PART 1 GENERAL

1.01 WORK SPECIFIED HEREIN
A. This Specification shall cover the furnishing of all labor, equipment, materials, accessories and services necessary to furnish and install roof insulation and roofing system as indicated and specified.
B. Installation of new asphalt built-up, gravel surfaced roofing system and flashings, complete with new wood nailers and new sheet metal as specified.
C. Provision of temporary roof membrane seals as required to maintain watertight conditions and protect roofing system during installation.

1.02 REFERENCE STANDARDS
A. Reference to standards and/or specifications herein shall be interpreted to mean the latest revision unless noted otherwise. The following abbreviations appear in the specification:
   ASTM American Society for Testing and Materials
   AWPI American Wood Preservers Institute
   FM Factory Mutual Engineering Corporation
   FS Federal Specification
   NRCA National Roofing Contractors Association
   OSHA Occupational Safety and Health Administration
   UL Underwriters Laboratory
B. The following standards shall be made a part of this Specification:
   ASTM C208 Standard Specification for Insulating Board (Cellulosic Fiber), Structural and Decorative
   ASTM D312-84 Standard Specification for Asphalt Used in Roofing, Type IV
   ASTM D2178-89 Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing
   ASTM D4586-86 Standard Spec. for Asphalt Roof Cement, Asbestos Free, Type I
   ASTM D4601-86 Specification for Asphalt Coated Base Sheet Used in Roofing Type II.
   AWPI LP-2 Wood Preservative
   FM I-90 Factory Mutual Construction Bulletin 1-28, (Roof Assembly Classifications; Class I, and I-90 Approvals).
   FS LL-L-535A Insulation Board, Thermal
   FS SS-CC-153 Roof Cement
   FF SS-R-620b Roofing Felt, Roll, Asphalt-Prepared
   NCRA Deck Dryness Test
   UL 790 Tests for Fire Resistance of Roof Covering Materials, Class A Rated
C. Permission for deviation from these standards and/or specifications must be approved, in writing, by the Roofing Program Coordinator in advance of Bid Proposal submittal.

1.03 QUALITY ASSURANCE
A. Manufacturer shall be an Associate Member, in good standing, of the National Roofing Contractors Association and Western States Roofing Contractors Association.
B. Manufacturer shall be nationally recognized in the roofing, waterproofing industry for fifty years.
C. Contractor shall be the roofing material manufacturer's approved qualified applicator.
D. Upon request by the Engineer, the Contractor shall provide the names of at least ten jobs from the greater Phoenix area, available for inspection by the Roofing Program Coordinator, that are similar or identical to the system specified in this Specification.
E. Contractor's designated foreman shall have a minimum of five years experience in the Installation of asphalt built-up roofing systems similar to the system specified in this Specification.
F. The completed roofing system assembly shall meet or exceed the UL Assembly #790, Class B requirements.
G. Materials shall be typically installed in compliance with the "NRCA Construction Details" as published by the National Roofing Contractors Association, unless otherwise expressly noted within this specification. Any deviations from these details and this specification, required by the roofing material manufacturer for its compliance with paragraph 1.4 Guarantee, shall be submitted in writing with the contractor's Form of Proposal.

1.04 GUARANTEE
A. The manufacturer/supplier of the materials for the roofing system shall provide a ten-year non-prorated guarantee covering materials and workmanship against any leaks, defects, or other deterioration of the system occurring from material performance failure or workmanship. Any such leaks, defects, or deterioration shall be repaired at no cost to purchaser. The purchaser will periodically inspect the roofing system and have a contractor approved by the material manufacturer perform annual maintenance items as necessary.
B. In conjunction with manufacturer's guarantee, the Contractor shall provide a two-year guarantee covering repair/ replacement of any materials and workmanship comprising the Contract Work resulting in leaks, defects or other deterioration of the system. Any leaks, defects or deterioration shall be repaired at no cost to Purchaser.
C. Unless otherwise expressly noted within this Specification, the roofing system installed shall comply with the applicable roofing material manufacturer's written recommendations.
D. Upon completion of project and payment by Purchaser, Manufacturer shall deliver to purchaser a ten year manufacturer Roof System Quality Assurance Warranty and Owner's manual. Manufacturer will, during the second and fifth year of the warranty, inspect the roofing and provide a written executive summary regarding condition and serviceability of roof.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Materials shall be stored on pallets or equivalent wood blocking.
B. All materials shall be covered with waterproof covering top to bottom. Covering shall be secured with twine or rope.
C. Roofing materials shall be handled so as to avoid bending, tearing or other damage during transportation and installation.
D. Roofing felts, asphalt and other materials shall be stored in a place protected from water and extreme temperatures.
E. Rolls of roofing felt shall be stored on ends only. Rolls which have been flattened or otherwise damaged shall be discarded.
F. Material handling equipment shall conform to, and be operated in conformance with, OSHA and local building code requirements.
G. Material handling equipment shall be selected and operated so as not to damage newly applied roofing, the existing roof system or the building. Do not load materials or operate equipment on any roof area in a manner that could endanger or disturb occupants of the building. The Engineer will determine lay down and storage area locations available to the Contractor at the pre-bid conference.
H. Asphalt shall be delivered to project site with manufacturer's label intact, showing characteristics and EVT of product. No bulk shipment or tanker supplied asphalt will be permitted.

1.06 SITE CONDITIONS
A. Access to roof shall be from the exterior. Coordinate access and work with the Engineer.
B. Installation work shall not be performed during rainy or inclement weather. Maintain building weather tight during inclement weather. Engineer may stop project if, in his/her opinion, the work should not be continued due to adverse weather conditions.
C. Contractor shall assume that the building space directly under the roof areas included by this specification will be occupied and utilized for ongoing operations. Contractor shall not interrupt Purchaser's operations unless written approval is received from the Engineer.

1.07 SUBMITTALS
Submit manufacturer’s literature indicating roofing system and roof insulation to be provided. Literature/catalog cut sheets submitted shall be for same product and manufacturer as listed by the Contractor on its Form of Proposal for the respective project. Minimum aged “R” value for one inch of insulation board shall be 4.17.

PART 2 PRODUCT

2.01 INSULATION
A. Insulation shall be fiberglass insulation board as manufactured by Owens-Corning Fiberglas or similar, as approved by Roofing Program Coordinator, installed in two layers of minimum 3/4 inch board with total thickness of insulation to be equal to insulation removed or as shown on the plans.
B. Insulation shall conform to FS HH-I-526 and ASTM C726. Insulation to be supplied in nominal 24 by 48 inch boards with asphalt adhered kraft paper cover.
C. Insulation shall be compatible with roofing system and be approved by roofing material manufacturer.
D. Insulation shall remain dimensionally stable for the life of the roof system.
E. Insulation tape, if desired by manufacturer, shall be fiberglass roof tape as supplied by Owens-Corning Fiberglas Corporation.

2.02 BASE SHEET
Base sheet shall be roofing material manufacturer's standard asphalt coated fiberglass base sheet minimum weight of 25 pounds per square, Conglas W-1 or Perma Ply No. 28, conforming to specification requirements.

2.03 ASPHALT BUILT UP SYSTEM
Asphalt built-up roofing system shall be as listed below or similar system meeting this specification as approved by Roofing Program Coordinator:
A. Fiberglass Felt: Type V1 fiberglass felts by Tremco, Conglas, or Owens-Corning Fiberglas in accordance with ASTM D2178.
B. Special Steep Asphalt: Steep Roofing Asphalt, Tremco Premium Type IV, conforming with requirements of ASTM D312, Type IV, provided by Tremco.
C. Roofing aggregate: Roofing aggregate shall meet requirements of ASTM D1863 and shall be hard, durable, opaque, washed free of clay, loam, sand or other foreign substances. No.5 granite, or clean/washed river aggregate sieve graded 3/16 inch to 3/8 inch is acceptable.
D. Weathering Surface Bitumen: Flood coat for embedment of aggregate shall be Tremco thermastic adhesive conforming to ASTM D36, and ASTM D92. (Softening point 195 degrees to 205 degrees Fahrenheit.)

2.04 PLASTIC CEMENT
A. In all exposed locations plastic cement shall be Tremco standard product, Tremco Polyroof, (conforming to FS SS-CC-153, Type 1, and ASTM D4586).
B. In concealed applications, not exposed to weather, plastic cement may be Tremco ELS, (conforming to FS SS-CC-153, Type I), or similar product approved by Roofing Program Coordinator.

2.05 STACK FLASHING
Stack flashing shall be four-pound lead with four inch flange. For pipes three inches or less in diameter, provide preformed lead counterflashing collar.

2.06 NAILERS
B. Nails shall be sized for adequate penetration and anchorage. Case hardened nails shall be used for concrete.
2.07 **MEMBRANE FLASHING**
Membrane flashing shall be SBS modified bitumen sheet MB3G25 mineral surfaced, as supplied by Tremco, or similar asphalt modified bitumen having a core of spunbound polyester mat coated with durable modified asphalt as approved by Roofing Program Coordinator. Membrane shall be formulated for hot asphalt mopping application. Ply sheet shall be Poly-Therm as supplied by Tremco.

2.08 **WALKWAY PADS**
Walkway pads shall be APOC "Dek-Top," Carey "Careytred," or W. R. Meadows "Seal-tight Protection Course," granular surfaced asphaltic boards not less than 1/2-inch thickness. Walkway pads must be of a material compatible with roofing system.

2.09 **INSULATION FASTENERS (STEELDECK)**
A. From Fabco Fastening Systems, West Newton, PA:
   a. Insul-Fixx (plastic disc or metal plate).
   b. Plate-Fixx (plastic disc).
B. From Buildex Div. of ITW, Itasca, IL:
   a. Roofgrip (plastic disc or metal plate).
   b. Climasealed Roofgrip (plastic disc or metal plate).
C. From B.F. Goodrich, Akron, OH:
   a. Lexsuco Insulation Clips with universal metal plate discs.
   b. Lexsuco Insulation Screw Fasteners ("R"ustop plastic discs).
D. Screw/clip length: Sufficient to engage steel deck.

2.10 **BASE SHEET FASTENERS (LIGHTWEIGHT CONCRETE)**
A. Tube-Lock Self Locking Tube Nail by Simplex
B. Zonolite Base Ply Fasteners by W. R. Grace
C. Capped E/S Nails by E S Products

**PART 3 EXECUTION**

3.01 **INSPECTION**
A. Roofing system shall not be installed until all unsatisfactory conditions affecting roof installation and durability are corrected. Beginning work constitutes acceptance of conditions by Contractor.
B. Verify that any remaining work of other trades requiring men and/or equipment to traverse roof deck has been approved by the Engineer and material manufacturer's representative.
C. Check projections, curbs, walls and deck for inadequate anchorage, foreign material, moisture or unevenness preventing execution or adversely affecting quality of new roofing system. Correct any deficiencies.
D. Examine the underside of metal roof deck for any piping, conduit or other equipment that could be damaged by penetration of metal deck by insulation mechanical fasteners. If any such items exist, determine with the Engineer proper protective procedures to follow to ensure no damage occurs due to installation of mechanical fasteners.

3.02 **PROTECTION**
A. Contractor shall be responsible for protection of property, including all areas around buildings, during course of work. All damage caused by this Contractor shall be repaired by this Contractor, at his expense, to its original condition to the complete satisfaction of the Engineer.
B. Protect building surface at laydown area with tarpaulins, secured in place. Provide dumpster or approved container for receiving debris. Spilled or scattered debris shall be cleaned up immediately. Removal material to be disposed of from roof as it accumulates and in a manner that will not allow accidental damage to adjacent critical equipment.
C. Asphalt built-up roofing system and flashings shall be fully installed and sealed in a watertight manner on the day of installation and before arrival of inclement weather. Night seals will be closely examined by job foreman after each working day to ensure watertightness. Prior to removal of temporary and daily waterstops/tie-ins, all ponded water shall be removed in such a...
manner as not to create any water penetration into the building. Contractor shall be responsible for any water damage to the building and/or contents.

D. Contractor shall instruct and supervise his workmen to ensure that aggregate, asphalt and/or debris is not tracked into new work areas or into areas adjacent to the work site.

3.03 CONSTRUCTION PREPARATION
A. Work sequence shall be scheduled to avoid use of newly constructed roofing for storage, walking surface, or equipment movement. Equipment and ground storage areas shall be moved to designated locations as work progresses.
B. Drains shall be plugged with rags to prevent debris entry. Plugs shall be removed at end of each workday and before arrival of inclement weather. Coordinate with the Engineer the closing of all air intakes to the building. Air intakes are to be reset to original condition as soon as practical, or at completion of roofing work.
C. Standing pipes and roof-mounted conduit shall be lifted, disconnected and saved for later reinstallation. Reinstall at completion of roofing membrane installation. If the Contractor is not qualified to plug plumbing or disconnect electrical connections, the Contractor will, at his expense, subcontract this work.
D. Prior to application of roofing base sheet and/or insulation, the roof deck must be clean and dry, and concrete roof deck must pass the NCRA "Deck Dryness Test."

3.04 BASE SHEET INSTALLATION: WOOD, GYPSUM AND LIGHTWEIGHT CONCRETE ROOF DECKS
Install base sheet to deck with mechanical fasteners six inches on center down laps and 18 inches on center down sheet, staggered, 12 inches in from laps. Lap edges four inches and ends six inches.

3.05 BASE SHEET INSTALLATION, CONCRETE DECKS
A. Coat bare concrete deck surfaces with asphalt primer at a rate of one gallon per 100 square feet of roof area; allow to dry to the touch.
B. Install base sheet to primed concrete deck in a full mopping of hot special steep asphalt, Type IV, at a rate of not less than 25 pounds per square. Lap edges two inches and ends six inches.

3.06 INSULATION INSTALLATION: METAL DECK
A. Thoroughly clean deck and remove all debris from Purchaser's property.
B. Mechanically attach first layer of insulation to metal deck. Install fasteners as required to ensure insulation is firm under foot and in compliance with FM I-90, Class 1. Drive mechanical fasteners flush to top surface of insulation. Minimum number of fasteners shall be one fastener for each two square feet of area, and two fasteners for each piece of board. First layer of insulation shall be of sufficient thickness to span the flutes of the metal deck without damage from construction activities.
C. Form continuous insulation joints over deck flange. Do not cantilever insulation edges over deck ribs. Minimum edge bearing to be one inch. Filler insulation shall be a minimum of 18 inches square and shall have a minimum of two fasteners per piece.

3.07 INSULATION PLACEMENT
A. Closely butt edges of insulation units without forcing into place. Lay insulation with long dimension of insulation board perpendicular to roof slope. Exercise care in placement of bottom layer of insulation over metal deck to ensure tight joints and to prevent asphalt dropping to areas below deck.
B. Cut and fit insulation where roof deck intersects vertical surfaces, but keep 1/4 inch from all vertical flashings.
C. Miter insulation edges at ridges and elsewhere to prevent open joints and irregular surfaces. Maximum elevation variation between boards at joints shall be 1/8 inch.
D. At roof scuppers and drains, taper insulation from flush with opening to full thickness at 18 inches away from drains and scuppers on all sides.
E. Do not install insulation or vapor retarder to bridge across expansion joints or other similar devices.
F. Embed first layer of insulation board placed over a base sheet and second layer of roof insulation in a solid, uniform 30 pounds per 100 square feet mopping of hot special steep asphalt. Asphalt must be hot enough at the time of application to attain positive securement.
Hot asphalt mopping shall not proceed ahead of insulation installation by more than two boards. Insulation boards shall be placed in hot asphalt within 30 seconds of asphalt mopping application. "Walking-in" of the individual insulation boards is required to ensure maximum adhesive contact. Second layer of roof insulation shall be laid with joints staggered a minimum of 12 inches in both directions from joints of the first layer.

**3.08 CARPENTRY**
A. Mechanically attach wood blocking to structural deck. Blocking is to be a nominal six inches wide by insulation thickness.
B. Fasteners are to be in two rows, staggered, with a maximum of 24 inches spacing in either row. Maximum spacing within eight feet of corners is 12 inches.
C. Offset blocking layers 12 inches and weave corners.
D. For additional requirements, see specification section for Sheet Metal Flashing.

**3.09 CANT ATTACHMENT**
Set fiberboard cants into Type IV hot asphalt.

**3.10 MEMBRANCE BASE SHEET**
A. Over insulation board, install fiberglass base sheet in solid, uniform mopping of hot steep asphalt applied at the rate of 30 lbs. per 100 square feet.
B. Lay sheet smooth and free of wrinkles, buckles, or fishmouths. Lay so water flows over or parallel to, but never against the laps. Lap 2 inches on sides and 6 inches on ends. Lightly broom installed base sheet to insure full adhesion with substrate.
C. At perimeter and interior curb penetrations, extend sheet a minimum of 2 inches above the top of the cant strip, solidly adhered in hot asphalt without bridging and buckling.

**3.11 ROOF MEMBRANE APPLICATION**
A. Starting at a low point of the roof, install three plies of fiberglass felt, shingle fashion (starter sheets required), lapping each sheet nominal 25 inches over preceding sheet. Solidly mop each ply to underlying roofing with mini-mum 25 pounds per 100 square feet of hot asphalt. Lap ply sheet ends six inches. Stagger end laps a minimum of 18 inches. Each ply shall be completely and firmly embedded in hot asphalt and be free of wrinkles, buckles, blisters, fishmouths and voids.
B. Apply bitumen no more than ten feet ahead of each roll being embedded. Embed felt in hot bitumen, within 20 seconds of time bitumen is mopped. From unmopped side, broom each ply before bitumen cools. Ensure complete and continuous seal and contact between bitumen and ply sheets, including ends, edges, and laps. Avoid walking on plies until bitumen has set.
C. Extend roofing plies into roof drain trim. Lay four-pound lead, set in flashing cement, around drain and one inch inside drain. (The lead is three feet square in size.) Prime the top surface of the lead flashing and allow to dry. Install layer of membrane flashing over lead in a full coating of hot asphalt and extending four inches beyond edge of lead. Install two plies of fiberglass felt set in minimum 25 pounds per 100 square feet of hot steep asphalt. Each layer to extend a minimum of four inches beyond previous layer and be installed so water will flow freely to drain.
D. On curb details, plies shall extend two inches above cants and be set in hot asphalt. Cover with one layer membrane flashing, each piece shall not be more than six feet long; width shall extend from four inches beyond toe of cant to four inches above bottom edge of sheet metal flashing and be adhered to substrate wall with full continuous mopping of hot asphalt.

**3.12 FLASHINGS**
A. Prime vertical substrate with asphaltic primer at rate of one gallon per 100 square feet.
B. Install new roofing plies not less than two inches beyond top edge of cant, fully adhered in hot asphalt.
C. Set one ply of Poly-Therm flashing to substrate in uniform continuous mopping of hot asphalt, from four inches beyond toe of cant to two inches above bottom of metal counterflash. Overlap plies four inches. Remove wrinkles and voids.
D. Cut modified bitumen flashing sheet in lengths not to exceed ten feet. Coat back surface of flashing sheet and Poly-Therm flashing surface with uniform and continuous (1/16 inch thick) mopping of hot asphalt. Extend flashing sheet six inches beyond toe and four inches above
bottom edge of metal counterflashing. Press sheet firmly in place; ensure complete bond and continuity without wrinkles or voids.

E. Mechanically fasten top of modified bitumen flashing sheet to substrate with one inch cap nails eight inches on center. Nails to be located a minimum of 1-1/2 inches above bottom edge of metal counterflashing.

3.13 METAL STACK FLASHINGS
A. Slide new four-pound lead flashing over pipe. Set in plastic cement on completed plies prior to application of protective finish. Coat top surface of flange with asphalt primer and allow to dry.
B. Only on nailable decks, fasten flange through roof membrane with large-head, case-hardened nails three inches on center. Seal flange with two layers of fiberglass membrane in hot asphalt. Each layer extending a minimum of four inches beyond previous layer.
C. Install modified bitumen membrane flashing, set in hot asphalt, between metal flange and roof surface over metal flange. Membrane flashing shall extend four inches beyond metal flange.
D. If outside diameter of pipe is three inches or less, cut off lead at top of pipe and install preformed lead counterflashing collar.
E. If outside diameter of pipe is greater than three inches, bend lead inside pipe (minimum one Inch) with pliers or rubber/plastic mallet. Do not use roofing hammer, since blows from hammer may crack lead. Any lead that is cracked shall be replaced with new four-pound lead at Contractor's Expense.

3.14 TEMPORARY TIE-INS
A. Extend new roofing plies onto existing cleaned roof a minimum of 12 inches in a full mopping of hot asphalt.
B. Seal outside edges with a layer of plastic cement, "feathered" to a smooth finish.
C. On curb and wall details, plies shall extend a minimum of two inches above cants and a layer of plastic cement shall be applied to top edge and "feathered" to a smooth finish.
D. Projections shall have a layer of plastic cement applied to base. Ensure mastic is beveled and "feathered" to a smooth finish.

3.15 PROTECTIVE FINISH
Over the entire asphalt and fiberglass felt roofing membrane apply a uniform and continuous flood coat of hot Tremco Thermastic at the minimum rate of 3 1/2 gallons per 100 square feet. Immediately broadcast a minimum of 300 pounds aggregate per 100 square feet into the hot bitumen to achieve a uniform, securely embedded surface coating. Cover bitumen completely with no bleed-through. After bitumen has set, sweep aggregate surface and remove loose aggregate from roof surface and drain sumps.

3.16 WALKWAY PAD INSTALLATION
Install walkway pads after completion of membrane installation and prior to aggregate surface application. Walkway pads shall be set in adhesive recommended by pad manufacturer and acceptable to roofing manufacturer and shall be installed to insure complete contact and prevent curling. Pads shall be placed in locations as shown on drawings and as indicated by the Engineer with a maximum four-inch space between pads. Unless otherwise noted, long dimension of pad shall be placed perpendicular to direction of travel.

3.17 FIELD QUALITY CONTROL
A. Manufacturer's representative shall make daily inspections of work in progress in conjunction with the Contractor's Quality Control personnel.
B. Contractor's superintendent shall provide weekly reports to the Engineer describing the amount of work completed, any job slowdowns and how they were solved, and other pertinent data.
C. Manufacturer's representative, concurrently with the Engineer and Roofing Program Coordinator, shall provide a final inspection of the work before protective finish has been applied over completed plies. Contractor's job foreman shall attend installation inspection and shall provide repair materials to repair areas of new roofing system found unsatisfactory by the Engineer, Roofing Program Coordinator and/or material manufacturer's representative.
3.18 ADJUSTING AND CLEANING
   A. Any deficiencies found during final inspection will be corrected within five working days and will be re-inspected by the manufacturer’s representative and the Engineer.
   B. Lightly broom sweep entire roofing area and remove any debris or excess aggregate.
   C. Unplug drains and set drain screens or baskets in position. Provide new drain screens and baskets in locations where screens or baskets are broken or missing.
   D. Clean gutters and downspouts of all debris so they are free flowing.
   E. Leave premises clean to the complete satisfaction of the Engineer.

END SECTION