat Polysiocyanurate) being loose-laid and the second layer (cover board) being mechanically attached to the decking. Where Tapered Insulation is to be installed, carefully lay out the insulation pattern in accordance with the approved shop drawings. Verify that there is a positive slope to all drains and/or edges of roof designed for drainage. All joints between the first and second layers of insulation shall be staggered a minimum six inches (6’). All end joints shall be staggered a minimum six inches (6’). The insulation pattern shall not vary once it has been established. Tie-ins shall be continuously staggered so there are no continuous joints through the layers of insulation. All joints shall be tight, smooth, and flush, and there shall be no voids or gaps between the insulation boards.

11.3 Wood Decks: Scatter nail a layer of rosin sized sheathing paper over the wood deck prior to the installation of the insulation, as required to prevent bitumen drippage. Insulation shall be installed in 2 layers, the first layer being mechanically attached to the decking using a minimum of 4 fasteners per board. Fasteners and fastener patterns shall meet all requirements of wind uplift performance requirements. The second layer of insulation shall be adhered in a continuous and even mopping of Type III asphalt applied
at the MINIMUM rate of 30 pounds per 100 square feet (minimum 30 lbs/100 SF). All joints between the first and second layers of insulation shall be staggered a minimum six inches (6”). All end joints shall be staggered a minimum six inches (6”). The insulation pattern shall not vary once it has been established. Tie-ins shall be continuously staggered so there are no continuous joints through the layers of insulation. All joints shall be tight, smooth, and flush, and there shall be no voids or gaps between the insulation boards.

11.4 At cricket areas (as well as tapered hips/valleys) the roof cover board shall be carefully cut and mitered to match the specific profile of the cricket. Bevel the edge of the cover board at transitions to the cover board, installed in the field of the roof, in order to insure proper fit (without voids) down the tapered hip/valley line.

12.0 GENERAL INSTALLATION REQUIREMENTS

12.1 MEMBRANE INSTALLATION:

12.1.1 Coordinate installation of roofing system components so that insulation and roofing plies are not exposed to precipitation or left exposed overnight. Provide cut-offs at end of each day’s work to cover exposed ply sheets and insulation with two (2) plies of #15 organic roofing felt set in full moppings of bitumen and with joints and edges sealed with roofing cement. Remove cut-offs immediately before resuming work.

12.1.2 Asphalt Bitumen Heating: Heat and apply bitumen in accordance with the Equiviscous Temperature (EVT) Method as recommended by National Roofing Contractors Association (NRCA). Do not raise temperature above minimum normal fluid-holding temperature necessary to attain EVT (plus 5°F at point of application) more than one (1) hour prior to time of application. Determine flash point, finished blowing temperature, EVT, and fire-safe handling temperature of bitumen either from information by manufacturer or by suitable test. Do not exceed recommended temperature limits during bitumen heating. Do not heat to a temperature higher than twenty five degrees (25°) below flash point. Discard bitumen that has been held at temperature exceeding Finishing Blowing Temperature (FBT) for more than three (3) hours. Keep kettle lid closed except when adding bitumen.

12.1.3 Asphalt Bitumen Mopping Rate:

12.1.3.1 Interply Mopping: Apply bitumen at the rate of approximately twenty five (25) lb (11.3kg) of bitumen per roof square.

12.1.3.2 Modified Membrane Mopping: Apply bitumen at the rate of approximately thirty (30) lb (13.6kg) of bitumen per roof square.

12.1.4 Flood Coat: Apply surfacing material specified rate dependent on the material used.

12.1.5 Substrate Joint Penetrations: Prevent bitumen from penetrating substrate joints, entering building, or damaging roofing system components or adjacent building construction.

12.1.6 Apply roofing materials as specified by manufacturer’s instructions.

12.1.6.1 Keep roofing materials dry before and during application.

12.1.6.2 Do not permit phased construction.

12.1.6.3 Complete application of roofing plies, modified sheet and flashing in a continuous operation.
12.1.6.4 Begin and apply only as much roofing in one day as can be completed that same day.

12.1.7 Cut-Offs (Waterstops): At end of each day's roofing installation, protect exposed edge of incomplete work, including ply sheets and insulation. Provide temporary covering of two (2) plies of #15 organic roofing felt set in full moppings of bitumen with joints and edges sealed.

12.2 FELT PLY INSTALLATION

12.2.1 Fiberglass Plies Type IV: Install two (2) fiberglass felts in twenty five (25) lbs. (11.3 kg) per sq. of bitumen shingled uniformly to achieve two (2) plies over the entire prepared substrate. Shingle in direction of slope to shed water on each area of roof. Apply a flood coat of bitumen over top ply.

12.2.2 Lap ply sheet ends eight (8) inches. Stagger end laps twelve (12) inches minimum.

12.2.3 Lightly broom in fiberglass plies to assure complete adhesion.

12.2.4 Extend plies two (2) inches beyond top edges of cants at wall and roof projections and equipment bases.

12.2.5 Install base flashing ply to all perimeter and projection details.

12.3 MODIFIED MEMBRANE APPLICATION (Field Ply)

12.3.1 Solidly bond the modified membrane to the base layers with specified asphalt at the rate of twenty five (25) to thirty (30) lbs. (11-13kg) per 100 square feet.

12.3.2 The modified membrane roll must push a puddle of asphalt in front of it with asphalt slightly visible at all side laps. Exercise care during application to eliminate air entrapment under the membrane.

12.3.3 Apply pressure to all seams to ensure that the laps are solidly bonded to substrate.

12.3.5 Install subsequent rolls of modified membrane across the roof as above with a minimum of four (4) inch (101mm) side laps and eight (8) inch (203mm) end laps. Stagger the end laps. Apply the modified membrane in the same direction as the previous layers but stagger the laps so they do not coincide with the laps of the base layers.

12.3.6 Apply asphalt no more than five (5) feet (1.5m) ahead of each roll being embedded.

12.3.6.1 Extend membrane two (2) inches (50mm) beyond top edge of all cants in full moppings of the specified asphalt [as shown on the drawings].

12.4 FLASHING MEMBRANE INSTALLATION

12.4.1 Seal all 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.

12.4.2 Prepare all walls, penetrations, expansion joints [and where shown on the drawings] to be flashed with asphalt primer at the rate of one hundred (100) square feet per gallon. Allow primer to dry tack free.

12.4.3 Use the modified membrane as the flashing membrane. Adhere to the underlying base flashing ply with specified asphalt unless otherwise noted in these specifications. Nail off at a minimum of eight (8) inches o.c. from the finished roof at all vertical surfaces.
12.4.4 Solidly adhere the entire sheet of flashing membrane to the substrate.

12.4.5 Seal all vertical laps of flashing membrane with a three-course application of trowel-grade mastic and fiberglass mesh.

12.4.6 Coordinate counter flashing, cap flashings, expansion joints, and similar work with modified bitumen roofing work [as specified in other sections].

12.4.7 Coordinate roof accessories, miscellaneous sheet metal accessory items, including piping vents and other devices with the roofing system work [as specified in other sections].

12.4.8 Curb Detail

12.4.8.1 Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

12.4.8.2 Set cant in bitumen. Run all field plies over cant a minimum of two (2) inches.

12.4.8.3 Install base flashing ply covering curb set in bitumen with six (6) inches on to field of the roof.

12.4.8.4 Install a second ply of modified flashing ply in bitumen over the base flashing ply, nine (9) inches on to the field of the roof. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

12.4.8.5 Install pre-manufactured counterflashing with fasteners and neoprene washers or per manufacturer’s recommendations.

12.4.8.6 Set equipment on neoprene pad and fasten as required by equipment manufacturer.

12.4.9 Exhaust Fan

12.4.9.1 Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

12.4.9.2 Set cant in bitumen. Run all plies over cant a minimum of two (2) inches.

12.4.9.3 Install base flashing ply covering curb with six (6) inches on to the field of the roof.

12.4.9.4 Install a second ply of modified flashing ply installed over the base flashing ply, nine (9) inches on to the field of the roof. Attach top of membrane to top of wood curb and nail at eight (8) inches o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

12.4.9.5 Install metal exhaust fan over the wood nailers and flashing to act as counterflashing. Fasten per manufacturer’s recommendation.

12.4.10 Passive Vent/Air Intake

12.4.10.1 Minimum curb height is eight (8) inches. Prime vertical at a rate of one hundred (100) square feet per gallon and allow to dry.

12.4.10.2 Set cant in bitumen. Run all plies over cant a minimum of two (2) inches.

12.4.10.3 Install base flashing ply covering curb with six (6) inches on to the field of the roof.
12.4.10.4 Install a second ply of modified flashing ply installed over the base flashing ply, nine (9) inches on to field of the roof. Attach top of membrane to top of wood curb and nail at eight (8) inches o.c. Apply a three-course application of mastic and mesh at all vertical seams and allow to cure and aluminize.

12.4.10.5 Install passive vent/air intake over the wood nailers and flashing to act as counterflashing. Fasten per manufacturer's recommendations.

12.4.11 Roof Drain

12.4.11.1 Plug drain to prevent debris from entering plumbing.

12.4.11.2 Taper insulation to drain minimum of twenty four (24) inches from center of drain.

12.4.11.3 Run roof system plies over drain. Cut out plies inside drain bowl.

12.4.11.4 Set lead/copper flashing (thirty (30) inch square minimum) in ¼ inch (6mm) bed of mastic. Run lead/copper into drain a minimum of two (2) inches. Prime lead/copper at a rate of one hundred (100) square feet per gallon and allow to dry.

12.4.11.5 Install base flashing ply (forty (40) inch square minimum) in bitumen.

12.4.11.6 Install modified membrane (forty eight (48) inch square minimum) in bitumen.

12.4.11.7 Install clamping ring and assure that all plies are under the clamping ring.

12.4.11.8 Remove drain plug and install strainer.

12.4.12 Plumbing Stack

12.4.12.1 Minimum stack height is twelve (12) inches.

12.4.12.2 Run roof system over the entire surface of the roof. Seal the base of the stack with elastomeric sealant.

12.4.12.3 Prime flange of new sleeve. Install properly sized sleeves set in ¼ inch (6mm) bed of roof cement.

12.4.12.4 Install base flashing ply in bitumen.

12.4.12.5 Install membrane in bitumen.

12.4.12.6 Caulk the intersection of the membrane with elastomeric sealant.

12.4.12.7 Turn sleeve a minimum of one (1) inch down inside of stack.

12.4.13 APPLICATION OF SURFACING

12.4.13.1 Aggregate Surfacing: Apply surfacing materials in the quantities specified (five hundred (500) lbs. (226kg) per square for aggregate, four hundred (400) lbs. (181kg) per square for slag). Uniformly embed aggregate in a flood coat of bitumen at a rate of sixty (60) to seventy (70) lbs. (27-32kg) per square coverage after felt flashings, tests, repairs, and corrective actions have been completed and approved.

12.4.13.2 Aggregate shall be dry and placed in a manner required to form a compact, embedded overlay. To aid in proper embedment, lightly roll aggregate provided that there is no damage to the roofing membrane.
13.0 CORRECTIVE ACTION:

13.1 All corrective action shall be approved in writing from the Primary Roofing Material Manufacturer.

13.2 A minimum of two (2) plies of felt shall be mopped over all areas found to be deficient unless testing results require complete removal of the roofing membrane. Voids greater than 1 1/2", dry spots greater than 1/4", and interply mopping less than eighteen pounds per 100 square foot (18 lbs/100SF) shall constitute deficiencies. Voids which extend through multiple plies shall be repaired by cutting the void through the multiple plies and mopping the same number of multiple plies over the deficient area. Any areas with less than the required number of plies shall be covered with the number of missing plies plus an additional ply, (e.g. if the sample indicates there are 3 plies on a 4 ply system, then the missing ply plus one (1) ply -- making a total of two (2) plies -- shall be installed). Remove and replace all roofing with more than forty pounds of interply mopping per hundred square feet per ply (40 lbs/100 SF/ply).

13.3 No phased application will be accepted and no roofing installed during inclement weather conditions will be accepted. This will constitute deficiencies, and all roofing will be removed down to the substrate and replaced.

14.0 LIGHTNING PROTECTION:

14.1 General: The Lightning Protection System shall be made to comply with applicable standards established by the National Fire Protection Association, Underwriters Laboratories, Inc. and the Lightning Protection Institute. This shall NOT include extending Lightning Rod Conductors. This shall include replacing damaged or missing Lightning Rods as required.

14.2 Completion: Upon completion of the work, the Contractor shall provide a letter from the Lightning Protection Installer which states that the existing lightning protection system (in the area of roof replacement only) has been installed in order to comply with applicable standards established by the National Fire Protection Association, Underwriters Laboratories, Inc. and the Lightning Protection Institute.

14.3 Lightning Rods (Air Terminals) to replace missing rods shall be of the same material (aluminum or copper) and of the same size as the existing lightning rod system and shall be manufactured by Thompson Lightning Protection, Inc., 901 Sibley Highway, Saint Paul, Minnesota 55118-1792, Phone Number 612-455-7661 or as approved by the Architect/Engineer.

14.4 Lightning Rod Supports and Cable Supports shall be "Adhesive Point Base" supports of the same material as the lightning rod and/or cable and shall be manufactured by Thompson Lightning Protection, Inc., 901 Sibley Highway, Saint Paul, Minnesota 55118-1792, Phone Number 612-455-7661 or as approved by the Architect/Engineer.

14.5 Lightning Rod Conductors (Cable) to replace missing shall be of the same size and material as the existing Lightning Protect System and shall be manufactured by Thompson Lightning Protection, Inc., 901 Sibley Highway, Saint Paul, Minnesota 55118-1792, Phone Number 612-455-7661 or as approved by the Architect/Engineer.
15.0 SHEET METAL (where applicable or necessary for complete system)

15.1 General: All work shall be in accordance with SMACNA (Sheet Metal and Air Conditioning Contractors National Association, Inc.), NRCA (National Roofing Contractors Association), and these Contract Documents, the most restrictive standard applying.

15.2 Protection: Exercise extreme care when working on roof surfaces to avoid damaging or puncturing the roof membrane or membrane flashings.

15.3 Expansion & Contraction: Provide for expansion and contraction for all sheet metal components/accessories.

15.4 Seams & Joints - Sheet Metal Gravel Guards, Fascia, and Edge Metal: Sheet metal shall be installed in maximum 10'-0" sections/lengths with a 1/4" space between each section. The ¼" space/joint shall be protected with a centered, 6" wide cover plate.

15.5 Seams & Joints – Sheet Metal Receivers and Counter Flashings: Sheet metal shall be installed in maximum 10'-0" sections/lengths with a 3" overlap provided at each joint.

15.6 Seams and Joints – Sheet Metal Copings: Sheet metal shall be installed in maximum 10'-0" sections/lengths with 1" tall standing seams that are folded down at a 45-degree angle at the edge of the coping. Standing seams shall be cleated to the substrate (as shown in the drawings). 1" tall standing seams are required at all coping corners, coping intersections, and at changes in coping width.

15.7 Seams & Joints – Sheet Metal Gutters: Seams in gutters shall be overlapped 1", riveted 2" o.c., and sealed so as to form a watertight joint. Gutter Expansion Joints shall be installed as detailed with riveted and sealed joints.

15.8 Back Painting: Back paint flashings with bituminous paint where sheet metal is expected to be in contact with cementitious materials or dissimilar metals.

15.9 Fabrication: All sections shall be square, true, and accurate to size, and free from distortion. Lines shall be straight, true, and free from distortion. All edges shall be neatly hemmed.

15.10 Installation: Sheet metal shall fit tight in place with square corners, surfaces straight in planes, and lines accurate to profiles. Sheet metal shall be fabricated and installed so flashings will properly shed water and protect underlying membranes from physical damage and water penetration.

15.11 Soldering: All soldered joints shall be watertight. All soldered joints shall be lapped and riveted prior to soldering. Wipe and wash clean immediately after soldering to remove all traces of flux.

15.12 Sealant Installation: Continuously and uniformly apply sealant to all areas vulnerable to water entry.

15.13 Dissimilar Metals: No dissimilar metals shall come into contact with each other. Use only fasteners and other metal components that are compatible with the metal type being secured.

15.14 All sheet metal flashings shall be continuous at all corners and transitions. Counter flashings shall be extended a minimum of 2" beyond the termination of the membrane.
flashing, and the exposed end shall be appropriately hemmed and sealed as required. Mitered terminations, transitions, and corners shall be used so as to provide a continuous flashing system including both the sheet metal counter flashing and membrane base flashing. All ends and junctures between flashings of different height, types, etc. shall be neatly finished so as no edges of roofing, insulation, cant strip, blocking, flashing, etc. are exposed.

15.15 Prefinished Sheet Metal: Remove all strippable film from the top surface of all prefinished sheet metal before installation. Prefinished metal shall not be soldered.

16.0 ROUGH CARPENTRY

16.1 Install miscellaneous blocking, cants, nailing strips, framing and sheathing members true, plumb, and level. Construct members of continuous pieces of longest possible lengths. Rough carpentry shall be securely anchored to the structure so as to resist a force of 100 lbs./LF in any direction. Fasteners shall be spaced no more than 4'-0" apart and not less than 2 fasteners per board shall be used. All nailers/blocking, for attachment of sheet metal flange-type flashings, shall be installed in conjunction with the insulation, prior to the installation of the roofing membrane.

16.2 Install plywood sheathing to existing wall construction by anchoring the plywood sheathing top and bottom with anchors 12" o.c.. Intermediate rows of anchors shall be installed every 2'-0" horizontally with fasteners spaced 12" o.c.. Plywood should be installed in the longest possible lengths.

17.0 MECHANICAL/ELECTRICAL (Roof Replacement Only)

17.1 General: All work shall conform to the requirements of the Local Building Code, Uniform Mechanical Code, National Electric Code, and Underwriters Laboratory. All equipment shall be installed or reinstalled in accordance with the Manufacturer's Requirements and shall be fully operable and functional upon completion.

17.2 Raising Existing Roof Mounted/Supported Mechanical Units/Curbs/Vents (Equipment Platform): Existing roof mounted units/curbs/vents shall be raised as required to install roofing, flashings, and new curbs (if applicable) in accordance with the Contract Documents. Extreme care shall be taken to prevent damage to the units. All support lines/conduits (gas, electrical, steam, ammonia, Freon, etc.) servicing the units shall be properly disconnected in order to facilitate moving the unit. Coordinate with the Owner, and notify the Owner and Architect/Engineer at least 48-hours before disconnecting any mechanical unit. All units disconnected shall be reconnected and be fully operational at the end of the same working day.

17.3 Pitch Pan Supports and Flashings: There shall be no pitch pan supports or flashings unless specifically indicated on the drawings. Any pitch pan used shall have a removable watertight cover.

17.4 Minimum Curb Height Requirements: Curb heights shall be a minimum of 8" unless indicated otherwise in the drawings.

17.5 Equipment Height Requirements: Any equipment that obstructs the reroofing, flashing installation, or future maintenance of areas in, under, and around equipment shall be raised to permit proper work.

17.6 Tolerances (Flashing Location) for Roof Penetrations: Flashings shall be located so as to provide access for maintenance. Flashings shall not be closer than 6 inches from other
flashings and be situated so no flashing interferes with another. Any penetration that does not meet the spacing requirement of 6” for proper flashing separation shall be relocated to allow for proper flashing separation.

18.0 ABANDONED EQUIPMENT:

18.1 General: All abandoned equipment, vents, stacks, or other penetrations no longer necessary as shown on the drawings or as determined by the Owner shall be removed. The roof deck shall be repaired, and the area reroofed in accordance with the Contract Documents.

19.0 CLEANING

19.1 Clean all soiled areas and remove bituminous markings from finished surfaces. Consult Manufacturers products and services for advice and conform to their instructions.

20.0 WARRANTY

20.1 Primary Built-up Roofing Material Manufacturer’s Warranty: Upon completion of the roof, the contractor shall provide the Owner a 20-Year Materials and Labor warranty from the Primary Roofing Material Manufacturer as published in their latest literature.

20.2 Contractor’s Warranty: In addition, the contractor shall provide a notarized document from an authorized agent on company letterhead stating the following:

The building, roofing membrane, metal panels, sealant work (if applicable) and flashings are in conformance with all the requirements of the primary roofing material manufacturer and qualify for the __________________ guarantee (maximum guarantee available) from the ____________________________ (Primary roofing material manufacturer selected).

In addition, should deficiencies (blisters, splits, etc.) and/or leaks occur within the first two years, the contractor shall make repairs as required to maintain the building in watertight condition, in conformance with the requirements in these contract documents, and the requirements of the primary roofing material manufacturer.

Repairs shall be made in a permanent manner in conformance with the standards provided in this document. Any defect causing a leak shall be corrected.

Damage resulting from hurricane force winds, hail, fire, unusual structural movement, structural failure, and abuse are excluded from this agreement.

This agreement in no way absolves the Contractor or Primary Roofing Material Manufacturer from any implied or expressed warranties or fitness for purpose.

20.3 Primary Roof Restoration Material Manufacturer’s Warranty: Upon completion of the roof, the contractor shall provide the Owner a 10-Year Materials and Labor warranty from the Primary Roofing Material Manufacturer as published in their latest literature.

20.4 Primary SPF Roof Material Manufacturer’s Warranty: Upon completion of the roof, the contractor shall provide the Owner a 10-Year Materials and Labor warranty from the Primary Roofing Material Manufacturer as published in their latest literature.
20.5 Other Warranties: In addition the contractor shall provide the followings warranties:

20.5.1 Prefinished Metal: Upon completion the Contractor shall provide a 20-Year warranty from the Prefinished Sheet Metal Manufacturer covering the finish on the prefinished sheet metal.

20.5.2 Lightning Protection: Upon completion of the work, the Contractor shall provide a letter from the Lightning Protection Installer which states that the existing lightning protection system (in the area of roof replacement only) has been installed in order to comply with applicable standards established by the National Fire Protection Association, Underwriters Laboratories, Inc. and the Lightning Protection Institute.

21.0 FLUID APPLIED ROOFING OVER MODIFIED BITUMEN

21.1 MANUFACTURERS


21.1.2 Substitutions: Or equal. Substitution request must be submitted with bid proposal for review and approval.

21.2 ROOF RESTORATION SYSTEM FOR BUILT-UP SMOOTH OR MINERAL MODIFIED SURFACE ROOFS

21.2.1 Revitalizer:

21.2.1.1 Primer: Garla-Prime.

21.2.1.2 Coating: Revitalizer.

21.2.1.3 Flashing: Replace flashings.


21.2.1.5 Surfacing: Mineral.

21.3 EDGE TREATMENT AND ROOF PENETRATION FLASHINGS

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

21.3.2 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.

21.3.3 Pitch pans, Rain Collar 24 gauge stainless or 20oz (567gram) copper. All joints should be welded/soldered watertight. See details for design.

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

21.3.5 Plumbing stacks should be 4lb (1.8kg) sheet lead formed and rolled.
21.3.6 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.

21.3.6.1 Tensile Strength, ASTM D 412: 400 psi
21.3.6.2 Elongation, ASTM D 412: 300%
21.3.6.3 Density @77 degrees F 8.5 lb/gal typical

21.3.7 Fabricated Flashings: 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.

21.3.8 Manufactured Roof Specialties: 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.

21.4 EXAMINATION

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

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

21.4.3 If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

21.5 ROOF PREPARATION AND REPAIR

21.5.1 General:

21.5.1.1 Remove existing roof flashings from curbs and parapet walls down to the surface of the roof. Remove existing flashings at roof drains and roof penetrations.

21.5.1.2 Remove all wet, deteriorated, blistered or delaminated roofing membrane or insulation and fill in any low spots occurring as a result of removal work to create a smooth, even surface for application of new roof membranes.

21.5.1.3 Install new wood nailers as necessary to accommodate insulation/recovery board or new nailing patterns.

21.5.1.4 When mechanically attached, the fastening pattern for the insulation/recovery board shall be as recommended by the specific product manufacturer.

21.5.1.5 Re-roofing over coal tar pitch requires a mechanically attached recovery board or insulation and a base sheet prior to the application of roofing system.

21.5.1.6 Existing roof surfaces shall be primed as necessary and allowed to dry prior to installing the roofing system.

21.5.2 Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
21.5.3 Repair all defects such as deteriorated roof decks; replace saturated insulation board, replace loose or brittle membrane or membrane flashings. Verify that exiting conditions meet the following requirements:

21.5.3.1 Existing membrane is either fully adhered or that the membranes mechanical fasteners are secured and functional.

21.5.3.2 Application of roofing materials over a brittle roof membrane is not recommended.

21.5.4 Remove all loose dirt and foreign debris from the roof surface. Do not damage roof membrane in cleaning process.

21.5.5 Clean and seal all parapet walls, gutters and coping caps, and repair any damaged metal where necessary. Seal watertight all fasteners, pipes, drains, vents, joints and penetrations where water could enter the building envelope.

21.5.6 Clean the entire roof surface by removing all dirt, algae, paint, oil, talc, rust or foreign substance. Use a 10 percent solution of TSP (tri-sodium phosphate), Simple Green and warm water. Scrub heavily soiled areas with a brush. Rinse with fresh water to remove all TSP solution. Allow roof to dry thoroughly before continuing.

21.5.7 Repair existing roof membrane as necessary to provide a sound substrate for the liquid membrane. All surface defects (cracks, blisters, tears) must be repaired with similar materials.

21.5.8 Pre-Treatment of Known Growth - General Surfaces: Once areas of moss, mold, algae and other fungal growths or vegetation have been removed and surfaces have also been thoroughly cleaned, apply a biocide wash at a maximum spread rate of 0.2 gallons/square (0.08 liters/m), to guard against subsequent infection. Allow to dry onto absorbent surfaces before continuing with the application. On non-absorbent surfaces, allow to react before thoroughly rinsing to remove all traces of the solution.

21.6 INSTALLATION

21.6.1 General Installation Requirements:

21.6.1.1 Install in accordance with manufacturer's instructions. Apply to minimum coating thickness required by the manufacturer.

21.6.1.2 Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing the roof system.

21.6.1.3 Insurance/Code Compliance: Where required by code, install and test the roofing system to comply with governing regulation and specified insurance requirements.

21.6.1.4 Protect work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore work damaged by installation of the roofing system.

21.6.1.5 All primers must be top coated within 24 hours of application. Re-prime if more time passes after priming.

21.6.1.6 Keep roofing materials dry during application. Phased construction
can be allowed as long as no, more than 7 days pass between coats excluding primers.

21.6.1.7 Coordinate counter flashing, cap flashings, expansion joints and similar work with work specified in other Sections under Related Work.

21.6.1.8 Coordinate roof accessories and miscellaneous sheet metal accessory items, including piping vents and other devices with work specified in other Sections under Related Work.

21.6.2 Smooth or Mineral Surface Restoration: Renovation work includes:

21.6.2.1 Surface preparation: Remove all loose roofing granules, dirt and foreign debris from the roof surface.

21.6.2.2 Flashing:


b. Parapets and Vertical Surfaces: Prepare parapet walls and vertical surfaces where indicated on the Drawings, with asphalt primer. Allow primer to dry tack free. Apply flashing plies as follows:

   1) Solidly adhere flashing membrane to substrate and nail using termination bar.
   2) Seal all vertical laps of flashing membrane with a three-course application of Flashing Bond and fiberglass mesh and aluminize.
   3) Seal junction of flashing membrane and roof with a three-course application of Flashing Bond and mesh.

c. Metal Flashings: Repair/Replace metal flashings, pitch pockets, etc.

21.6.2.3 Primer: Prime entire roof surface at 1/2 gallon per 100 SF.

21.7 INSTALLATION EDGE TREATMENT AND ROOF PENETRATION FLASHING

21.7.1 Fabricated Flashings: 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.

21.7.2 Manufactured Roof Specialties: Manufactured roof specialties shall conform to the detail requirements of SMACNA "Architectural Sheet Metal Manual" and/or the National Roofing Contractors Association "Roofing and Waterproofing Manual" as applicable.

21.7.3 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 metal edge hooked to continuous cleat and set in bed of roof cement. Fasten flange to wood nailers every 3 inches (76 mm) o.c.
5. Prime metal edge at a rate of 100 square feet per gallon and allow to dry.

6. Strip in flange with base flashing ply covering entire flange in bitumen with 6 inches (152 mm) on to the field of roof. Assure ply laps do not coincide with metal laps.

7. Install a second ply of modified flashing ply in bitumen over the base flashing ply, 9 inches (228 mm) on to the field of the roof. Seal outside edge with rubberized cement.

21.8 CLEANING

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

21.8.2 Remove asphalt markings from finished surfaces.

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

21.9 PROTECTION

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

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

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

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

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

21.10 FIELD QUALITY CONTROL

21.10.1 Require attendance of roofing materials manufacturers' representatives at site during installation of the roofing system.

21.10.2 Perform field inspection and [and testing] as required.

21.10.3 Correct defects or irregularities discovered during field inspection.

21.11 FINAL INSPECTION

21.11.1 At completion of roofing installation and associated work, meet with Contractor, Architect, installer, installer of associated work, roofing system manufacturer's representative and others directly concerned with performance of roofing system.

21.11.2 Walk roof surface areas, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. Identify all items requiring correction or completion and furnish copy of list to each party in
attendance.

21.11.3 If core cuts verify the presence of damp or wet materials, the installer shall be required to replace the damaged areas at his own expense.

21.11.4 Repair or replace deteriorated or defective work found at time above inspection as required to a produce an installation that is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

21.11.5 Architect upon completion of corrections.

21.11.6 Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

21.12 PROTECTION

21.12.1 Protect installed products until completion of project.

21.12.2 Touch-up, repair or replace damaged products before Substantial Completion.

21.13 SCHEDULES

21.13.1 Coatings:

21.13.1.1 Coating: Revitalizer: Multi-purpose liquid waterproofing membrane designed to restore existing smooth surfaced SBS, aged APP, and built-up roof surfaces.

a. Non-Volatile, ASTM D4479: Typical 69%

b. Density, ASTM D 1475: 7.99 lbs./gal

c. Viscosity @ 77 degrees F (25 degrees C), Stormer round blade 16-20 sec

d. Flash Point, ASTM D 93: Minimum 105 degrees F (40.6 degrees C)

e. Asphalt Content ASTM D4479: 62%

f. Compound Stability: Passes 200 degrees F (93.3 degrees C)

g. Wet Film Thickness @ 6 gal. 96 mils

h. VOC: 300 g/l

21.13.2 Reinforcement/Base Coat


22.0 FLUID APPLIED ROOFING OVER SINGLE PLY ROOFING

22.1 ACCEPTABLE MANUFACTURERS

22.1.1 Basis of Design, The Garland Company: Materials, manufacturer’s product designations, and/or manufacturer’s names specified herein shall be regarded as the minimum standard of quality required for work of this section. The Garland
22.1.2 Substitutions: Or equal. Substitution request must be submitted with bid proposal for review and approval.

22.2 DESCRIPTION

22.2.1 Restoration work including but not limited to:
A multi-purpose, high build, urethane, liquid waterproofing membrane designed to maintain, restore and upgrade the performance of existing single-ply membranes, modified membranes, asphalt, profiled metal sheet and asbestos cement sheet. (White Knight)

- Elongation (ASTM D 412) 360%
- Tensile Strength (ASTM D 412) 1500 psi
- Tear Resistance (ASTM D 1004) 140 lbs/in.
- Energy Star Approved Yes
- Flash Point 110°F (43°C)
- Non-Volatile (ASTM D 75) 83%

22.3 SINGLE PLY MEMBRANE CHARACTERISTICS

22.3.1 All field and flashing repairs made with single ply membrane must be done with a cured membrane of a like material to the existing roof membrane

1. EPDM Reinforced
   - Elongation (ASTM D4637) 250%
   - Tearing Strength (ASTM D751) 150 lbf
   - Brittleness Point (ASTM D2137) -49°F (-45°C)
   - Thickness of membrane (ASTM D751) .045 in.

22.4 WASHES FOR MEMBRANE PREPARATION

22.4.1 Cleaner wash for preparing surface for polyurethane coating.

1. Simple Green: All-purpose Industrial degreaser/cleaner

22.5 ADHESIVES/SEALANTS

22.5.1 Adhesives used to adhere to single ply membranes in field and flashing repairs.

1. Lap Sealant: A one-part, elastomeric sealant designed for sealing the exposed edge of an EPDM, against the effects of weathering.

22.6 FIBERGLASS/POLYESTER REINFORCEMENT PHYSICAL PROPERTIES

22.6.1 Restoration work including but not limited to:

22.7 EXECUTION, GENERAL

22.8.1 Comply with requirements of Division 01 Section "Common Execution Requirements."

22.8 EXAMINATION

22.8.1 Examine substrate surfaces to receive coating and associated work and conditions under which roofing will be installed. Do not proceed with roofing until unsatisfactory conditions have been corrected in a manner acceptable to Installer.

22.9 GENERAL INSTALLATION REQUIREMENTS

22.9.1 Cooperate with manufacturer, inspection and test agencies engaged or required to perform services in connection with installing the roof system.

22.9.2 Insurance/Code Compliance: Where required by code, install and test the roofing system to comply with governing regulation and specified insurance requirements.

22.9.3 Protect other work from spillage of roofing materials and prevent materials from entering or clogging drains and conductors. Replace or restore other work damaged by installation of the roofing system.

22.9.4 Urethane coating Rate: Urethane coating shall be applied at no less than two (2.0) gallons/square (0.82 liters/m²) for non-reinforced system in the field with a two (2.0) gallon/square (0.82 liters/m²) base coat on all seams, flashings and penetrations.

22.9.5 Apply roofing materials as specified herein unless recommended otherwise by manufacturer’s instructions. Keep roofing materials dry during application. Do not permit phased construction.

22.10 CLEANING AND SURFACE PREPARATION

22.10.1 All defects such as deteriorated roof decks must be repaired; saturated insulation board must be replaced, etc. per Garland specifications prior to application of the urethane coating materials. Verify that existing conditions meet the following requirements:

1. The existing membrane is either fully adhered or that the membranes mechanical fasteners are secured and functional.

2. Application of roofing materials over a brittle roof membrane is not recommended.

22.10.2 Remove all loose dirt and foreign debris from the roof surface.

22.10.3 Do not damage roof membrane in cleaning process.

22.10.4 Clean and seal all parapet walls, gutters and coping caps, and repair any damaged metal where necessary. Seal watertight all fasteners, pipes, drains, vents, joints and penetrations where water could enter the building envelope.
22.10.5 Clean the entire roof by removing all dirt, algae, paint, oil, talc, rust or foreign substance. Use a 10% solution of TSP (tri-sodium phosphate), Simple Green and warm water. Scrub heavily soiled areas with a brush. Rinse with fresh water to remove all TSP solution. In ponding areas be sure to rinse at least twice to make sure all cleaning solution is rinsed clean. Cleaning residue will act as a bond breaker if not properly rinsed. Allow roof to dry before continuing.

22.10.6 Repair existing roof membrane as necessary to provide a sound substrate for the liquid membrane. All surface defects (cracks, blisters, tears) must be repaired with similar cured material.

22.10.7 Repair existing roof membrane as necessary to provide a sound substrate for the liquid membrane. Repair all surface defects (cracks, blisters, tears):

22.10.8 Blister Repairs
1. Clean the repair area.
2. All blisters must be cut and opened. Use a roofer's knife to open the blister with an "X" or "H" cut. Fold the flaps and remove any existing moisture. Permit the area to dry before applying repair materials.
3. All membranes require being repair with EPDM cover strip (cured membrane) and splice tape, on all of the seams that are repaired.
4. After positioning the six (6) inch reinforcement to roll out, apply White-Knight on about 8 in (20 cm) wide to surface where reinforcement ply is going to be applied. Do not apply White-Knight too far ahead of fabric or coating may dry before fabric can be embedded. The minimum application rate should be 1.5 gallons/square (0.61 liters/m²). Immediately roll 6 in (15 cm) width reinforcement into coating. Care should be taken to lay the fabric tight to the roof surface without air pockets, wrinkles, fishmouths, etc.
5. After embedding reinforcement into the White-Knight/ Stallion, apply additional White-Knight/ Stallion to completely saturate the fabric at minimum application rate of 1.0 gallon/square (0.41 liters/m²). This saturation coat should be applied as soon as possible after embedding reinforcement into the White-Knight/ Stallion.
6. During this process be sure to keep the application saturated with White-Knight to prevent plucking or snagging of reinforcement. Allow to dry for a minimum of 24 hours before applying finish coats.

22.10.9 Tears and Open Lap Repairs
1. All tears and open laps require reinforcement or self-stick EPDM flashing membrane and butyl tape, on all of the seams.
2. After positioning reinforcement to roll out, apply White-Knight about 8 in (20 cm) wide to surface where reinforcement ply is going to be applied. Do not apply White-Knight too far ahead of fabric or coating may dry before fabric can be embedded. The minimum application rate should be 1.5 gallons/square (0.61 liters/m²). Immediately roll 6 in (15 cm) width reinforcement into coating. Care should be taken to lay the fabric tight to the roof surface without air pockets, wrinkles, fishmouths, etc.
3. After embedding reinforcement into the White-Knight/ Stallion, apply additional White-Knight/ Stallion to completely saturate the fabric at...
minimum application rate of 1.0 gallon/square (0.41 liters/m²). This saturation coat should be applied as soon as possible after embedding reinforcement into the White-Knight/Stallion.

4. During this process be sure to keep the application saturated with White-Knight/Stallion to prevent plucking or snagging of reinforcement. Allow to dry for a minimum of 24 hours before applying finish coats.

22.11 PRE-TREATMENTS

22.11.1 Known Growth - General Surfaces: After areas of moss, mold, algae and other fungal growths or vegetation have been removed and surfaces have been thoroughly cleaned, apply a biocide wash (TSP, Simple Green) at a maximum spread rate of 0.2 gallons/square (0.1 liters/m²), to guard against subsequent infection. Allow to dry onto absorbent surfaces before continuing with the application. On non-absorbent surfaces, allow to react before thoroughly rinsing to remove all traces of the solution. Note: See Health & Safety data before use.

22.12 SYSTEM APPLICATION PARTIALLY REINFORCED

22.12.1 Applying Reinforcement and White-Knight to field seams to be covered:

1. Determine where first run of 6 in (15 cm) reinforcement will be started.

2. After positioning reinforcement to roll out, apply White-Knight about 8 in (20 cm) wide to surface where reinforcement ply is going to be applied. Do not apply White-Knight too far ahead of fabric or coating may dry before fabric can be embedded. The minimum application rate should be 1.5 gallons/square (0.61 liters/m²). Immediately roll 6 in (15 cm) width reinforcement into coating. Care should be taken to lay the fabric tight to the roof surface without air pockets, wrinkles, fishmouths, etc.

3. After embedding reinforcement into the White-Knight, apply additional White-Knight to completely saturate the fabric at minimum application rate of 1.0 gallon/square (0.41 liters/m²). This saturation coat should be applied as soon as possible after embedding reinforcement into the White-Knight.

4. Total White-Knight used to embed and saturate the reinforcement should be a minimum of 2.5 gallons/square (1.0 liters/m²).

5. During this process be sure to keep the application saturated with White-Knight to prevent plucking or snagging of reinforcement. Allow to dry for a minimum of 24 hours before applying finish coats.

22.12.2 Application of White-Knight Finish Coats:

1. Before application of finish coat your local Garland Representative needs to inspect application.

2. After field seam application has been complete and allowed to dry, apply White-Knight in a uniform manner at minimum application rate of 2.0 gallon/square (0.82 liters/m²).

3. During final application of the White-Knight special attention should be given to coating flashings and other critical areas to build adequate membrane thickness. Multiple coats may be necessary on verticals to
prevent sagging. In any event all specified material must be applied and minimum membrane thickness achieved.

22.12.3 Membrane Deterioration:
1. It is recommended that Garland’s fiberglass/ polyester mat be used over areas of the membrane that are in deteriorated condition.
2. Apply urethane coating at a rate of 1.5 gallons/square (0.61 liters/m²), embed fiberglass/polyester mat and brush in. Then apply another 1.0 gallons/square (0.61 liters/m²) over the mat.
3. Let material dry 24 hours, before coating the field of the roof with 2.0 gallons/square (0.82 liters/m²), or 32 mils wet film thickness, for the finish coat.

22.12.4 Coating shall be applied in strict accordance with manufacture’s published directions and instructions.
1. Manual Application:
   a. Pour urethane coating onto roof in 24 in. (60 cm) rows and spread with ½ in. nap or foam roller.
   b. Back roll urethane coating with an 18 in. (45 cm) wide ½ in. nap roller for even application. Quality check that coating meets 2.0 gallons/square (0.82 liters/m²), or 32 mils wet film thickness.
2. Spray Application:
   a. Spray across roof, back-roll as needed to ensure uniform coverage, then back spray across the same area to complete application.
   b. Spray Pump Recommendations:
      1) Pump Ratio 45:1
      2) Hose ¾ ID Hose first 100 ft. (30 m) with swivel connections and ½ in. ID Hose for second 100 ft. (30 m).
      3) Pressure 5000 psi.
      4) Working pressure is 2700 to 3000 at the gun. Depending on equipment setup, you may be able to spray the coating as low as 1800 psi. Based on tip size, raise pressure to remove fingers in spray pattern.
      5) High pressure fittings.
      6) Input flow 100 psi.
      7) Tip = .032 - .037 for a 8 in. (20 cm) pattern at 12 in. (30 cm) distance.
      8) Recommended 12 in. (30 cm) extension with swivel tip.
      9) Tip and pump sizes will change depending on temperature and pattern concerns.
   c. All material must be applied smoothly with proper film thickness, at a uniform spread rate of 4.5 gallons/square (0.61 liters/m²) for reinforced system.
d. Keep wet film gauges on-hand at all times during the application process to ensure proper coverage. Coverage rates below will designate gallons, wet mils, and dry mils.

1) 1.0 gallons will equal 16 wet mils and 12 dry mils
2) 1.5 gallons will equal 24 wet mils and 19 dry mils
3) 2.5 gallons will equal 40 wet mils and 32 dry mils
4) 4.5 gallons will equal 72 wet mils and 57 dry mils

22.13 FIELD QUALITY CONTROL

22.13.1 Require attendance of roofing materials manufacturers' representatives at site during installation of the roofing system. Perform field inspection and testing as required.

22.13.2 Correct defects or irregularities discovered during field inspection.

22.14 CLEANING

22.14.1 Remove dirt and debris from all walls, windows, floors, ladders and finished surfaces.

22.14.2 In areas where finished surfaces are soiled by dirt, debris or any other sources of soiling caused by work of this section, consult manufacturer of surfaces for cleaning instructions and conform to their instructions.

22.14.3 Repair or replace defaced or disfigured finishes caused by work of this section.

22.15 CONSTRUCTION WASTE MANAGEMENT

22.15.1 Remove and properly dispose of waste products generated during roofing procedures. Comply with requirements of authorities having jurisdiction

22.16 FINAL INSPECTION

22.16.1 At completion of roofing installation and associated work, meet with Contractor, Architect, installer, installer of associated work, Owner, roofing system manufacturer's representative and other representatives directly concerned with performance of roofing system.

22.16.2 Walk roof surface areas of the building, inspect perimeter building edges as well as flashing of roof penetrations, walls, curbs and other equipment. List all items requiring correction or completion and furnish copy of list to each party in attendance.

22.16.3 The roofing system manufacturer reserves the right to request a thermographic scan of the roof during final inspection to determine if any damp or wet materials have been installed. The thermographic scan shall be provided by the Roofing Contractor.

22.16.4 If core cuts verify the presence of damp or wet materials, the Roofing Contractor shall be required to replace the damaged areas at his own expense.
22.16.5 Repair or replace deteriorated or defective work found at time above inspection as required to produce an installation which is free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

22.16.6 Notify the Architect and Owner upon completion of corrections.

22.16.7 Following the final inspection, provide written notice of acceptance of the installation from the roofing system manufacturer.

22.16.8 Immediately correct roof leakage during construction. If the Contractor does not respond within twenty four (24) hours, the Owner will exercise rights to correct the Work under the terms of the Conditions of the Contract.

22.17 DEMONSTRATION AND TRAINING

22.17.1 At a time and date agreed to by the Owner, instruct the Owner’s facility manager, or other representative designated by the Owner, on the following procedures:

1. Roof troubleshooting procedures.
2. Notification procedures for reporting leaks or other apparent roofing problems.
3. Roofing maintenance.
4. The Owner's obligations for maintaining the roofing warranty in effect and force.
5. The Manufacturer's obligations for maintaining the roofing warranty in effect and force.

23.0 SPRAYED POLYURETHANE FOAM ROOFING

23.1 MANUFACTURERS

23.1.1 NEOGARD Division of Jones-Blair Company, 2728 Empire Central, Dallas, TX 75235, (800) 321-6588, www.NEOGARD.com for the elastomeric polyurethane coating.

23.1.2 BASF Corporation, 1609 Biddle Avenue, Wyandotte, MI 48192, (800) 547-4004, www.basf.com/spray for the spray polyurethane foam (SPF).

23.2 MATERIALS

23.2.1 Sprayed Polyurethane Foam

1. The sprayed polyurethane foam insulation shall be a two-component system made by combining an isocyanate (A) component with a polyol (B) component. The sprayed polyurethane foam system shall be BASF Elastospray ALPHA (B) component and Elastospray (A) component as made by BASF Corporation or ALPHA program approved equal.

2. The cured sprayed in place polyurethane foam shall have the following minimum characteristics:

   i. PERFORMANCE REQUIREMENTS FOR CURED FOAM
   ii. PHYSICAL PROPERTIES TEST METHOD RESULTS
iii. Tensile Strength ASTM D1623 60-80 psi
iv. Density ASTM D 1622 2.9-3.2 pcf
v. Compressive Strength
vi. (parallel to rise)
vii. ASTM D1621 55 +/- 5% psi @ yield
viii. Closed Cell Content ASTM D1940 >90% min.
ix. Humid Aging (& % linear change) 158oF, 97% RH, 28 xi. Day
xii. ASTM D2126 -0.26%

23.2.2 Elastomeric Coating System

1. The elastomeric polyurethane coating shall be the Permathane II FR system as manufactured by NEOGARD®, Dallas, TX and consist of 70620 base coat and 70611 series top coat.

2. Performance requirements for cured elastomeric coating system used on this project are:

i. PERFORMANCE REQUIREMENTS FOR CURED FILM
ii. PHYSICAL
iii. PROPERTIES
iv. TEST
v. METHOD BASE COAT TOPCOAT
vi. Tensile Strength ASTM D412 1,000 psi 1,500 psi
vii. Elongation ASTM D412 375% 360%
viii. Permanent Set ASTM D412 <10% <10%
ix. Tear Resistance ASTM D1004 100 lb/in 140 lb/in
x. Water Resistance ASTM D471 <3 @ 7 days <3 @ 7 days
xi. MVT @ 30 mils ASTM E96 1.6 Perms 2.2 Perms
xii. Shore A ASTM D2240 50 - 55 70 - 75
xiii. Adhesion ASTM D903 20 lb/in 15 lb/in
xiv. Weathering
xv. Resistance ASTM D822 N/A Slight Chalk
xvi. Thermal Shock Alternate
xvii. Heat/Cold
xviii. No Loss of
xix. Adhesion
xx. No Loss of
xxi. Adhesion
xxii. Fire Resistance ASTM E108,
xxiii. UL 790 System Rated Class "A"

23.2.3 ACCESSORIES

1. Miscellaneous materials such as primers, elastomeric sealants, metal, vents, and drains shall be a composite part of the roof system and shall be compatible with the ALPHA roofing system.

23.3 EXECUTION

23.3.1 SURFACE PREPARATION

1. Existing substrates must be clean, dry and free of all loose dirt, dust and debris. Oil, grease, release agents or other contaminants shall be removed with proper cleaning solutions. When installing sprayed polyurethane foam over existing built up, modified bitumen, single ply, metal or other existing roof assemblies, a nondestructive evaluation using infrared, technology shall be required. In lieu of a nondestructive evaluation, core cuts may be taken a minimum of 1 every 10 squares in the existing roof assembly down to the structural deck to confirm the existing assembly is free of trapped moisture. Licensed applicator must provide written verification of the test method used for determining the condition of the existing roofing system. Written verification must include a roof diagram indicating where core cuts were taken, or a copy of the nondestructive roof scan. Licensed applicator must also confirm that all wet roofing materials have been removed and replaced with like and kind materials prior to installation of sprayed polyurethane foam.

2. Aged Polyurethane foam roof systems:

A. Remove the top ½” of the existing surface of the sprayed polyurethane foam/coating system by means of a mechanical scarifier to a level surface. Any wet or loose areas shall be completely removed and replaced to grade.

B. Vacuum or blow the resulting polyurethane foam surface free of all dust and debris.

C. Prime surface of the polyurethane foam with a dark primer as recommended by the sprayed polyurethane foam Manufacturer.

D. Apply a minimum of 1” sprayed polyurethane foam to the resulting primed sprayed polyurethane foam surface with the first pass of foam being ½” thick.

3. Other Considerations: Lightning rods, security devices, electrical conduits and other ancillary rooftop projections and/or equipment shall be masked prior to the application of the polyurethane foam. Lightning rod cables shall not be embedded in the SPF and should be removed prior to the SPF application. Electrical and mechanical conduits should be relocated or raised above the roof surface.
23.3.2 SPRAYED POLYURETHANE FOAM APPLICATION

1. APPLICATION

A. The sprayed polyurethane foam application shall not proceed during a period of inclement weather, nor should any SPF be applied until exterior surfaces are thoroughly dry. The SPF shall not be applied below an ambient air or substrate temperature of 40°F (4.4°C) and/or above 85% relative humidity.

B. The application of the polyurethane foam shall be in accordance with sprayed polyurethane foam Manufacturer’s instructions.

C. The sprayed polyurethane foam shall be applied in a minimal pass thickness of ½ inch.

D. The spray equipment used shall be that recommended by the sprayed polyurethane foam Manufacturer.

E. The sprayed polyurethane foam thickness shall be a minimum of 1.5 inches after cured. The polyurethane foam shall be applied uniformly over the entire surface with a tolerance of plus ¼ inch of thickness minus 0, except where variations are required to insure proper drainage or to complete a feathered edge. The sprayed polyurethane foam shall not be applied in thickness greater than 2 inches in one pass.

F. The final sprayed polyurethane foam surface texture shall be “smooth, orange peel, course orange peel, or verge of popcorn”. SPF surfaces termed “popcorn” or “treebark” surfaces are unacceptable. These areas shall be removed and re-sprayed to an acceptable surface. (See Addendum A)

G. The SPF shall be uniformly terminated a minimum of four (4) inches above the roofline at all penetrations (except drains, parapet walls, or building junctions). Sprayed in place cants shall be smooth and uniform to allow positive drainage. (See Addendum B – Detail Drawings) Snowmen, term used to describe the finish of sprayed polyurethane foam, is not acceptable.

H. If polyurethane foam is not coated within 24 hours, surface shall be examined for surface oxidation and moisture contamination. If oxidation or contamination exists, contact the ALPHA sprayed polyurethane foam Manufacturer for recommendations.

J. Any damage or defects to the polyurethane foam surface shall be repaired prior to the elastomeric polyurethane coating application.

2. Flashings and Coverings: Flashings and waterproof coverings for expansion joints shall be uncured, non-staining, 60 mil (0.060”) Neoprene elastomer sheet material.

23.3.3 ELASTOMERIC POLYURETHANE COATING APPLICATION

1. ALPHA System: The fluid-applied elastomeric protective coating system, herein specified, shall be applied in accordance to the procedures outlined below. The composite protective coating system includes the following:
A. Base Coat:
   i. The initial base coat shall be applied the same day as the sprayed polyurethane foam. If due to weather conditions, more than 24 hours elapse between sprayed polyurethane foam and the base coat application, the sprayed polyurethane foam shall be inspected for UV degradation by an approved third party inspector. If such degradation is present contact the sprayed polyurethane foam Manufacturer for recommended procedures.
   ii. The sprayed polyurethane foam shall be free of dust, dirt, contaminants and moisture prior to the application of the base coat.
   iii. Apply the elastomeric polyurethane 70620 Series base coat membrane at a minimum rate of 3 gallons per 100 sq.ft. in a minimum of 2 coats to yield an average thickness of 37 dry mils in strict accordance with procedures outlined by NEOGARD.

B. Topcoat:
   i. Subsequent coating shall be applied in a timely manner to insure proper adhesion between coats.
   ii. The previous base coat shall be allowed to cure and be inspected for pinholes, thinly coated areas, uncured areas or other defects. Any defects shall be repaired prior to the topcoat application. The base coat shall be free of dirt, dust, moisture, or other contaminants prior to the application of the topcoat.
   iii. Apply the elastomeric polyurethane 70611 Series topcoat membrane at a minimum rate of 3/4 gallon per 100 sq.ft. in 1 coat to yield an average thickness of 9 dry mils in strict accordance with application procedures outlined by NEOGARD.
   iv. The cured dry film thickness of the finished multiple coat application shall be checked according to NEOGARD’s specifications. Areas that are found to have less than the thickness specified shall require additional coating.

C. Aggregate Finish:
   i. Apply the elastomeric polyurethane 70611 Series topcoat membrane at a minimum rate of 3/4 gallon per 100 sq.ft. in 1 coat to yield an average thickness of 9 dry mils in strict accordance with application procedures outlined by NEOGARD.

   Immediately broadcast a Neogard approved #11 roof granules into wet coating at the rate of 30 lbs. per 100 square feet.

   When dry, remove excess loose granules. Minimum coating thickness of the system at any point on the roof to be 20 dry mils beneath the aggregate. The above application rates are theoretical, calculated for glass-smooth surfaces with no allowances made for loss, job
or surface conditions. The applicator is to compensate for these conditions and provide the specified dry mils coverage rather than apply the coatings at only the theoretical coverage rate.

23.3.4 FIELD QUALITY CONTROL

1. Prior to beginning any work, a representative from Neogard, Applicator and Owner shall meet at the project site in a preconstruction meeting to identify any risks and assist the Alpha Approved Applicator in developing a Risk Management Plan (RMP).

2. From preconstruction through project completion the applicator is to provide the ALPHA Manufacturers, PBSRG, and the Owner with Weekly Risk Reports. (See Addendum C)

3. Following project completion, a detailed inspection shall be conducted by an approved third party inspector.

4. Site Condition: Leave all areas around job site free of debris, roofing materials, equipment and related items after completion of job.

5. Notification of Completion: Notify the manufacturer by means of manufacturer’s printed Notification of Completion form of job completion in order to schedule a final inspection date.

   A. Final Inspection

   B. Post-installation Meeting: Hold a meeting at the completion of the project, attended by all parties that were present at the pre-job conference. A punch list of items required for completion shall be compiled by the Contractor and the manufacturer’s representative. Complete, sign, and mail the punch list form to the manufacturer’s headquarters.

6. Issuance of The Guarantee: Complete all post installation procedures and meet the manufacturer’s final endorsement for issuance of the specified guarantee.

7. Pre-Construction Discussion items

   A. The meeting is to occur one week prior to starting work and is to include the MSU Roofing Department Staff.

      i. Review preparation and installation procedures and coordinating and scheduling required with related work.

      ii. Review methods and procedures for roofing installation, and manufacturer’s written procedures.

      iii. Review schedule and facilities needed for progress and avoid delays.

      iv. Examine deck substrate conditions and finishes.

      v. Review special installation details.

      vi. Review temporary protection requirements.

      vii. Review manufacturer inspection requirements and forms.

      viii. Final roof inspections will include acceptance from the manufacturer, General Contractor, subcontractor,
23.3.5 CLEANING

1. Remove debris, resulting from completion of coating operation, from the project site.

END OF SECTION