SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING
05/12, CHG 5: 11/19
MCBL 02/24

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN SOCIETY OF CIVIL ENGINEERS (ASCE)

ASCE 7-16	(2017; Errata 2018; Supp 1 2018) Minimum Design Loads and Associated Criteria for Buildings and Other Structures

AMERICAN SOCIETY OF SAFETY PROFESSIONALS (ASSP)

ASSP A10.24	(2022) Roofing - Safety Requirements for Low-Sloped Roofs

ASPHALT ROOFING MANUFACTURER'S ASSOCIATION (ARMA)

ARMA 410BUR88	(2001) Manual of Roof Maintenance and Repair
ARMA PMBRG98	(1998) Quality Control Guideline for the Application of Polymer Modified Bitumen Roofing

ASTM INTERNATIONAL (ASTM)

ASTM C208	(2012; R 2017; E 2017; E 2019) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C552	(2022) Standard Specification for Cellular Glass Thermal Insulation
ASTM C578	(2022) Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C726	(2017) Standard Specification for Mineral Wool Roof Insulation Board
ASTM C728	(2017; R 2022) Standard Specification for Perlite Thermal Insulation Board
ASTM C1153	(2010) Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging

ASTM C1289	(2022a) Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM D41/D41M	(2011; R 2016) Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing
ASTM D312/D312M	(2016a) Standard Specification for Asphalt Used in Roofing
ASTM D1668/D1668M	(1997a; R 2014; E 2014) Glass Fabrics (Woven and Treated) for Roofing and Waterproofing
ASTM D1863/D1863M	(2005; R 2011; E 2012) Mineral Aggregate Used on Built-Up Roofs
ASTM D1970/D1970M	(2019) Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
ASTM D2170/D2170M	(2018) Standard Test Method for Kinematic Viscosity of Asphalts (Bitumens)
ASTM D2824/D2824M	(2018) Standard Specification for Aluminum-Pigmented Asphalt Roof Coatings, Non-Fibered, and Fibered without Asbestos
ASTM D4073/D4073M	(2006; E 2019; R 2019) Standard Test Method for Tensile-Tear Strength of Bituminous Roofing Membranes
ASTM D4263	(1983; R 2018) Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
ASTM D4402/D4402M	(2015) Viscosity Determination of Asphalt at Elevated Temperatures Using a Rotational Viscometer
ASTM D4586/D4586M	(2007; E 2012; R 2012) Asphalt Roof Cement, Asbestos-Free
ASTM D4601/D4601M	(2004; R 2020) Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing
ASTM D4637/D4637M	(2015) EPDM Sheet Used in Single-Ply Roof Membrane
ASTM D4897/D4897M	(2016) Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing
ASTM D5147/D5147M	(2014) Standard Test Methods for Sampling

	and Testing Modified Bituminous Sheet Material
ASTM D6162/D6162M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
ASTM D6163/D6163M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
ASTM D6164/D6164M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements
ASTM D6222/D6222M	(2016) Standard Specification for Atactic Polypropylene (ARP) Modified Bituminous Sheet Materials Using Polyester Reinforcements
ASTM D6223/D6223M	(2016) Standard Specification for Atactic Polypropylene (ARP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements
ASTM D6298	(2016) Standard Specification for Fiberglass Reinforced Styrene-Butadiene-Styrene (SBS) Modified Bituminous Sheet with a Factory Applied Metal Surface
ASTM E108	(2020a) Standard Test Methods for Fire Tests of Roof Coverings

FM GLOBAL (FM)

FM 4470	(2022) Single-Ply, Polymer-Modified Bitumen Sheet, Built-up Roof (BUR), and Liquid Applied Roof Assemblies for Use in Class 1 and Noncombustible Roof Deck Construction
FM APP GUIDE	(updated on-line) Approval Guide http://www.approvalguide.com/

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2021) International Building Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2020) Occupational and Educational Personal Eye and Face Protection Devices

MIDWEST ROOFING CONTRACTORS ASSOCIATION (MRCA)

CERTA	(2007) NRCA/MRCA Certified Roofing Torch Applicator Program

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 58	(2020; TIA 20-1; TIA 20-2; TIA 20-3) Liquefied Petroleum Gas Code
NFPA 241	(2022) Standard for Safeguarding Construction, Alteration, and Demolition Operations

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA C3701	(1997) Repair Manual for Low Slope Membrane Roof Systems
NRCA CONDET	(2014) Construction Details Manual
NRCA RoofMan	(2020) The NRCA Roofing Manual

SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION (SMACNA)

SMACNA 1793	(2012) Architectural Sheet Metal Manual, 7th Edition

SINGLE PLY ROOFING INDUSTRY (SPRI)

ANSI/SPRI/FM 4435/ES-1	(2017) Test Standard for Edge Systems Used with Low Slope Roofing Systems

U.S. DEPARTMENT OF ENERGY (DOE)

Energy Star	(1992; R 2006) Energy Star Energy Efficiency Labeling System (FEMP)

U.S. NATIONAL ARCHIVES AND RECORDS ADMINISTRATION (NARA)

29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.12	Construction Work
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.16	Rules of Construction

UNDERWRITERS LABORATORIES (UL)

UL 790	(2022) UL Standard for Safety Test Methods for Fire Tests of Roof Coverings
UL RMSD	(2012) Roofing Materials and Systems

1.2 DESCRIPTION OF ROOF MEMBRANE SYSTEM

Minimum two-ply SBS modified bitumen roof membrane consisting of modified bitumen base sheet and cap sheet. Modified bitumen roof membrane must be set in hot asphalt.

All work must follow the NRCA RoofMan guidelines and standards stated within this Section.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Roof Plan; G (Drawing depicting wind loads and boundaries of enhanced perimeter and corner attachments of roof system components, as applicable)

Field Inspection and Existing Conditions Report; G

Identify all fire safety issues including exposed or concealed combustible materials, which may require additional protection during roof installation.

SD-03 Product Data

Modified Bitumen Sheets; G

Heat Island Reduction; G

Energy Star Label for Top Coating; G

Asphalt; G

Fiberglass Felt; G

Primer; G

Modified Bitumen Roof Cement; G

Pre-Manufactured Accessories; G

Fasteners And Plates; G

Polyisocyanurate Boards; G

Gutters, Downspouts, and Miscellaneous Metal Accessories; G

Sample Warranty certificate; G

Submit all data required by Section 07 22 00 ROOF AND DECK INSULATION, together with requirements of this section. Include

in data written acceptance by the roof membrane manufacturer of the products and accessories provided. Provide products as listed in the applicable wind uplift and fire rating classification listings, unless approved otherwise by the Contracting Officer.

SD-05 Design Data

Wind Uplift Calculations; G

Provide Engineering calculations, signed, sealed, and dated by a qualified Engineer validating the wind resistance per ASCE 7-16, ASTM D4073/D4073M, and ANSI/SPRI/FM 4435/ES-1 of non-rated roof system.

SD-07 Certificates; G

Provide evidence that products used within this specification are manufactured in the United States.

Qualification of Manufacturer; G

Certify that the manufacturer of the modified bitumen membrane meets requirements specified under paragraph QUALIFICATION OF MANUFACTURER.

Qualification of Applicator; G

Certify that the applicator meets requirements specified under paragraph QUALIFICATION OF APPLICATOR.

Qualification of Engineer of Record; G

Certify that the Engineer of Record is fully qualified, competent, and currently licensed to practice in the project jurisdiction.

Bill of Lading

Submit bill of lading when labels of asphalt containers do not bear the flash point (FP), finished blowing temperature (FBT), and equiviscous temperature (EVT).

Wind Uplift Resistance; G classification, as applicable

Fire Resistance classification; G

Submit the roof system assembly wind uplift and fire rating classification listings.

SD-08 Manufacturer's Instructions

Modified Bitumen Membrane Application; G

Flashing; G

Temperature Limitations for Asphalt

Base Sheet attachment, including pattern and frequency of mechanical attachments required in field of roof, corners, and perimeters to provide for the specified wind resistance.

Primer

Fasteners

Ventilating Base Sheets

Coating Application; G

Cold Weather Installation; G

Include detailed application instructions and standard manufacturer drawings altered as required by these specifications. Include membrane manufacturer requirements for nailers and backnailing of roof membrane on steep slopes. Explicitly identify in writing, differences between manufacturer's instructions and the specified requirements.

SD-11 Closeout Submittals

Warranty; G

Information Card; G

Instructions To Government Personnel

Include copies of Safety Data Sheets for maintenance/repair materials.

Submit 30 year "No-Dollar-Limit" warranty for labor and materials, including metal edge system in accordance with ANSI/SPRI ES-1 requirements.

1.4 QUALITY ASSURANCE

1.4.1 Qualification of Manufacturer

Modified bitumen sheet roofing system manufacturer must have a minimum of 20 years experience in manufacturing modified bitumen roofing products.

1.4.2 Qualification of Applicator

Roofing system applicator must be approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and have a minimum of five years experience as an approved, authorized, or licensed applicator with that manufacturer and be approved at a level capable of providing the specified warranty. The applicator must supply the names, locations and client contact information of five projects of similar size and scope that the applicator has constructed using the manufacturer's roofing products submitted for this project within the previous three years.

1.4.3 Qualifications of Photovoltaics (PV) Rooftop Applicator

The PV rooftop applicator must be approved, authorized, or certified by a

Roof Integrated Solar Energy (RISE) Certified Solar Roofing Professional (CSRP), and comply with applicable codes, standards, and regulatory requirements to maintain the weatherproofing abilities of both the integrated roof system and photovoltaic system.

1.4.4 Qualification of Engineer of Record

Engineer of Record must be currently licensed within the jurisdiction of the project.

Engineer of Record must be approved, authorized, and currently licensed by the state of North Carolina, and have a minimum of five years experience as an approved Engineer for manufacturers of similar roof systems. Engineer of Record must supply the names and locations of five projects of similar size and scope for which he has provided engineering calculations using the manufacturer's products submitted for this project within the previous three years. Engineer of Record must provide certified engineering calculations for:

Wind uplift requirements]in accordance with Local and State codes

ASCE 7-16,in accordance with International Building Code.

Seismic requirements per local and state building codes

Seismic requirements per ICC IBC Chapter 16, Section 1608.3

Snow load requirements per ICC IBC Chapter 16 Section 1608.3 and Section 7 of ASCE 7-16

1.4.5 Fire Resistance

Complete roof covering assembly must:

a. Be Class A or B rated in accordance with ASTM E108, FM 4470, or UL 790; and

b. Be listed as part of Fire-Classified roof deck construction in UL RMSD, or Class I roof deck construction in FM APP GUIDE.

FM or UL approved components of the roof covering assembly must bear the appropriate FM or UL label.

1.4.6 Wind Uplift Resistance

Provide a complete roof system assembly that is rated and installed to resist wind loads calculated in accordance with ASCE 7-16 and validated by uplift resistance testing in accordance with Factory Mutual (FM) test procedures. Do not install non-rated systems, except as approved by the Contracting Officer. Submit licensed engineer's Wind uplift calculations and substantiating data to validate any non-rated roof system. Base wind uplift measurements on a design wind speed of 209 km/h 150 mph in accordance with ASCE 7-16 and other applicable building code requirements.

1.4.7 Preroofing Conference

After approval of submittals and before performing roofing and insulation

system installation work, hold a preroofing conference to review the following:

a. Drawings, including Roof Plan, specifications and submittals related to the roof work

b. Roof system components installation

c. Procedure for the roof manufacturer's technical representative's onsite inspection and acceptance of the roof structure, and roofing substrate, the name of the manufacturer's technical representatives, the frequency of the onsite visits, distribution of copies of the inspection reports from the manufacturer's technical representatives to roof manufacturer

d. Contractor's plan for coordination of the work of the various trades involved in providing the roofing system and other components secured to the roofing

e. Quality control, (ARMA PMBRG98) plan for the roof system installation

f. Field inspection and existing conditions report identifying all fire safety issues including exposed or concealed combustible materials, which may require additional protection during roof installation

g. Safety requirements

Coordinate preroofing conference scheduling with the Contracting Officer. The conference must be attended by the Contractor, the Contracting Officer's designated personnel, and personnel directly responsible for the installation of roofing and insulation, flashing and sheet metal work, mechanical and electrical work, other trades interfacing with the roof work, designated safety personnel trained to enforce and comply with ASSP A10.24, Fire Marshall, and a representative of the roofing materials manufacturer. Before beginning roofing work, provide a copy of meeting notes and action items to all attending parties. Note action items requiring resolution prior to start of roof work.

1.5 DELIVERY, STORAGE, AND HANDLING

1.5.1 Delivery

Deliver materials in manufacturers' original unopened containers and rolls with labels intact and legible. Mark and remove wet or damaged materials from the site. Where materials are covered by a referenced specification, the container must bear the specification number, type, and class, as applicable. Labels or bill of lading for roofing asphalt must indicate asphalt type, FP, FBT, and EVT, that is, the temperature at which the viscosity is either 125 centistokes when tested in accordance with ASTM D2170/D2170M or 75 centipoise when tested in accordance with ASTM D4402/D4402M. Deliver materials in sufficient quantity to allow work to proceed without interruption.

1.5.2 Storage

Protect materials against moisture absorption and contamination or other damage. Avoid crushing or crinkling of roll materials. Store roll materials on end on clean raised platforms or pallets one level high in dry

locations with adequate ventilation, such as an enclosed building or closed trailer. Do not store roll materials in buildings under construction until concrete, mortar, and plaster work is finished and dry. Maintain roll materials at temperatures above 10 degrees C 50 degrees F for 24 hours immediately before application. Do not store materials outdoors unless approved by the Contracting Officer. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Do not use polyethylene sheet as a covering. Tie covering securely to pallets to make completely weatherproof. Provide sufficient ventilation to prevent condensation. Do not store more materials on roof than can be installed the same day and remove unused materials at end of each days work. Distribute materials temporarily stored on roof to stay within live load limits of the roof construction.

Maintain a minimum distance of 10.67 meters 35 foot for all stored flammable materials, including materials covered with shrink wraps, craft paper or tarps from all torch/welding applications.

Immediately remove wet, contaminated or otherwise damaged or unsuitable materials from the site. Damaged materials may be marked by the Contracting Officer.

1.5.3 Handling

Prevent damage to edges and ends of roll materials. Do not install damaged materials in the work. Select and operate material handling equipment to prevent damage to materials or applied roofing.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not install roofing system when air temperature is below 4.44 degrees C 40 degrees F, during any form of precipitation, including fog, or when there is ice, frost, moisture, or any other visible dampness on the roof deck. Follow manufacturer's printed instructions for Cold Weather Installation.

1.7 HOT-MOPPED ASPHALT APPLIED MODIFIED BITUMEN MEMBRANE SAFETY

1.7.1 Property Protection

Take all precautions necessary to prevent ignition of combustible materials during hot-mopped asphalt application of roofing. Immediately call the fire department if a fire commences. Review all fire safety procedures as outlined at the pre-roofing conference.

Install materials using the techniques recommended by CERTA NRCA/MRCA Certified Roofing Torch Applicator Program available from the National Roofing Contractors Association (NRCA) and the Midwest Roofing Contractors Association (MRCA) as endorsed by the Asphalt Roofing Manufacturers Association (ARMA) and the United Union of Roofers, Waterproofers and Allied Workers. Application procedures must comply with NFPA 241, OSHA 29 CFR 1910 and 29 CFR 1910.12, 29 CFR 1926.16, 29 CFR 1926 Subpart F., UL Fire Resistance Directory Volume No. 1, NRCA R&W Manual, and Florida Building Code Volume 2004.

Do not store flammable liquids on the roof.

No Asphalt Kettles are allowed on roofs. Locate kettles and supply LP-Gas Cylinders safely and secured per NFPA 241 outside of the building's perimeter a minimum of 6.096 m 20 foot from the structure and any combustible materials.

Maintain a minimum separation of 6.096 m 20 foot between LP-Gas Cylinders and kettle. Provide protective fire retardant blanket barrier or shield between any building structure to a minimum height of 8 foot and a clear surround distance of 2.44 m 4 foot if operations force placement of kettle within a distance of 6.096 m 20 foot. Do not obstruct or place kettles or Cylinder storage within 3.048 m 10 foot of exits, means of egress, gates, roadways, entrances. Locate kettles downwind and away from any building air intakes.

Provide a minimum of two portable fully charged 9.072 kg 20 pound ABC (dry chemical)fire extinguishers no closer than 1.524 m 5 foot and no further than 7.62 m 25 foot of horizontal travel distance from each kettle at all times while kettle is in operation, in easily accessible and identifiable locations. Also provide two multipurpose 2-A:20-B:C portable fire extinguisher on the roof being covered or repaired.

Comply with the following safety procedures:

a. Fuel containers, burners, and related appurtenances of roofing equipment in which liquefied petroleum gas is used for heating must comply with the requirements of NFPA 58.

b. Fuel containers having capacities greater than one pound must be located a minimum of 3.048 m 10 foot clear distance from the burner flame.

c. Clearly label all LP-Gas Cylinders as "Flammable Gas", and secure to prevent accidental tip-over.

d. Check all pressure regulators and hoses prior to use for proper functioning and integrity.

e. Turn off fuel supply at LP Gas Cylinder when kettle is not in use.

f. Equip all kettles with a functioning temperature measuring device to ensure no heating in excess of 10 degrees C 50 degrees F below the flash point.

g. Provide covers, lid, or top which are close fitting, constructed of minimum No.14 manufacturer's gauge steel, and can be gravity closed on all kettles.

h. Clean all roofing mops and rags free of excess asphalt and store safely away from all combustible materials. Store discarded roofing mops and rags in a non-combustible container and remove from site each day.

i. Position all pump lines handling hot asphalt securely and equip all pump lines with a shut-off valve on each with a coupler which may be opened when lines are full. Do not subject pump lines to pressures in excess of safe and recommended NRCA and ARMA working pressures. Station an operator near the equipment to cut off flow and care for other emergencies while conducting heating, pumping and application

operations.

j. Asphalt bucket used by roofers or workers in similar trades must be constructed of minimum No. 24 gauge or heavier sheet steel and have a metal bail of no less than 6.35 mm 1/4 inch diameter material. The bail is to be fastened to offset ears or equivalent which have been riveted, welded, or otherwise safely and securely attached to the bucket. Soldered bail sockets are prohibited. Position workers and other employees to avoid being struck by bucket or other roofing materials, which may accidentally fall while being hoisted, lowered, or used in the roofing operation. Provide safety barriers and caution signs at all skylights or other roof holes.

k. Do not use flammable liquids with a flash point below 37.78 degrees C 100 degrees F (gasoline and similar products) for cleaning purposes.

Do not use solid fuel or Class I liquids as fuel for roofing asphalt kettles. Provide a minimum of one employee fully knowledgeable of kettle operations and hazards to maintain constant surveillance during kettle operation within a minimum distance of 7.62 m 25 foot of the kettle.

Check all fire extinguishers prior to commencement of work, and upon completion of the day's work, to ensure fullness and operability.

Project supervisor must make daily inspections with the facility manager of all conditions and operations which could present hazards during hot-mopped applications and issue directives to address all such concerns and items of the work and existing conditions.

Identify and protect all combustible roof components, possible fire traps, and hidden hazards. Seal off voids or openings in the substrate with non-combustible materials prior to installing hot-mopped applied materials in the area. Install protective fire retardant blankets and shields at building walls, eaves, parapets and equipments curbs constructed of combustible materials within 0.9144 meter 3 foot radius of the area of hot-mopped kettle prior to commencement of the work.

When working around intakes and openings, temporarily disconnect and block to prevent fumes from kettle from being drawn into the opening.

1.7.2 Fire Watch

All personnel on the roof during hot-mopped application must be properly trained to use a fire extinguisher. Provide a fire watch for a minimum of 2 hours after completion of hot-mopped kettle operations at the end of each work shift. Maintain the fire watch for additional time required to ensure no potential ignition conditions exist. Utilize heat sensing meters to scan for hot spots in the work. Provide a minimum duration fire watch of two hours conducted by personnel properly trained in the use of the camera to survey the underside of the roof deck, attic, and plenum spaces (where possible) and the topside of smoldering elements. Camera must have a manufacturer's certificate of calibration, and the use of the camera must be in compliance with Installation security policies.

Do not leave the rooftop unattended during breaks in work during a work shift. Walk and scan all areas of application checking for hot spots, fumes, or smoldering, especially at wall and curb areas, prior to departure at the end of each work shift. Ensure any and all suspect conditions are

eliminated prior to leaving the site each work shift.

1.7.3 Open Flame Application (Torch) Equipment and Personnel Safety

Train all crew members in preventive measures for indirect and direct dangers and hazards associated with roofing work, which include, but are not limited to the following:

a. Heat Stress: Wear light colored clothing, a hat for ultra-violet protection, and other eye protective devices. Drink sufficient quantities of non-alcoholic, non-caffeine liquids. Stage shifts for crew members to allow for breaks from heat and sun exposure without interfering with work progress.

b. First Aid for Burns: Immediately call for an ambulance. Contact local Occupational Health Services (OHS).

All crew members must wear correct personal protective equipment (PPE), including, but not limited to the following items:

a. Long-sleeved shirts buttoned at the collar and cuffs, made of non-flammable materials. Polyester materials are not allowed.

b. Work boots covering ankles with rubber or composite soles.

c. Long pants without cuffs to extend over the top of the work boots, be made of non-flammable materials. No polyester allowed.

e. OSHA and ANSI/ISEA Z87.1 approved face shields, goggles or safety glasses to be worn during torching and any other applicable roofing functions.

f. OSHA and ANSI approved hard hats.

1.7.4 Wind Conditions

Use side shields with all torching operations when winds are occurring to prevent flame distortion of end burners. Use torch machine equipment with bottom shield plate to prevent flame spread on to roof deck and substrate. When high wind gusts are present, notify the safety officer and cease all use of torching equipment until wind conditions lower and authorization from the safety officer to proceed is received.

1.8 SEQUENCING

Coordinate the work with other trades to ensure that components which are to be secured to or stripped into the roofing system are available and that permanent flashing and counter flashing, per NRCA CONDET, and are installed as the work progresses. Ensure temporary protection measures are in place to preclude moisture intrusion or damage to installed materials. Apply roofing immediately following application of insulation as a continuous operation. Coordinate roofing operations with insulation work so that all roof insulation applied each day is covered with roof membrane installation the same day.

1.9 WARRANTY

Provide roof system material and workmanship warranties meeting specified requirements. Provide revision or amendment to standard membrane manufacturer warranty as required to comply with the specified requirements. Provide a manufacturer's warranty that has no dollar limit, covers full system water-tightness, and has a minimum duration of 30 years.

1.9.1 Roof Membrane Manufacturer Warranty

Furnish the roof membrane manufacturer's 30-year no dollar limit roof system materials and installation workmanship warranty, including flashing, insulation in compliance with ASTM C1289, and accessories necessary for a watertight roof system construction. Provide one sole source warranty for roof system (30 years) including the edge metal (ANSI SPRI ES-1 CODE) and the coating system (10 year finish warranty). A signed letter from the president of the manufacturer stating the roof membrane, edge metal and coatings are products of the manufacturer shall accompany the roof submittal package. No relabeled products from third-party manufacturers are acceptable. Provide coverage for damage to the roofing system caused by sustained winds having a velocity of 130 pmh or less. Provide warranty directly to the Government and commence warranty effective date at time of Government's acceptance of the roof work. The warranty must state that:

a. If within the warranty period the roof system, as installed for its intended use in the normal climatic and environmental conditions of the facility, becomes non-watertight, shows evidence of moisture intrusion within the assembly, blisters, splits, tears, delaminates, separates at the seams, or shows evidence of excessive weathering due to defective materials or installation workmanship, the repair or replacement of the defective and damaged materials of the roof system assembly and correction of defective workmanship are the responsibility of the roof membrane manufacturer. All costs associated with the repair or replacement work are the responsibility of the roof membrane manufacturer.

b. When the manufacturer or his approved applicator fail to perform the repairs within 72 hours of notification, emergency temporary repairs performed by others does not void the warranty.

c. Upon completion of installation, and acceptance by the Contracting Officer and Roofing System Engineer of Record, the manufacturer must supply the appropriate warranty to the Owner.

d. Installer must submit a minimum two year warranty to the membrane manufacturer from the date of acceptance, with a copy to the Contracting Officer and Roofing System Engineer of Record.

1.9.2 Roofing System Installer Warranty

The roof system installer must warrant for a period of two years that the roof system, as installed, is free from defects in installation workmanship, to include the roof membrane, flashing, insulation, accessories, attachments, and sheet metal installation integral to a complete watertight roof system assembly. Write the warranty directly to the Government. The roof system installer is responsible for correction of defective workmanship and replacement of damaged or affected materials. The roof system installer is responsible for all costs associated with the repair or replacement work.

1.9.3 Continuance of Warranty

Repair or replacement work, ARMA 410BUR88, NRCA C3701 that becomes necessary within the warranty period and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the roof membrane manufacturer warranty for the remainder of the manufacturer warranty period.

1.10 CONFORMANCE AND COMPATIBILITY

Provide the entire roofing and flashing system in accordance with specified and indicated requirements, including fire and wind resistance (ANSI/SPRI/FM 4435/ES-1) requirements. Work not specifically addressed and any deviation from specified requirements must be in general accordance with recommendations of the NRCA Roofing and Waterproofing Manual, membrane manufacturer published recommendations and details, and compatible with surrounding components and construction. Submit any deviation from specified or indicated requirements to the Contracting Officer for approval prior to installation.

PART 2 PRODUCTS

2.1 MATERIALS

Coordinate with other specification sections related to the roof work. Furnish a combination of specified materials that comprise a roof system acceptable to the roof membrane manufacturer and meeting specified requirements. Protect materials provided from defects and make suitable for the service and climatic conditions of the installation.

2.2 MODIFIED BITUMEN SHEETS AND FIBERGLASS FELT MATERIALS

Furnish a combination of specified materials that comprise the modified bitumen manufacturer's standard system of the number and type of plies specified. Provide materials suitable for the service and climatic conditions of the installation. Modified bitumen sheets must be watertight and visually free of pinholes, particles of foreign matter, non-dispersed raw material, factory splices, or other conditions that might affect serviceability. Polymer modifier must comply with ARMA PMBRG98 and be uniformly dispersed throughout the sheet. Edges of sheet must be straight and flat.

a. Fiberglass Felt Base Sheet: ASTM D4601/D4601M,ASTM D1668/D1668M Type II, as approved by the modified bitumen roof membrane manufacturer. The reinforced fabric must contain two fibers interwoven, stitched composite polyester/fiberglass scrim. Glued composite scrims are not acceptable.

b. SBS Base Sheet: ASTM D6163/D6163M, Type III, Grade S, minimum 2.0 mm 80 mils thick. Tensile Strength (ASTM D5147): 2 in/min. @ 73.4 +/- 3.6°F MD 100 lbf/in CMD 100 lbf/in; 50 mm/min. @23 +/- deg. C; MD 17.5 kN/m; CMD 17.5kN/m. Tear Strength (ASTM D5147): 2 in/min. @ 73.4 +/- 3.6° FMD 110 lbf; CMD 100 lbf/in. 50 mm/min. @23 +/- 3 deg. C; MD 489 N; CMD 444 N. Elongation at Maximum Tensile (ASTM D5147): 2 in/min. @ 73.4 +/- 3.6 Deg. F; FMD 4%; CMD 4%; 50 mm/min @23 +/- 3 deg. C; MD 4%; CMD 4%. Low Temperature Flexibility (ASTM D5147): Passes -40°F (-40°C).

c. SBS Cap Sheet: ASTM D6162/D6162M or ASTM D6164/D6164M or ASTM D6163/D6163M; Type III, Grade G, minimum 170 mils thick, and as required to provide specified fire safety rating. The cap sheet is to contain a minimum 6% recycled content. Tensile Strength (ASTM D5147): 2 in/min @ 73.4 +/- 3.6 deg. FMD 1000 1bf/in; CMD 1100 bf/in 50 mm/min @ 23 +/- 3 deg. MD 175 N CMD 192.5 KN/M. Tear Strength (ASTM D5147) 2 in/min @ 73.4 +/- 3.6 deg. FMD 17001bf; CMD 1800 1bf/in 50 mm/min @ 23 +/- 3 deg. C MD 7561.6N; CMD 8006.4N Elongation at Maximum Tensile (ASTM D5147): 2 in/min @ 73.4 +/- 3.6 deg. F; MD 16.0% CMD 16.0% 50 mm/min @ 23 +/- 3 deg. C MD 16.0% Low Temperature Flexibility (ASTM D 5147): Passes -40 deg. F (-40°C).

2.3 BASE FLASHING MEMBRANE

Membrane manufacturer's standard, minimum two-ply modified bitumen membrane flashing system compatible with the roof membrane specified and as recommended in membrane manufacturer's published literature. Provide flashing membranes that meet or exceed the properties of the material standards specified for the modified bitumen base, interply and cap sheet, except that flashing membrane thickness must be as recommended by the membrane manufacturer. Provide metal clad flashing membrane that complies with ASTM D6298.

All flashings are to be set in modified hot asphalt and consist of one layer of tri-laminate base sheet and finish flashing the same as the mineral cap.

Perform three course repairs on all laps and aluminize. The tri-laminate base sheet shall have the following characteristics:

a. All flashings shall have double coated reinforced scrim with the following minimum performance requirements according to ASTM D5147
b. The sheet is to contain a minimum of 29% recycled content and be manufacturered by the Membrane Roof Manufacturer.
c. Tensile Strength (ASTM D5147) : 2 in/min @ 73.4 +/- 3.6 deg. F MD 315 1bf/in CMD 315 1bf/in.
d. Tear Strength (ASTM D5147) : 2 in/min @ 73.4 +/- 3.6 deg. F MD 550 1bf/in CMD 550 1bf/in.
e. Elongation at Maximum Tensile (ASTM D5147) : 2 in/min @ 73.4 +/- 3.6 deg. F MD 5% CMD 5% 50 mm/min @ 23 +/- 3 deg. C MD 5% CMD 5%.

2.4 ASPHALT

ASTM D312/D312M, Type III or IV, in accordance with modified bitumen membrane manufacturer requirements and compatible with the slope conditions of the installation for vapor barriers and insulation boards on concrete decks only. SEBS modified hot asphalt to be used on flashing, base, and cap sheets on concrete deck and all other applications unless otherwise noted to have the following characteristics:

a. Elongation @ 77 degree F (ASTM D412) 750% Min.
b. Softening point (ASTM D36) 203 degree F - 211 degree F.

2.5 MEMBRANE SURFACING

Provide modified bitumen roof membrane cap sheet with factory-applied granule surfacing of color as selected from membrane manufacturer's standard colors. Provide modified bitumen membrane manufacturer's

recommended field-applied protective coating.

Coat the entire roof surfaace with white, reflective coating system to meet or exceed the following:

a. Base Coat: White Elastometric Roof Coating: Energy Star, CRRC, Title 24 approved white acrylic roof coating ASTM E 903, C 1549 Reflectance 81%, SRI (Solar Reflective Index) 101.
b. Top Coat: White Kynar Aquatec Roof Coating: Energy Star, CRRC, Title 24 approved white water based, fluoropolymer-acrylic resin roof coating. ASTM C 1549 Reflectance 90%, SRI (Solar Reflective Index) 112.

Both the base coat and the top coat must be products of the roof membrane manufacturer with the proper paperwork to accompany submittals.

2.6 PRIMER

ASTM D41/D41M, or other primer compatible with the application and as approved in writing by the modified bitumen membrane manufacturer.

2.7 MODIFIED BITUMEN ROOF CEMENT

ASTM D4586/D4586M, Type II for vertical surfaces, Type I for horizontal surfaces, compatible with the modified bitumen roof membrane and as recommended by the modified bitumen membrane manufacturer.

2.8 CANT AND TAPERED EDGE STRIPS

Provide standard cants and tapered edge strips of perlite conforming to ASTM C728the same material as the roof insulationor when roof insulation material is not available, provide pressure preservative treated wood, wood fiberboard, or rigid perlite board cants and edge strips as recommended by the manufacturer. or wood fiber conforming to ASTM C208 treated with bituminous impregnation, sizing, or waxing and fabricated to provide maximum 45 degree change in direction of membrane. Cant strips must be minimum for minimum 127 mm 5 inch face and 88.9 mm 3-1/2 inch vertical height when installed at 45 degree face angle 101.6 mm , except where clearance restricts height to lesser dimension. Taper edge strips at a rate of 25.4 mm to 38.1 mm per 304.8 mm one to 1-1/2 inch per foot to a minimum of 3.175 mm 1/8 inch of thickness. Provide kiln-dried preservative-treated wood cants, in compliance with requirements of Section 06 10 00 ROUGH CARPENTRY at base of wood nailers set on edge and wood curbing and where otherwise indicated.

2.9 FASTENERS AND PLATES

Provide coated, corrosion-resistant fasteners as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM 4470 and FM APP GUIDE for Class I roof deck construction and the wind uplift resistance specified. For fastening of membrane or felts to wood materials, provide fasteners driven through 25.4 mm 1 inch diameter metal discs, or one piece composite fasteners with heads not less than 25.4 mm 1 inch in diameter or 25.4 mm 1 inch square with rounded or 45 degree tapered corners.

2.9.1 Masonry or Concrete Walls and Vertical Surfaces

Use hardened steel nails or screws with flat heads, diamond shaped points, and mechanically deformed shanks not less than 25.4 mm 1 inch long for securing felts, modified bitumen sheets, metal items, and accessories to masonry or concrete walls and vertical surfaces. Use power-driven fasteners only when approved in writing by the Contracting Officer.

2.9.2 Metal Plates

Provide flat corrosion-resistant round stress plates as recommended by the modified bitumen sheet manufacturer's printed instructions and meeting the requirements of FM 4470; not less than 50.8 mm 2 inch in diameter. Form discs to prevent dishing or cupping.

2.10 PRE-MANUFACTURED ACCESSORIES

Pre-manufactured accessories must be manufacturer's standard for intended purpose, comply with applicable specification section, compatible with the membrane roof system and approved for use by the modified bitumen membrane manufacturer.

2.10.1 Pre-fabricated Curbs

Provide 20 gauge AZ55 galvalume curbs with minimum 101.6 mm 4 inch flange for attachment to roof nailers. Curbs must be minimum height of 254 mm 10 inch above the finished roof membrane surface.

2.10.2 Elevated Metal Walkways and Platforms

As specified in Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS 05 51 33 METAL LADDERS 05 52 00 METAL RAILINGS 05 51 00 METAL STAIRS.

2.11 WALKPADS

Provide roof walkpads that are polyester reinforced, granule-surfaced modified bitumen membrane material, minimum [_____] [5 mm] 5 mm mils thick, compatible with the modified bitumen sheet roofing and as recommended by the modified bitumen sheet roofing manufacturer. Panels must not exceed 1.219 meters 4 foot in length. Other walkpad materials require approval of the Contracting Officer prior to installation.

2.12 PAVER BLOCKS

Precast concrete, minimum 38.1 mm 1-1/2 inch thick, minimum 457 mm 18 inch square for walkways and minimum 152.4 mm by 304.8 mm 6 inch by 12 inch for use in supporting surface bearing components but extending not less than 50.8 mm 2 inch beyond all sides of surface bearing bases. Install walkpad material under all paver blocks.

2.13 ROOF INSULATION BELOW MODIFIED BITUMEN MEMBRANE SYSTEM

Provide insulation compatible with the roof membrane, approved by the membrane manufacturer and meeting all the requirements of ASTM C1289 polyisocyanurate boards.

Type II, Class I, Grade 3, 25 psi-minimum. 25 R-Value (Minimum). Tapered or as indicated in other documents.

Fasteners: Provide flush-driven fasteners through flat round or hexagonal steel or plastic plates. Provide zinc-coated steel plates, flat round not less than 35 mm 1 3/8 inch diameter, hexagonal not less than 0.4 mm 28 gage. Provide high-density plastic plates, molded thermoplastic with smooth top surface, reinforcing ribs and not less than 75 mm 3 inches in diameter. Fully recess fastener head into plastic plate after it is driven. Form plates to prevent dishing. Do not use bell or cup shaped plates. Provide fasteners in accordance with insulation manufacturer's recommendations for holding power when driven, to withstand 130 MPH wind.

Vapor Barrier (Concrete Decks only. Two plies of Type IV fiberglass plies set in hot Type III asphalt.

2.14 COVER BOARD (Recovery Board)

Cement Roof Board manufactured to conform to ASTM C1325.
Nominal thickness: 1/2 in.
Nominal weight: 2.4 lbs/SF.
Flexural strength (parallel) per ASTM C947: > 750 psi.
Compressive strengths: > 1000 psi.
Flute spanability per ASTM E661: 12 in.
Permeance per ASTM E96: 5.84 perms.
R Value per ASTM E831: 0.39 .SF.h/BTU.
Water Absorption per ASTM C473: < 0.07% MAX.
Mold resistance per ASTM D3273: 10.
Minimum bending radius: 6 ft.

2.15 ALUMINUM

ANSI-SPRI ES-1.
ASTM B209M ASTM B209 anodized color form alloy and temper appropriate for use.

Alclad 3003 or Alclad 3004, or Alclad 3005, clad on one side.
Finish: Baked-on factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and pretreated.

Finish coating dry-film thickness: 0.020 to 0.033 mm 0.8 to 1.3 mils

Color: Per BEAP

2.16 EDGE METAL / FLASHING / GUTTERS / DOWNSPOUTS / FASCIA

Use only aluminum manufactured for the purpose of flashing.

All exposed sheet metal gutters, including hangers, downspouts, gravel stops, and fascias; CAP, valley, steeped, base, and eave flashing, expansion joints,and related accessories must be of the same material.

Furnish sheet metal items in 8 to 10 foot lengths. Single pieces less than 8 feet long may be used to connect to factory -fabricated inside and outside corners, and at ends of runs. Factory fabricate corner pieces with minimum 12 inch legs. Provide all accessories and other items essential to

complete the sheet metal installation. Provide accessories made of the same or compatible materials as the items to which they are applied.

Aluminum alloy sheet and plate: ASTM B209M anodized color form alloy, and temper appropriate for use. ALCLAD 3003, ALCLAD 3004, ALCLAD 3005, clad on both sides.

Exposed exterior finish: Baked-on, factory-applied color coating of polyvinylidene fluoride (PVF2) or other equivalent fluorocarbon coating applied after metal substrates have been cleaned and pretreated. Provide finish coating dry-film coating dry-film thickness of 0.020 to 0.033 min. 0.8 to 1.3 mills. Color as selected from standard color wheel.

Aluminum alloy, extruded bars, rods, shapes, and tubes: ASTM B221M and ASTM B221.

Fasteners: Use the same metal or a metal compatible with the item fastened. Use stainless steel fasteners to fasten dissimilar materials (ASTM A480/A480M, type 302 or 304, 2D finish, fully annealed).

Minimum thickness of 0.025" (22Gage) for: Base course; wall opening heads and sills; through wall and spandrel; cap and base flashing; vertical and horizontal surfaces; roof edges, ridges, and hips; crickets, valleys, or gutters; chimney pans; and ledge flashing.

Minimum thickness of 0.032" for: coping widths up to 12".

Minimum thickness of 0.040" for: coping widths above 12".

Minimum thickness of 0.032" for: soffits.

2.17 ADHESIVE

2.17.1 ADHESIVE - HOT

Hot Type III SBS Modified asphalt

2.17.2 ADHESIVE - COLD

Cold adhesive is not alternate material to hot applied methods. Use cold adhesive if shown in drawings. Provide membrane manufacturer's recommended low volatile organic compound (VOC) cold process adhesive for application of the membrane plies. Provide moisture-cured, asphalt modified polyester polymer based adhesive. Provide product that will cure in 1 to 5 days maximum depending on climatic conditions. Apply product as recommended by manufacturer, including but not limited to: tools, temperature, coverage

2.18 POLYUREA FOR DRAINAGE

Single component alaphatic Polyurea

Tensile Strength (ASTM D 412) 2300 psi

Tear Strength (ASTM D 624) 230 lbs / SF

Wet Film Thickness 32 minimum 32 mils

PART 3 EXECUTION

3.1 EXAMINATION

Ensure that the following conditions exist prior to application of the roofing materials:

a. Do not install items that show visual evidence of biological growth.

b. Drains, curbs, cants, control joints, expansion joints, perimeter walls, roof penetrating components, and equipment supports are in place.

c. Surfaces are rigid, clean, dry, smooth, and free from cracks, holes, and sharp changes in elevation. Joints in the substrate are sealed to prevent dripping of bitumen into building or down exterior walls.

d. The plane of the substrate does not vary more than 6.35 mm 1/4 inch within an area 3.048 by 3.048 meters 10 by 10 foot when checked with a 3.048 meter 10 foot straight edge placed anywhere on the substrate.

e. Substrate is sloped as indicated to provide positive drainage.

f. Walls and vertical surfaces are constructed to receive counter flashing, and will permit mechanical fastening of the base flashing materials.

g. Treated wood nailers are in place on non-nailable surfaces, to permit nailing of base flashing at minimum height of 203.2 mm 8 inch above finished roofing surface.

h. Protect all combustible materials and surfaces which may contain concealed combustible or flammable materials. All fire extinguishing equipment has been placed as specified.

i. Verify all Fire Watch personnel assignments.

j. Treated wood nailers are fastened in place at eaves, gable ends, openings, and intersections with vertical surfaces for securing of membrane, edging strips, attachment flanges of sheet metal, and roof fixtures. Embedded nailers are flush with deck surfaces. Surface-applied nailers are the same thickness as the roof insulation.

k. Cants are securely fastened in place in the angles formed by walls and other vertical surfaces. The angle of the cant is 45 degrees and the height of the vertical leg is not less than 88.9 mm 3-1/2 inch.

l. Venting is provided in accordance with the following:

(1) Edge Venting: Perimeter nailers are kerfed across the width of the nailers to permit escape of gaseous pressure at roof edges.

(2) Underside Venting: Vent openings are provided in steel form decking for cast-in-place concrete substrate.

m. Exposed nail heads in wood substrates are properly set. Warped and split boards sheets have been replaced. There are no cracks or end

joints 6.35 mm 1/4 inch in width or greater. Knot holes are covered with sheet metal and nailed in place. WoodPlywood decks are covered with rosin paper or unsaturated felt prior to base sheet or roof membrane application. Joints in plywood substrates are taped or otherwise sealed to prevent air leakage from the underside.

n. Insulation boards are installed smoothly and evenly, and are not broken, cracked, or curled. There are no gaps in insulation board joints exceeding 6.35 mm 1/4 inch in width. Insulation is being roofed over on the same day the insulation is installed.

o. Cast-in-place substrates have been allowed to cure and the surface dryness requirements specified under paragraph FIELD QUALITY CONTROL have been met.

p. Joints between precast concrete deck units are grouted, leveled, and stripped in with felt or bituminous stripping membrane set in bituminous cement prior to applying other roofing materials over the area.

q. Roof deck and framing are sloped as indicated to provide positive drainage.

3.2 PREPARATION

3.2.1 Protection of Property

3.2.1.1 Protective Coverings

Install protective coverings at paving and building walls adjacent to hoists, and kettles prior to starting the work. Lap protective coverings not less than 15.24 cm 6 inch, secure against wind, and vent to prevent collection of moisture on covered surfaces. Keep protective coverings in place for the duration of the roofing work.

3.2.1.2 Bitumen Stops

Provide felt bitumen stops or other means to prevent bitumen drippage at roof edges, openings, and vertical projections before hot mopped application of the roofing membrane.

3.2.2 Equipment

3.2.2.1 Mechanical Application Devices

Mount mechanical application devices on pneumatic-tired wheels. Use devices designed and maintained to operate without damaging the insulation, roofing membrane, or structural components.

3.2.2.2 Flame-Heated Equipment

Do not place flame-heated equipment on roof. Provide and maintain a fire extinguisher adjacent to flame-heated equipment and on the roof.

3.2.2.3 Electric-Heated Equipment

Provide adequate electrical service as required by manufacturer of

electrical equipment to ensure against damage to equipment and property and to ensure proper application of roofing materials.

3.2.3 Heating of Asphalt

Break up solid asphalt on a surface free of dirt and debris. Heat asphalt in kettle designed to prevent contact of flame with surfaces in contact with the asphalt. Utilize kettles with visible working thermometer and thermostatic controls set to the temperature limits specified herein. Keep controls in working order and calibrated. Use immersion thermometer, accurate within a tolerance of plus or minus one degree C 1.8 degrees F, to check temperatures of the asphalt frequently. When temperatures exceed maximums specified, remove asphalt from the site. Do no permit cutting back, adulterating, or fluxing of asphalt.

3.2.3.1 Temperature Limitations for Asphalt

Heat and apply asphalt at the temperatures specified below unless specified otherwise by manufacturer's printed application instructions. Use thermometer to check temperature during heating and application. Have kettle attended constantly during heating process to ensure specified temperatures are maintained. Do not heat asphalt above its finished blowing temperature (FBT). Do not heat asphalt between 260 and 274 degrees C 500 and 525 degrees F for longer than four consecutive hours. Do not heat asphalt to the flash point (FP). Apply asphalt and embed membrane sheets when temperature of asphalt is within plus or minus 14 degrees C 25 degrees F of the equiviscous temperature (EVT) but not less than 204 degrees C 400 degrees F. Before heating and application of asphalt refer to the asphalt manufacturer's label or bill of lading for FP, FBT, and EVT of the asphalt used.

3.2.4 Priming of Surfaces

Prime all surfaces to be in contact with adhered membrane materials. Apply primer at the rate of 3 liters per 10 sq. meters 0.75 gallon per 100 sq. ft. or as recommended by modified bitumen sheet manufacturer's printed instructions to promote adhesion of membrane materials. Allow primer to dry prior to application of membrane materials to primed surface. Avoid flammable primer material conditions in torch applied membrane applications.

3.2.4.1 Priming of Concrete and Masonry Surfaces

After surface dryness requirements have been met, coat concrete and masonry surfaces which are to receive membrane materials uniformly with primer.

3.2.4.2 Priming of Metal Surfaces

Prime flanges of metal components to be embedded into the roof system prior to setting in bituminous materials or stripping into roofing system.

3.2.5 Membrane Preparation

Unroll modified bitumen membrane materials and allow to relax a minimum of 30 minutes prior to installation. In cold weather, adhere to membrane manufacturer's additional recommendations for pre-installation membrane handling and preparation. Inspect for damage, pinholes, particles of foreign matter, non-dispersed raw material, factory splices, or other

conditions that might affect serviceability. Edges of seams must be straight and flat so that they may be seamed to one another without forming fish mouths or wrinkles. Discard damaged or defective materials.

3.2.6 Substrate Preparation

Apply membrane to clean, dry surfaces only. Do not apply membrane to surfaces that have been wet by rain or frozen precipitation within the previous 12 hours. Provide cleaning and artificial drying with heated blowers or torches as necessary to ensure clean, dry surface prior to membrane application. Open flame operations are not allowed.

3.3 APPLICATION

Apply roofing materials as specified herein unless approved otherwise by the Contracting Officer. Keep roofing materials dry before and during application. Complete application of roofing in a continuous operation. Begin and apply only as much roofing in one day as can be completed that same day. Maintain specified temperatures for asphalt. Provide temporary roofing and flashing as specified herein prior to application of permanent roofing system.

3.3.1 Phased Membrane Construction

Phased application of membrane plies is prohibited unless otherwise approved by the Contracting Officer and supported by the membrane manufacturer's written application instructions. If cap sheet installation is delayed, thoroughly clean the applied membrane material surface and dry immediately prior to cap sheet installation. Priming of the applied membrane surface may be required at the discretion of the Contracting Officer prior to cap sheet installation.

3.3.2 Temporary Roofing and Flashing

Provide watertight temporary roofing and flashing where considerable work by other trades, such as installing cooling towers, antennas, pipes, ducts, and other items shown in construction documents is to be performed on the roof or where construction scheduling or weather conditions require protection of the building's interior before permanent roofing system can be installed. Do not install temporary roofing over permanently installed insulation. Provide rigid pads for traffic over temporary roofing.

3.3.2.1 Removal

Completely remove temporary roofing and flashing before continuing with application of the permanent roofing system.

3.3.3 Application Method

3.3.3.1 Hot Asphalt Application of Modified Bitumen Membrane

Apply membrane immediately following application of hot asphalt. Apply hot asphalt within 1.829 m 6 foot of roll. Do not work ahead with asphalt. Asphalt must be completely fluid, with mop temperatures within the asphalt's EVT range, but not less than 204.4 degrees C 400 degrees F, at the instant membrane comes into contact with asphalt. Apply bitumen between layers to provide full, continuous, uniform coverage and complete

contact of hot asphalt with the sheet above and below. Embed sheets in asphalt. As sheets are being rolled into hot asphalt, immediately and thoroughly apply uniform positive pressure by squeegee, roll, or broom to ensure full adhesion and lap seal, eliminate trapped air and to provide tight, smooth laminations. Avoid excessive extrusion of asphalt at lap areas. Control asphalt bleed out to approximately 25.4 mm 1 inch maximum.

3.3.4 Ventilating Base Sheets

Apply ventilating base sheets with 76.2 mm 3 inch side laps and 152.4 mm 6 inch end laps in accordance with manufacturer's printed application instructions for substrate and wind uplift conditions specified. Provide mechanical attachments as required for wind resistance specified and to include increased frequency of attachment at corner and perimeter areas. Drive fasteners flush with no dishing or cupping of fastener plate. Top mop perforated sheet with a full, continuous mopping of hot asphalt.

3.3.5 Fiberglass FeltModified Bitumen Base Sheet

Fully adhere base sheets in accordance with membrane manufacturer's printed instructions. Roll and broom in the base sheet to ensure full contact with the hot asphalt application. On nailable substrates, mechanically fasten base sheet in conformance with specified wind resistance requirements and membrane manufacturer's printed instructions, and to include increased fastening frequency in corner and perimeter areas. Drive fasteners flush with no dishing or cupping of fastener plate. Where applicable, mechanically fasten base sheet in conjunction with insulation to the substrate, in accordance with membrane manufacturers printed instructions. Apply sheets in a continuous operation. Apply sheets with side laps at a minimum of 50.8 mm 2 inch unless greater side lap is recommended by the manufacturer's standard written application instructions. Provide end laps of not less than 152.4 mm 6 inch and staggered a minimum of 914.4 mm 36 inch. Apply sheets at right angles to the roof slope so that the direction of water flow is over and not against the laps so that plies of sheets extend from eave line on one side of the barrel-type roof and 457.2 mm 18 inch over the center line of the crown of the roof. Apply sheets on the other side in the same manner, resulting in twice the normal amount of roofing sheets and asphalt at the crown. Extend base sheets approximately 50.8 mm 2 inch above the top of cant strips at vertical surfaces and to the top of cant strips elsewhere. Trim base sheet to a neat fit around vent pipes, roof drains, and other projections through the roof. Application must be free of ridges, wrinkles, and buckles.

3.3.6 Modified Bitumen Membrane Application

Ensure proper sheet alignment prior to installation. Apply membrane layers perpendicular to slope of roof in shingle fashion to shed water, including application on areas of tapered insulation that change slope direction. Bucking or backwater laps are prohibited. Fully adhere membrane sheets to underlying substrate materials. Provide minimum 76.2 mm 3 inch side laps and minimum 152.4 mm 6 inch end laps and as otherwise required by membrane manufacturer. Stagger end laps minimum 914.4 mm 36 inch. Offset side laps between membrane layers a minimum of 304.8 mm 12 inch. Offset end laps between membrane layers a minimum of 914.4 mm 36 inch. Install all membrane layers the same workday, unless supported otherwise by roof membrane manufacturer application instructions and approved by the Contracting Officer. Provide tight smooth laminations of each membrane layer without wrinkles, ridges, buckles, kinks, fishmouths, or voids.

Ensure full membrane adhesion and full lap seals. Rework to seal any open laps prior to application of subsequent membrane layers. The completed membrane application must be free of surface abrasions, air pockets, blisters, ridges, wrinkles, buckles, kinks, fishmouths, voids, or open seams.

3.3.6.1 Cap Sheet Installation

Underlying applied membrane must be inspected and repaired free of damage, holes, puncture, gouges, abrasions, and any other defects, and free of moisture, loose materials, debris, sediments, dust, and any other conditions required by the membrane manufacturer prior to cap sheet installation. Do not apply cap sheet if rain or frozen precipitation has occurred within the previous 24 hours. Align cap membrane and apply by the specified method with the proper side and end lap widths. Set cap sheet in hot asphalt as recommended by the modified bitumen membrane manufacturer when the roof deck and materials used in the installation of the roofing system are non-combustible. Cut at a 45 degree angle across selvage edge of cap membrane to be overlapped in end lap areas prior to applying overlapping cap membrane. Apply matching granules in any areas of bitumen bleed out while the asphalt is still hot. Minimize traffic on newly installed cap sheet membrane.

3.3.6.2 Backnailing of Cap Sheet

Unless otherwise recommended by the modified bitumen membrane manufacturer and approved by the Contracting Officer, provide minimum 88.9 mm 3-1/2 inch wide nailing strips matching insulation thickness and applied perpendicular to roof slope for backnailing of roof membrane. Space nailing strips as recommended by the membrane manufacturer, but not exceeding 4.88 m 16 foot on center unless approved otherwise by the Contracting Officer. Coordinate the nailer installation with insulation requirements. Install the modified bitumen cap sheet to provide for end laps at nailer locations. Nail the modified bitumen cap sheet at the end lap area across the width of the sheet. Nail within 25.4 mm 1 inch of each edge of the sheet and at 203.2 mm to 215.9 mm 8 inch to 8-1/2 inch on center across the width of the sheet in a staggered fashion. Nails must have 25.4 mm 1 inch diameter metal cap or be nailed through 25.4 mm 1 inch diameter caps. Cover nails by overlapping adjacent upslope sheet at the end lap area.

3.3.7 Membrane Flashing

Apply two-ply modified bitumen strip flashing and sheet flashing in the angles formed where the roof deck abuts walls, curbs, ventilators, pipes, and other vertical surfaces, and where necessary to make the work watertight. Apply membrane flashing in accordance with the roof membrane manufacturers printed instructions and as specified. Cut at a 45 degree angle across terminating end lap area of cap membrane prior to applying adjacent overlapping cap membrane. Press flashing into place to ensure full adhesion and avoid bridging. Ensure full lap seal in all lap areas. Mechanically fasten top edge of modified bituminous base flashing 150 mm (6 inches) on center through minimum 25.4 mm 1 inch diameter tin caps with fasteners of sufficient length to embed minimum one inch into attachment substrate. Apply matching granules in any areas of asphalt bleed out while the asphalt is still hot. Apply membrane liner over top of exposed nailers and blocking and to overlap top edge of base flashing installation at curbs, parapet walls, expansion joints and as otherwise indicated to serve as waterproof lining under sheet metal flashing components. Metal flashing

per SMACNA 1793 guidelines and standards is specified under Section 07 60 00 FLASHING AND SHEET METAL. Do not set metal flashing in hot asphalt.

3.3.7.1 Membrane Strip Flashing

Set primed flanges of metal flashing in full bed of modified bituminous cement material and securely fasten through to attachment substrate. Strip-in with membrane flashing so that strip extends not less than 101.6 mm 4 inch beyond outer edge of flange. Where multiple membrane stripping plies are installed, extend each additional stripping ply minimum 101.6 mm 4 inch beyond edge of previous ply.

3.3.7.2 Membrane Flashing at Roof Drain

Roof drains are specified in Section 22 00 00 PLUMBING, GENERAL PURPOSE. Flashing for roof drains, is specified in Section 07 60 00 FLASHING AND SHEET METAL. Extend membrane sheets to edge of drain bowl opening at the roof drain deck flange in accordance with membrane manufacturer's printed application instructions. Securely clamp membrane sheets and metal roof drain flashing and strip flashing in the flashing clamping ring. Secure clamps so that sheets and metal flashing are free from wrinkles and folds. Trim stripping must be flush with inside of clamping ring.

3.3.7.3 Pre-fabricated Curbs

Securely anchor prefabricated curbs to nailer or other base substrate and flash with modified bitumen membrane.

3.3.7.4 Set-On Accessories

Where pipe or conduit blocking, supports and similar roof accessories are set on the membrane, adhere walkpad material to bottom of accessories prior to setting on roofing membrane. Install set-on accessories to permit normal movement due to expansion, contraction, vibration, and similar occurrences without damaging roofing membrane. Do not mechanically secure set-on accessories through roofing membrane into roof deck substrate.

3.3.7.5 Lightning Protection

Flash and attach lightning protection system components to the roof membrane in a manner acceptable to the roof membrane manufacturer.

3.3.8 Roof Walkpads

Install walkpads at roof access points and where otherwise indicated for traffic areas and for access to mechanical equipment, in accordance with the modified bitumen sheet roofing manufacturer's printed instructions. Provide minimum 152.4 mm 6 inch separation between adjacent walkpads to accommodate drainage. Provide walkpad or an additional layer of cap sheet under precast concrete paver blocks to protect the roofing.

3.3.9 Elevated Metal Walkways and Platforms

Install over completed roof system in accordance with Section 05 50 13 MISCELLANEOUS METAL FABRICATIONS, or Section 05 51 33 METAL LADDERS, or Section 05 52 00 METAL RAILINGS, or Section 05 51 00 METAL STAIRS or other construction documents. Provide for protection of roof membrane by placing

walkpad material, or other material approved by the Contracting Officer, at all surface bearing support locations.

3.3.10 Paver Blocks

Install paver blocks where indicated and as necessary to support surface bearing items traversing the roof area. Set paver block on a layer of walkpad or cap sheet applied over the completed roof membrane.

3.3.11 Field Applied Surfacing

After completion of roof membrane and flashing installation, and correction of tears, gouges, and other deficiencies in the installed work, apply specified surfacing.

3.3.11.1 Aggregate

Uniformly flood coat the surface with hot asphalt at a rate of approximate 27.2 kg 60 pounds per square. While asphalt is still hot, apply gravel aggregate surfacing material at a rate of 181.4 kg 400 pounds per square or 136.1 kg 300 pounds per square for slag or other approved aggregate surfacing. Provide for full and uniform coverage of the roof surface. Solidly adhere approximately 50 percent of the aggregate in the asphalt.

3.3.11.2 Coating Application

Apply surface coating materials to membrane and flashing in accordance with coating material manufacturer's recommendations.

3.3.12 Correction of Deficiencies

Where any form of deficiency is found, take additional measures as deemed necessary by the Contracting Officer to determine the extent of the deficiency and perform corrective actions as directed by the Contracting Officer.

3.3.13 Clean Up

Remove debris, scraps, containers and other rubbish and trash resulting from installation of the roofing system from job site each day.

3.4 CORRECTION OF DEFICIENCIES

Where any form of deficiency is found, take additional measures as deemed necessary by the Contracting Officer to determine the extent of the deficiency and perform corrective actions as directed by the Contracting Officer.

3.5 PROTECTION OF APPLIED ROOFING

At the end of the day's work and when precipitation is imminent, protect applied modified bitumen roofing system from water intrusion.

3.5.1 Water Cutoffs

Straighten insulation line using loose-laid cut insulation sheets and seal the terminated edge of modified bitumen roofing system in an effective

manner. Seal off flutes in metal decking along the cutoff edge. Remove the water cut-offs to expose the insulation when resuming work, and remove the insulation sheets used for fill-in.

3.5.2 Temporary Flashing for Permanent Roofing

Provide temporary flashing at drains, curbs, walls and other penetrations and terminations of roofing sheets until permanent flashing can be applied. Remove temporary flashing before applying permanent flashing.

3.5.3 Temporary Walkways, Runways, and Platforms

Do not permit storing, walking, wheeling, and trucking directly on applied roofing materials. Provide temporary walkways, runways, and platforms of smooth clean boards, mats or planks as necessary to avoid damage to applied roofing materials, and to distribute weight to conform to live load limits of roof construction. Use rubber-tired equipment for roofing work.

3.6 FIELD QUALITY CONTROL

Perform field tests in the presence of the Contracting Officer. Notify the Contracting Officer one day before performing tests.

3.6.1 Test for Surface Dryness

Before application of membrane sheets and starting work on the area to be roofed, perform test for surface dryness in accordance with the following:

a. Foaming: When poured on the surface to which membrane materials are to be applied, one pint of asphalt when heated in the range of 176 to 204 degrees C 350 to 400 degrees F, must not foam upon contact.

b. Strippability: On cementitious substrate surfaces, after asphalt used in the foaming test application has cooled to ambient temperatures, test coating for adherence. Should a portion of the sample be readily stripped clean from the surface, do not consider the surface to be dry and do not start application. Should rain occur during application, stop work and do not resume until surface has been tested by the method above and found dry.

c. Prior to installing any roof system on a concrete deck, conduct a test per ASTM D4263. The deck is acceptable for roof system application when there is no visible moisture on underside of plastic sheet after 24 hours.

3.6.2 Construction Monitoring

During progress of the roof work, make visual inspections as necessary to ensure compliance with specified parameters. Additionally, verify the following:

a. Materials comply with the specified requirements.

b. Materials are not installed in adverse weather conditions.

All materials are properly stored, handled and protected from moisture or other damages.

c. Equipment is in working order. Metering devices are accurate.

d. Substrates are in acceptable condition, in compliance with specification, prior to application of subsequent materials.

(1) Nailers and blocking are provided where and as needed.

Insulation substrate is smooth, properly secured to its substrate, and without excessive gaps prior to membrane application.

(2) The proper number, type, and spacing of fasteners are installed.

Membrane heating, hot mopping, or adhesive application is provided uniformly and as necessary to ensure full adhesion of roll materials. Asphalt is heated and applied within the specified temperature range.

The proper number and types of plies are installed, with the specified overlaps.

Applied membrane surface is inspected, cleaned, dry, and repaired as necessary prior to cap sheet installation.

(3) Lap areas of all plies are completely sealed.

Membrane is fully adhered without ridges, wrinkles, kinks, fishmouths, or other voids or delaminations.

Installer adheres to specified and detailed application parameters.

Associated flashing and sheet metal are installed in a timely manner in accord with the specified requirements.

Temporary protection measures are in place at the end of each work shift.

3.6.2.1 Manufacturer's Inspection

Manufacturer's technical representative must visit the site a minimum of three times per week during the installation for purposes of reviewing materials installation practices and adequacy of work in place. Previously noted deficiencies or application errors must be performed as requested by the Contracting Officer. After each inspection, submit a report, signed by the manufacturer's technical representative to the Contracting Officer within 3 working days. Note in the report overall quality of work, deficiencies and any other concerns, and recommended corrective action.

3.6.3 Samples of Roofing

Take samples per ASTM D5147/D5147M, sized 101.6 mm by 1016 mm 4-inch by 40-inch cut across width of modified bitumen sheets as directed by the Contracting Officer. Cut samples will be examined by the Contracting Officer for specified number of plies, proper lap width, complete lap seal, full uniform adhesive compound application and adhesion, full bond between plies, harmful foreign materials, presence of moisture, and wet insulation. Where cuts are not retained by the Contracting Officer or disposed, set cut

strip back in cut area in bed of modified bitumen cement. Repair area of cut with new minimum two-ply modified bitumen membrane patch.

3.6.4 Roof Drain Test

After completing roofing, but prior to Government acceptance, perform the following test for watertight integrity. Plug roof drains and fill with water to edge of drain sump for 8 hours. Do not plug secondary overflow drains at the same time as adjacent primary drain. To ensure some drainage from roof, do not test all drains at same time. Measure water at beginning and end of the test period. When precipitation occurs during test period, repeat test. When water level falls, remove water, thoroughly dry, and inspect installation; repair or replace roofing at drain to provide for a properly installed watertight flashing seal. Repeat test until there is no water leakage.

3.7 INSTRUCTIONS TO GOVERNMENTCONTRACTOR PERSONNEL

Furnish written and verbal instructions on proper maintenance procedures to designated Government personnel. Furnish instructions by a competent representative of the modified bitumen membrane manufacturer and include a minimum of 4 hours on maintenance and emergency repair of the membrane. Include a demonstration of membrane repair, and give sources of required special tools. Furnish information on safety requirements during maintenance and emergency repair operations.

3.8 INFORMATION CARD

For each roof, furnish a typewritten information card for facility Records and a card laminated in plastic and framed for interior display at roof access point, or a photoengraved 1 mm 0.039 inch thick aluminum card for exterior display. Card must be 215 mm by 275 mm 8 1/2 by 11 inch minimum, identifying facility name and number; location; contract number; approximate roof area; detailed roof system description, including deck type, membrane, number of plies, method of application, manufacturer, insulation and cover board system and thickness; presence of tapered insulation for primary drainage, presence of vapor retarder; date of completion; installing contractor identification and contact information;

membrane manufacturer warranty expiration, warranty reference number, and contact information. Install card at roof top or access location as directed by the Contracting Officer and provide a paper copy to the Contracting Officer.

-- End of Section --