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USACE / NAVFAC / AFCEC **UFGS-07 52 00 (August 2025)**

Preparing Activity: NAVFAC **Superseding UFGS-07 52 00 (May 2012)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated April 2026
****

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DIVISION 07 - THERMAL AND MOISTURE PROTECTION

SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING

08/25

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SECTION 07 52 00

MODIFIED BITUMINOUS MEMBRANE ROOFING
08/25

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NOTE: This guide specification covers the requirements for modified bitumen sheet roofing. Hot mopped asphalt, torch applied, hot air, and cold-applied adhesive applications are included on both existing and new roof systems with slopes from 6 mm to 76 mm 1/4 inch to 3 inches per foot. Both SBS and APP modified bitumen membranes are included.

Due to the potential for fires during roofing installations, torch application of the roofing system is prohibited when combustible roof decks are present (such as wood, cement-wood fiber). Similarly, torch application of membrane directly to combustible substrate construction is prohibited. When torch application is prohibited, delete all requirements related to torch application and specify only the acceptable application method(s) and their associated requirements.

Special fire safety design and application precautions are required with torch application of modified bitumen membrane when combustible materials are present in the roof system or adjacent construction. Torch flame must not be applied directly to surface of wood, other combustible substrate construction, or easily ignited materials. Design detailing, specification, and application must account for fire safety and require alternate application methods where combustible substrates exist such as at roof curbs, parapet walls, expansion joints, and other wood construction. Detailing might include complete covering of the combustible substrate with self-adhering membrane compatible with subsequent torch-applied modified bitumen membrane application. Alternate application methods include cold-applied membrane flashings or torch-and-flop technique. Torch-and-flop involves: cutting the membrane in short lengths; flip the membrane over

and position near but not on the combustible application substrate; torch underside of the membrane to melt underside bitumen; flop membrane in place and rub with gloved hand to assure adhesion to substrate before bitumen cools.

Existing facilities might contain combustible materials underneath existing roof deck or adjacent to the roof construction. The existing construction must be investigated for the presence of combustible materials adjacent to the roof work. If the presence of combustible materials cannot be verified, delete all reference to torch applications and select one of the alternate methods of attachment.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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Acids, hydrocarbons, oil, and cooking greases attack modified sheet roofing. When these contaminants may be a problem on a roof, contact modified bitumen sheet manufacturers for specific recommendations.

Coordinate this section with other roof system components specifications such as rough carpentry, electrical, mechanical, insulation and sheet metal flashing, and structure. Also coordinate this section with the criteria contained in UFC 3-110-03, "Roofing" as it relates to the specific project and Service Exceptions indicated therein.

Requirements for special conditions, including Hurricane force wind (uplift) and seismic design considerations are included in brackets. References and paragraphs which do not apply to specific projects should be deleted.

****

PART 1 GENERAL

1.1 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

****

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 7-22	(2022; Supp 1 2023; Supp 2 2023; Supp 3 2025) 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 PMBRG98	(1998) Quality Control Guideline for the Application of Polymer Modified Bitumen Roofing

ASTM INTERNATIONAL (ASTM)

ASTM C208	(2022) Standard Specification for Cellulosic Fiber Insulating Board
ASTM C728	(2017a; R 2022) Standard Specification for Perlite Thermal Insulation Board
ASTM C1153	(2023) Standard Practice for Location of Wet Insulation in Roofing Systems Using Infrared Imaging
ASTM D41/D41M	(2011; R 2023) 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 2021) 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	(2021) 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 D3019/D3019M	(2017; R 2024) Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered
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	(2025) Standard Specification for Asphalt Roof Cement
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 D6162/D6162M	(2016) Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and 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 D6509/D6509M	(2016; R 2023) Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Base Sheet Materials Using Glass Fiber Reinforcements
ASTM D7379/D7379M	(2021) Standard Test Methods for Strength of Modified Bitumen Sheet Material Laps Using Cold Process Adhesive
ASTM E108	(2025) Standard Test Methods for Fire Tests of Roof Coverings
ASTM E1980	(2024) Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
ASTM F2170	(2019a) Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

COOL ROOF RATING COUNCIL (CRRC)

ANSI/CRRC S100	(2021) Standard Test Methods for Determining Radiative Properties of Materials

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 https://www.approvalguide.com/

INTERNATIONAL CODE COUNCIL (ICC)

ICC IBC	(2024) International Building Code

INTERNATIONAL SAFETY EQUIPMENT ASSOCIATION (ISEA)

ANSI/ISEA Z87.1	(2025) 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	(2024; TIA 24-2) Liquefied Petroleum Gas Code
NFPA 241	(2022; ERTA 22-1) Standard for Safeguarding Construction, Alteration, and Demolition Operations

NATIONAL ROOFING CONTRACTORS ASSOCIATION (NRCA)

NRCA CONDET	(2025) Construction Details Manual
NRCA RoofMan	(2025) 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. 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

UL SOLUTIONS (UL)

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

1.2 SEQUENCING

Coordinate the work with other trades to ensure that components which are 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.[Install roof membrane 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.]

1.3 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy and Air Force projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are for Contractor Quality Control approval. Submittals not having a "G" or "S" classification are for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

[SD-01 Preconstruction Submittals

****

NOTE: Include Construction Fire Safety Plan submittal for all torch-applied membrane applications.

****

[Construction Fire Safety Plan

][Odor Control Plan

]] SD-02 Shop Drawings

Roof Plan and Flashing Details; G, [_____]

Field Inspection and Existing Conditions Report

SD-03 Product Data

Written Acceptance Letter

Modified Bitumen Sheets; G, [_____]

[Heat Island Reduction; S

][Solar Reflectance; S

][Asphalt

][Cold-Applied Membrane Adhesive; G, [_____]

] Fiberglass Felt; G, [_____]

Flashing Membranes; G, [_____]

Liquid Applied Flashing; G, [_____]

Primer; G, [_____]

Modified Bitumen Roof Cement; G, [_____]

[Pre-Manufactured Accessories

] Fasteners; G, [_____]

Metal Fastening Plates

Cant and Tapered Edge Strips

[Walkpads

][Paver Blocks

][Photovoltaic (PV) Systems; G, [_____]

] Sample Warranty Certificate; G, [_____]

[Pre-Fabricated Curbs

] SD-05 Design Data

****
NOTE: Coordinate with requirements of WIND UPLIFT paragraph. Include bracketed requirement where non-rated systems may be permissible.
****

Wind Uplift Calculations; G, [_____]

SD-07 Certificates

Qualification of Manufacturer

Qualification of Applicator

****
NOTE: Include bracketed requirement when torch applications are permitted as an acceptable method of attachment.
****

[Qualification of Torch Operator; G, [_____]

][Qualification of Licensed Engineer

]**********
NOTE: Include bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

[Bill of Lading

] Wind Uplift Resistance; G, [_____]

Fire Resistance classification; G, [_____]

SD-08 Manufacturer's Instructions

****
NOTE: Edit the manufacturers instructions submission requirements as necessary for the system specified. Include bracketed requirements only as applicable to the system being specified (e.g., torch applied systems may not require asphalt in the installation).
****

Modified Bitumen Base Sheet Application; G, [_____]

Modified Bitumen Membrane Application; G, [_____]

Flashing; G, [_____]

Liquid Applied Flashing Installation

[Temperature Limitations for Asphalt

][Torches

][Cold Adhesive Applied Modified Bitumen Membrane; G, [_____]

] Primer

Fasteners

[[Ventilating]Base Sheets

][Coating Application; G, [_____]

] Cold Weather Installation; G, [_____]

SD-09 Manufacturer's Field Reports

[Manufacturer's Field Inspection Report; G, [_____]

] SD-11 Closeout Submittals

Warranty

Information Card

Instructions to [Government][Contractor] Personnel

[1.4 CONSTRUCTION FIRE SAFETY PLAN

****

NOTE: Include this subpart and associated subparagraphs when torch application is specified. An approved Construction Fire Safety Plan is required for any project involving torch-applied membrane materials to include field of roof membrane torch application or flashing membrane torch application. The purpose of the Plan is to stimulate forward planning and for the Contractor to demonstrate and communicate fire hazard acknowledgement, awareness, and understanding of requirements and enforcement of fire safety in order to prevent fire incidents.

****

Submit a project-specific Construction Fire Safety Plan for the specific conditions of the roof work involved. The plan must delineate specific fire safety precautions and prevention measures for the project work and must be enforced on the job site. Reference to a related standard is unacceptable as a substitute for providing specific fire safety precautions and prevention measures in the plan. Failure to submit an acceptable plan will preclude use of torch application and require an alternate application method at no additional cost to the Government.

The plan must include the following as a minimum and adhere to all specified and referenced safety requirements:

a. Fire Safety Awareness Training and documentation of training for all roofing contractor personnel on site. Training must be facilitated by the Site Safety and Health Officer (SSHO). Provide initial training at start of roof work and weekly awareness reinforcement training during conduct of torch-applied roof work of any nature. QC Manager must attend initial training. Training must address personal protection equipment (PPE), identification of potential fire hazards related to the work, recognition of combustible materials, and fire protection and prevention measures.

b. Personal Protection Equipment (PPE) for general laborers and any additional PPE for torch applicators.

c. Daily Pre-Work Inspection Plan to identify potential fire hazard conditions and address fire prevention measures. Inspection must be conducted by SSHO, roofing superintendent or foreman, QC Manager, and at least one torch applicator. Inspection must identify materials and conditions that could be ignited by torch flame including but not limited to: wood, primers, mastics, bituminous cements, adhesives, and other combustibles; open joints or gaps in construction; intakes and exhausts; rooftop discharges; flashing situations; areas adjacent to roof construction; utility service lines (such as gas lines and conduit); and any other fire hazard conditions. Inspection must also verify acceptable condition of torch equipment, hoses, tanks, and fire extinguishers. The plan may include a specific checklist tailored to the project conditions that lists identified hazards and required actions. Address specific fire prevention measures with torch applicators prior to start of work. Daily Pre-Work Inspection requires documentation and sign-off.

****

NOTE: Include the bracketed list item below for work involving roof demolition. Roof Demolition Completion Inspection is required where torch applications are used in roof replacement or roof repair work where demolition is involved.

****

[d. Roof Demolition Completion Inspection Plan to include inspection at completion of demolition prior to start of new materials installation in order to identify potential fire hazard conditions and address fire prevention measures with torch applicators prior to start of torch application work in the area of demolition and adjacent construction. Inspection must adhere to requirements of the Daily Pre-Work Inspection.

] e. Combustible Materials Protection Plan to include recognition and identification of the various types of potential combustibles and specific measures to protect combustible materials in the roof system and stored on the rooftop from contact with torch flame. Address protection measures related to location of combustibles, type of combustible, avoidance of flame contact, temporary coverings, and alternate application methods.

f. Torch Handling Procedures to include equipment safety checks, igniting procedures, handling of lit torch, flame control and avoidance of flame contact with combustibles and into concealed areas, safe distance recognition, field versus detail torch use, and shut down and disconnect of torch at end of workday.

g. Application Procedures for torch application work to include heating of and laying of membrane, prevention of overheating or ignition of combustible materials, and for flashing applications. Address application when approaching holes or openings in roof surface, penetrations, perimeters, rising walls, wood components, other areas of combustibles adjacent to roof construction, field versus detail torch use, and alternate application methods at wood or other combustible substrate construction.

h. Rooftop Fire Extinguishing Plan to include size, quantity, location or

positioning of fire extinguishers, and worker training on use of fire extinguishers.

i. Emergency Notification Plan to include prominent posting of fire department phone number and site address. Coordination with building occupants when building is occupied. Communication of plan to workers.

j. Fire Watch and Inspection Procedures to include details of when fire watch will take place, how conducted, exterior and interior, use of thermal imaging equipment, and potential signs of fire concern. Identify the thermal imaging equipment used to assist with fire watch.

]1.5 CONSTRUCTION HAZARDS 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 are required to 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.

d. Wear heavy leather gloves and flame retardant gauntlets during all handling of a torch, whether operating or not.

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

f. OSHA and ANSI approved hard hats.

1.6 QUALITY CONTROL

1.6.1 Qualification of Manufacturer

****
NOTE: Specify minimum 20 years manufacturer experience unless directed otherwise by the Government.
****

Submit information demonstrating modified bitumen sheet roofing system manufacturer has a minimum of [20][_____] year's experience in

manufacturing modified bitumen roofing products.

1.6.2 Qualification of Applicator

****
NOTE: Specify minimum 3 years as an approved contractor unless directed otherwise by the Government
****

Submit information demonstrating roofing system applicator is approved, authorized, or licensed in writing by the modified bitumen sheet roofing system manufacturer and have a minimum of [5][_____] 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 is required to 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 3 years.

[1.6.3 Qualification of Torch Operator

****
NOTE: Specify a CERTA certified torch applicator when torch applications are permitted.
****

Submit information demonstrating the torch applicators are CERTA certified to operate torch equipment and maintain and carry a valid Certified Roofing Torch Applicator (CERTA) card bearing name and certification date. CERTA certification valid for 3 years from date of issuance unless approved otherwise by the Contracting Officer.

][1.6.4 Qualification of Licensed Engineer

****
NOTE: Include this section requiring a licensed engineer when non-rated systems are being used or are allowed. This section can be deleted when a rated system is used. When renovation/re-work projects have a unique condition, it may not be possible to use a rated system.
****

[Submit information demonstrating the Engineer is currently licensed within the jurisdiction of the project.

][Engineer must be currently licensed and have a minimum of 5 year's experience with performing calculations required on similar roof systems. 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 3 years. Provide certified engineering calculations for:

[Wind uplift requirements][in accordance with][Local and State codes]

ASCE 7-22, 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 7-22

]]]1.6.5 Fire Resistance

Complete roof covering assembly must:

****
NOTE: Specify Class B option only when Class A may not be attainable such as membrane system application directly to wood deck. Provide justification/rationale for Class B option with design submission
****

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.

1.6.6 Wind Uplift Resistance

****
NOTE: Determine the required wind uplift resistance based on ASCE 7-22 wind loading calculations or applicable building code requirements. The specified FM rating incorporates a safety factor of 2 over the maximum calculated uplift pressure. Therefore, a FM rating of 1-90 correlates to a maximum uplift calculation of 2.2 kPa 45 psf. When a rated system is specified, ensure the specified roof system is capable of meeting the wind uplift resistance specified. Where non-rated systems may be permissible, include the bracketed option.

Delineate calculated values in the roof specification or drawings. Utilize independently tested and rated roof systems, such as Factory Mutual (FM)or Underwriters Laboratories (UL).
****

Provide a complete roof system assembly that is rated and installed to resist wind loads [indicated] [calculated in accordance with ASCE 7-22] 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 [_____] km/h [_____] mph in accordance with ASCE 7-22 and other applicable building code requirements. Submit the roof system assembly wind uplift classification listings.

[Provide Engineering calculations, signed, sealed, and dated by a qualified Engineer validating the wind resistance per ASCE 7-22 of non-rated roof system.]

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

g. Safety requirements including but not limited to, fire safety, fall protection, and pedestrian traffic protections, as applicable to the work being performed.

Coordinate preroofing conference scheduling with the Contracting Officer. Conference attendance is required for the Contractor, the Contracting Officer's designated personnel, and personnel directly responsible for the installation of roofing[and insulation],[torch operator,] 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,[and fully familiar with fire safety requirements of torch-applied roofing application,][designated fire watch personnel,][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.

1.6.8 Roof Plan and Flashing Details

Develop and submit Roof Plan drawing depicting wind loads and boundaries of enhanced perimeter and corner attachments of roof system components, as applicable. Submit flashing details for all roof flashing conditions.

[1.6.9 Odor Control Plan

****
NOTE: Hot asphalt and adhesives can generate irritating odors and fumes. Specify an odor control plan when asphalt or adhesives will be used in the roof membrane application on existing buildings.
****

Submit an odor control plan to mitigate product and production odors and fumes. Provide measures to minimize odors and prevent odor infiltration to interior of occupied or enclosed buildings.

]1.7 DELIVERY, STORAGE, AND HANDLING

1.7.1 Delivery

****
NOTE: Include bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

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

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, ensure the container bears the specification number, type, and class, as applicable.[Labels or bill of lading for roofing asphalt are required to 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.

1.7.2 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. Completely cover felts stored outdoors, on and off roof, with waterproof canvas protective covering. Tie covering securely to pallets to make completely weatherproof. Provide sufficient ventilation to prevent condensation. 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.

1.7.3 Handling

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

1.8 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. For cold applied adhesive application, follow manufacturers recommendations for specific material temperature ranges and minimum ambient and substrate temperatures for adhesive applications. Follow manufacturer's printed instructions for Cold Weather Installation.

Submit detailed application instructions and standard manufacturer drawings altered 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.

1.9 WARRANTY

Provide roof system warranties meeting specified requirements. Provide revision or amendment to standard warranty as required to comply with the specified requirements.

1.9.1 Roof Membrane Manufacturer Warranty

****

NOTE: Designer may specify 5 or 10 year manufacturer warranty on facilities of small roof area and of minor importance where interiors and contents are not severely impacted by water intrusion and any time a one-ply modified bitumen membrane system is specified. Environmentally controlled interiors require a minimum 20 year warranty.

****

Upon completion of installation, and acceptance by the Contracting Officer[, Construction Manager][and Designer of Record], the manufacturer is required to supply the appropriate warranty to the Owner. Furnish the roof membrane manufacturer's 20-year no dollar limit, roof system watertightness materials and installation workmanship warranty, including flashing, insulation, and accessories necessary for a watertight roof system construction. Write warranty directly to the Government, commencing at time of Government's acceptance of the roof work. The warranty is required to 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.

1.9.2 Contractor's Warranty

****
NOTE: Select five years for Army and Air Force projects and two years for all other projects.
****

The Contractor is required to warrant for a period of [two][five] years that the roof system, as installed, is watertight and 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 Contractor is responsible for correction of defective workmanship and replacement of damaged or affected materials. The Contractor is responsible for all costs associated with the repair or replacement work.

1.9.3 Continuance of Warranty

Repair or replacement work that becomes necessary within the warranty period and must be approved by the manufacturer and accomplished in a manner so as to restore the integrity of the roof system assembly and validity of the warranty for the remainder of the 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. Perform any work not specifically addressed and any deviation from specified requirements 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.

Submit written acceptance letter from the roof membrane manufacturer for the roof products and accessories to be installed. Provide products as listed in the applicable wind uplift and fire rating classification listings, unless approved otherwise by the Contracting Officer.

PART 2 PRODUCTS

****
NOTE: Edit the materials specification requirements as necessary for the system(s) specified in paragraph DESCRIPTION OF ROOF MEMBRANE SYSTEM.

Include bracketed requirements only as applicable to the system being specified (e.g., torch applied

systems are prohibited on combustible roof decks.
****

2.1 SYSTEM DESCRIPTION

2.1.1 Description of Roof Membrane System[s]

****
NOTE: Coordinate with paragraph MATERIALS.

Where one membrane system is required for all roof areas, use the first paragraph. Where different systems are required, use the second paragraph successively and replace the open brackets with a description of the substrate(s) and area of the building or project where each system is applied.

Specify the three-ply option including base sheet, interply sheet and cap sheet when mechanical fastening of bottom ply is required either directly to nailable deck or over insulation substrate and into nailable deck, and when perforated base sheet is used. Otherwise, specify two-ply option including modified bitumen base sheet and cap sheet.

Two-ply option may also be considered when the mechanical fastening of the modified bitumen base ply is concealed in the finished base ply installation (i.e., no exposed fasteners in the base ply prior to application of cap sheet such as occurs in base sheets fastened only in the side lap area and where the overlapping adjacent base sheet is torch sealed over the fasteners in the lap area).

Do not specify one ply modified bitumen roof membrane without prior Government approval and only consider for application on open air sheds or light storage structures and ancillary buildings of little importance. One ply membrane includes application of a single ply directly to deck or insulation substrate or over mechanically fastened or perforated base sheets.

Specify SBS for all hot asphalt membrane applications. Torch applied and cold adhesive applications may include either or both SBS and APP, selected based on the specific application and service conditions intended. Torch applications are prohibited on combustible roof decks (such as wood or cement-wood fiber); similarly, torch application of membrane directly to combustible substrate construction is prohibited. Special fire safety design and application precautions are required with torch application of modified bitumen membrane when combustible materials are present in the roof system.

More than one application method may be specified among the hot asphalt, torch applied, and cold-applied adhesive options. It is common to

include cold-applied options with torch applied applications. This allows contractor to choose the best option to mitigate fire hazards based on roof conditions and contractor familiarity as well as for flashing applications in conjunction with torch-applied field membrane.

Specify venting base sheet for application directly to new concrete deck and over nailable lightweight fill substrate materials. Partial, spot, or strip adhered venting base sheet on concrete deck may limit wind resistance and should not be specified in high wind zones.

****

[Minimum[two-ply][three-ply] SBS[or][APP][modified bitumen roof membrane consisting of[modified bitumen base sheet][fiberglass felt[venting]base sheet][, interply sheet] and cap sheet. Ensure modified bitumen roof membrane is[set in hot asphalt][torch applied][set in cold-applied adhesive].]

][[_____]: Minimum[two-ply][three-ply] SBS[or][APP] modified bitumen roof membrane consisting of[modified bitumen base sheet][fiberglass felt[venting] base sheet][, interply sheet] and cap sheet. Ensure modified bitumen roof membrane is[set in hot asphalt][torch applied][set in cold-applied adhesive].

] All work is to follow the NRCA RoofMan guidelines and standards stated within this Section.

2.1.2 Elimination, Prevention of Fall Hazards

****

NOTE: Incorporate in the design fall prevention methods or techniques to eliminate fall hazards from any part or component of the building, facility, structure, or equipment requiring future maintenance work, in accordance with ANSI/ASSE A1264.1. Fall prevention methods may include identifying, designing, and installing anchorages (hard points) for safe use of fall arrest equipment and systems. Select materials for metal compatibility in order to minimize corrosion, type 316 stainless steel is recommended. Based on the design, include specifics of the system(s) and material(s) in the following subsection.

****

2.1.2.1 Fall Protection System

[_____]

2.1.3 Energy[and Cool Roof] Performance

****

NOTE: Facilities with dominant cooling loads or in mild or warm climate zones are required to meet "cool roofing" requirements of FEMP. Design cool roofs following the requirements in UFC 3-110-03

"Roofing"and ASHRAE 90.1 Chapter 5, for the design of insulation and energy performance of the building. If a cool roof is not selected in climate zones 1-3, meet one of the exception requirements listed in ASHRAE 90.1 Chapter 5 or provide thermal insulation above the deck with an R value of 33 or greater. Consider that when cool roofing is used with insulation R values greater than 24, the 'cool roof' surface has little if no influence on the energy performance of the building. Additionally, designers should be aware of the possible negative impacts of using cool roofing that may result in unintended consequences. Condensation on the underside of mechanically-fastened systems can result in ice build-up in winter, mold growth on the facers, moisture dripping into the interior, and replacement of the roofs with less than four years of service. See UFC 3-110-03 for more information. Poor design of cool roofs in ASHRAE climate zones 4 and higher have resulted in the unintended consequence of condensation below the membrane - a result of the material's inability to warm and drive moisture downward. Roofs that experience this condensation have required replacement. Other unintended consequences include the overheating of masonry walls, interior spaces, roof top piping and mechanical equipment because of the reflected UV rays.

NOTE: Designer to specify the roof performance by R-Value on the drawings or stated in other specification sections.

****

****

NOTE: Retain the next to last bracketed note for projects with cool roof requirement. Retain the last bracketed sentence for projects with sustainable third party certification credit requirement for reduced heat island effect.

****

Install a roof system that meets an overall performance as specified on the drawings or by insulation specified in other sections.[The roofing system is required to include a top surface finish that meets the criteria for Cool Roof Products.[Provide emittance and reflectance percentages, solar reflectance index values,[and] slopes [_____], to meet sustainable third party certification requirements for Heat Island Reduction.]]

2.2 MATERIALS

2.2.1 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. Ensure modified bitumen sheets are 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 is required to comply with ARMA PMBRG98 and be uniformly dispersed throughout the sheet. Install so edges of sheet are straight and flat.

****

NOTE: Select the base sheet option required and delete other base sheet options. Specify base for direct application over roof deck or sheets under insulation in the insulation specification section.

Specify modified bitumen base sheet for two-ply membrane systems and incorporate in three-ply membrane systems.

Perforated venting base sheet option should only be specified for application directly on concrete deck. Base sheets with perforations are rolled into place and then top mopped with hot asphalt. Base sheets without perforations are mechanically attached to nailable substrates.

****

[a. Venting Base Sheet: ASTM D4897/D4897M, Type II,[without][with] perforations and as approved by the modified bitumen roof membrane manufacturer.

] **********

NOTE: Fiberglass felt base sheet indicated below should only be used in ancillary roof applications such as unoccupied buildings, shed roofs, and non-critical or non-hazardous storage. Otherwise, modified bitumen base sheet is required or a venting base sheet application is incorporated with a two-ply modified bitumen roof membrane.

****

[b. Fiberglass Felt Base Sheet: ASTM D4601/D4601M,ASTM D1668/D1668M Type II,[without][with] perforations and as approved by the modified bitumen roof membrane manufacturer.

] **********

NOTE: When specifying a two-ply modified bitumen membrane system, delete any reference to Interply sheet. Use modified bitumen base sheet and cap sheet. Modified bitumen interply sheet is the middle ply of a three-ply modified bitumen membrane. When a ventilating base sheet or mechanically fastened base sheet is part of the roof membrane construction, specify two-ply modified bitumen membrane atop the base sheet.

Specify polyester-reinforced membrane (ASTM D6162 or ASTM D6164) for high traffic roofs and where enhanced puncture resistance, impact resistance, and overall durability are required. Specify composite glass/polyester-reinforced membrane (ASTM D6162) where tensile strength is required or when combined properties between a glass and polyester-reinforced membrane are required. Where polyester reinforced

sheet is required, delete any reference to ASTM D6162/D6162M. Where glass/polyester-reinforced membrane is required, delete any reference to ASTM D6164/D6164M.

Higher classifications generally indicate more mass and higher physical properties. Specify Type II or Type III modified bitumen sheet materials for all heavy-duty or high traffic service conditions and for all instances where fiberglass reinforced modified bitumen sheets are permitted. Note that there is no Type III for polyester reinforced ply (ASTM D6164).

****

[c. SBS Base Sheet: [ASTM D6162/D6162M Type[I or] II[or III]][or][ASTM D6164/D6164M] Type[I or] II, Grade S, minimum 2.25 mm 90 mils thick.

][d. SBS Interply Sheet: [ASTM D6162/D6162M Type[I or] II[or III]][or][ASTM D6164/D6164M] Type[I or] II, Grade S, minimum 2.25 mm 90 mils thick.

] **********

NOTE: Specify Grade S cap sheet only with the approval of the Government and when gravel surfacing or field applied coating is required in lieu of factory-applied mineral granule surfacing. Higher classifications generally indicate more mass and higher physical properties. Specify Type II or Type III modified bitumen cap sheet materials for all heavy-duty or high traffic service conditions and for all instances where fiberglass reinforced modified bitumen cap sheets are permitted.

Specify 3.7 mm 145 mils minimum thickness for SBS cap sheet unless directed otherwise by the Government.

****

[e. SBS Cap Sheet: [ASTM D6162/D6162M][or][ASTM D6164/D6164M] Type[I][or][II][or][III], Grade [G][S], minimum [3.7 mm] [145 mils] [_____] thick, and as required to provide specified fire safety rating.

][f. APP Base Sheet: ASTM D6222/D6222M, Type I or II; or ASTM D6223/D6223M, Type I or II; or ASTM D6509/D6509M; Grade [G][S], minimum 3.5 mm 140 mils thick.

] **********

NOTE: Specify Grade S cap sheet only with the approval of the Government and when gravel surfacing or field applied coating is required in lieu of factory-applied mineral granule surfacing.

Specify minimum 4 mm 160 mil APP cap sheet thickness unless directed otherwise by the Government.

****

[g. APP Cap Sheet: ASTM D6222/D6222M, Type II; or ASTM D6223/D6223M, Type II; Grade [G][S], minimum 4.0 mm 160 mils thick.

]2.2.2 Base Flashing

****
NOTE: Consider reflectivity and aesthetics when specifying a foil surfaced flashing. Do not specify foil surfaced materials for facilities along flight line or adjacent to telemetry or tracking equipment.

Metal clad membrane flashing should not be considered effective grease protection for the flashing or roof membrane in areas where the roof may be exposed to cooking grease release. Lap areas remain susceptible to degradation from exposure to grease and solvents.
****

2.2.2.1 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 flashing membrane thickness as recommended by the membrane manufacturer.[Provide metal clad flashing membrane that complies with ASTM D6298].

2.2.2.2 Liquid Applied Flashing

****
NOTE: Liquid-applied flashing system may be used for round or irregular shaped roof penetrations that experience minimal movement stresses like pipe vents, support posts, wide flange equipment support penetrations. Liquid-applied flashing must not be used to flash building structural frame penetrations due to potential movement stresses encountered at the roof plane; although it may be used as a component of the overall flashing system in conjunction with sheet metal pans with independent hoods attached to penetration.
****

Membrane manufacturer's recommended fabric reinforced liquid-applied flashing system incorporating polymethyl methacrylate (PMMA) resin-based two-component liquid coating system with a polyester reinforcing fabric.

[2.2.3 Asphalt

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates. The maximum slope for Type III is generally appropriate up to 1:12 and type IV is up to 3:12 unless stated otherwise by the manufacturer.

****

ASTM D312/D312M, Type III or IV, low fuming, in accordance with modified bitumen membrane manufacturer requirements and compatible with the slope conditions of the installation.

][2.2.4 Cold-Applied Membrane Adhesive

****

NOTE: Materials standards and application requirements vary for cold applied membrane adhesives and may consist of cold applied asphalt or polymeric adhesives. Follow manufacturers' directions and limitations of use for cold applied adhesives. Indicate the ASTM designation and desired type classification for cold applied adhesives. Cold-applied adhesive should be included when cold-applied flashing membrane application may be used in conjunction with torch applied roof membrane application to avoid torch application near wood or other combustible substrate construction. Ensure product data and application instructions are included under "Submittals" when cold-process membrane applications are specified. This information will be referenced by the field personnel in monitoring the application process.

Consider low VOC adhesives for cold-process applications on occupied buildings and when otherwise necessary.

****

Membrane manufacturer's recommended[asphalt][polymeric][one-part][two-part][elastomeric][low volatile organic compound (VOC)] cold process adhesive for application of the membrane plies[that meets or exceeds[ASTM D3019/D3019M][or][ASTM D7379/D7379M]; Type[I][or][II][or][III]].

][2.2.5 Membrane Surfacing

****

NOTE: Coordinate surfacing requirements with the type of system specified in paragraph DESCRIPTION OF ROOF MEMBRANE SYSTEM and with paragraph ENERGY AND COOL ROOF PERFORMANCE. Specify factory-applied granule surfaced membrane except under non-typical conditions where aggregate or coating applications may be considered. Factory-applied granules or aggregate surfacing should be used where possible. Specify required finished membrane surfacing. Delete other options.

****

Provide modified bitumen roof membrane cap sheet with factory-applied granule surfacing of[light] [_____] color[as selected from membrane manufacturer's standard colors].[Provide modified bitumen membrane manufacturer's recommended field-applied protective coating of[white][light gray] [_____] color.[Provide aluminized coating that complies with ASTM D2824/D2824M, Type I or III, as recommended by the modified bitumen

roof membrane manufacturer].][Light colored, opaque water-worn gravel aggregate surfacing material conforming to ASTM D1863/D1863M, or other aggregate as recommended by the membrane manufacturer and approved by the Contracting Officer[, and applied in flood coat of hot asphalt].]

[2.2.5.1 Solar Reflectance

****

NOTE: Compliance with ASHRAE 90.1 is required on all projects. For ASHRAE 90.1 compliance, include the first bracketed sentences for projects in ASHRAE climate zones 0 thru 3. See ASHRAE 90.1 Chapter 5, section titled "Roof Solar Reflectance and Thermal Emittance", for exceptions when roof design conditions eliminate these requirements and this section can be deleted. When a designer desires IgCC compliance with cool roof requirements, include the second set of bracketed sentences for projects in ASHRAE climate zones 0 thru 3. See IgCC Chapter 5 for exceptions when design conditions eliminate these requirements.

****

[Provide roof finishes for more than 75 percent of the roof surface having a minimum 3-year aged solar reflectance of 0.55, and a minimum 3-year aged thermal emittance of 0.75 when tested in accordance with ANSI/CRRC S100, or, a minimum 3-year aged Solar Reflectance Index of 64 when determined in accordance with the Solar Reflectance Index method in ASTM E1980 using a convection coefficient of 6.62 W per m2 2.1 BTU per h ft2.][Use roofing materials having minimum 3-year aged SRI for more than 75 percent of roof surface (less than or equal to 2:12 slope, SRI greater than 64; greater than 2:12 slope, SRI greater than 25).] SRI values are based on a minimum three-year aged solar reflectance and thermal emittance, as measured in accordance with ANSI/CRRC S100.

]]2.2.6 Primer

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

2.2.7 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.

2.2.8 Cant and Tapered Edge Strips

****

NOTE: Use wood cant in non-supported flashing and wood blocking details (i.e., expansion joints, area dividers, and wall/roof intersections where roof deck is not supported by a wall).

If wood cants and/or tapered edge strips are used in the installation of the roof, torch application of the system is prohibited at these locations and alternate application methods must be specified and indicated on drawings.

****

Provide standard cants and tapered edge strips of[perlite conforming to ASTM C728][the same material as the roof insulation][or 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. Provide cant strips that are a minimum [38.1 mm 1-1/2 inch thick and provide 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 4 inch vertical height with 45 degree cant angle], 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 1 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.

2.2.9 Fasteners

****

NOTE: For fasteners in preservative treated wood, hot-dipped galvanized complying with ASTM A153 and connectors complying with ASTM A653, Class G15 are generally acceptable. Type 304 or Type 316 stainless-steel fasteners and connectors are recommended for maximum corrosion resistance. Carbon steel, aluminum, and electroplated galvanized steel fasteners and connectors are prohibited. For concrete, fasteners should be coated with corrosion-resistant coatings such as zinc, epoxy, fluorocarbons or other proprietary corrosion resistant materials.

****

Provide coated, corrosion-resistant[zinc-coated steel,][multi-coated (zinc plus anti-corrosion coating),][series 304 stainless steel,][series 316 stainless steel] 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.

2.2.9.1 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.

2.2.9.2 Metal Fastening 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.

[2.2.10 Pre-Manufactured Accessories

****
NOTE: Edit, delete, and insert accessory materials requirements as required for the installed specific project and components.
****

Provide pre-manufactured accessories that are 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.

[2.2.10.1 Pre-fabricated Curbs

Provide [_____] gauge[G90 galvanized][AZ55 galvalume] [_____] curbs with minimum 101.6 mm 4 inch flange for attachment to roof nailers. Provide curbs that are a minimum height of 203 mm 8 inch above the finished roof membrane surface.

][2.2.10.2 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].

]][2.2.11 Walkpads

****
NOTE: Use walkpads as walkways and at roof access points and where the roof or areas of the roof are intended to bear foot traffic for maintenance or other purposes.
****

Provide roof walkpads that are polyester reinforced, granule-surfaced modified bitumen membrane material, minimum [_____][5 mm] [_____][197] mils thick, compatible with the modified bitumen sheet roofing and as recommended by the modified bitumen sheet roofing manufacturer. Ensure panels do not exceed 1.219 meters 4 foot in length. Other walkpad materials require approval of the Contracting Officer prior to installation.

][2.2.12 Paver Blocks

****
NOTE: Use concrete pavers as walkways on aggregate surface roofs where the roof or areas of the roof are intended to bear foot traffic for maintenance or other purposes once a month or more frequently. Use paver blocks under heavy bearing components, irregular base bearings and for support and attachment of lightweight pipe, conduit, and drainage lines routed along roof surface.
****

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.

][2.2.13 Roof Insulation Below Modified Bitumen Membrane System

****

NOTE: If the roofing system contains insulation, coordinate with the appropriate insulation specification section. The insulation specification should include materials and installation up to the substrate on which the roof membrane base sheet and or membrane layers are installed. Coordinate base sheet attachment (mechanically fastened or adhered) with FM or UL fire and wind uplift requirements.

****

Provide insulation compatible with the roof membrane, approved by the membrane manufacturer and meeting all the requirements as specified in Section 07 22 00 ROOF AND DECK INSULATION.

]2.2.14 Membrane Liner

Provide self-adhering modified bitumen underlayment conforming to ASTM D1970/D1970M, EPDM membrane liner conforming to ASTM D4637/D4637M, or other waterproof membrane liner material as approved by the Manufacturer.

[2.2.15 Photovoltaic (PV) Systems - Rack Mounted Systems

****

NOTE: The installation of a PV roof system over existing roof systems should be undertaken with extreme caution. Do not install PV systems on roofs with a shorter expected service life than the new PV system. Prior to the design of such systems perform the following actions:

a. Determine if the existing roof structure can handle the anticipated roof load increase and modified roof loading conditions resulting from the PV system installation.

b. Inspect and determine that the existing roof system has at least 10 years of service life remaining. If not, remove the existing roof and provide a new replacement roof system design in tandem with the photovoltaic system.

c. If 10 years remaining service life remains, ensure the design of the intersecting details, required roof protection, re-inspections, and warranty requirements for maintaining the roof system has been coordinated with the installation and manufacturers' warranties.

d. Design the roof related details for anticipated roof replacement work. Coordinate with the PV system designer to anticipate and plan for future roof

replacement.

e. PV equipment on a rooftop creates additional roof protection requirements during initial installation and throughout the PV life-cycle. Ensure a roof protection program is specified during the PV system installation.

f. Permanently affix PV supports to stanchions which are anchored to the building structure.

****

Adhere to the Guidelines for Roof-Mounted PV Systems, published by NRCA.

]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 permits 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 substrate construction 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.

****

NOTE: Coordinate with Section 06 10 00 ROUGH CARPENTRY to ensure that waterborne preservative treatment is specified for wood which will be in contact with roofing components.

****

j. 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. Verify torch applicators are CERTA certified and have certification card on their person.

] **********

NOTE: Wood cants should also be used where there are non-wall supported flashing at wood blocking forming area dividers and expansion joints, and at wall and roof intersections where roof deck is not supported on wall.

****

l. 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.

****

NOTE: Include venting provision for wet fill substrate materials like lightweight cellular concrete.

****

[m. 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.

] **********

NOTE: Include moisture vapor pressure relief vents over wet fill substrates without a vapor barrier and insulation where field of roof exceeds 30 feet dimension in any direction or where moisture vapor may become trapped in the roof construction.

****

[(3) Moisture vapor pressure relief vents: Holes equal to the outside diameter of vents[are provided through the insulation] where vents are required. Space vents in accordance with membrane manufacturer's recommendations.

]]n. 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. [Wood][Plywood]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.]

[o. 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.

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

][q. 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.

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

3.2 PREPARATION

3.2.1 [Torch][Hot-Mopped Asphalt] Applied[(Heat Weld)] Modified Bitumen Membrane Safety

3.2.1.1 General Fire Safety

****
NOTE: Include first sentence at beginning of second paragraph when torch application is allowed.
****

Take precautions necessary to prevent ignition of combustible materials during[torch application][hot-mopped asphalt application] of roofing as follows:

a. Maintain good housekeeping practices throughout course of work to remove or secure all trash, debris, and loose materials that could create a fire hazard.

b. Do not store flammable liquids on the roof.

c. Immediately call the fire department if a fire commences.

d. Post fire department phone number and site address at roof access or other readily visible location as approved by the Contracting Officer. All roof crew members must be advised of current posting location as well as nearest accessible phone. Project SSHO, foreman, and fire watch personnel must have fire department phone number on their person and means of contacting fire department at all times on site.

e. 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 are to 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 International Building Code.]

3.2.1.1.1 Fire Extinguishers and Related Items

****
NOTE: Include first bracketed option for torches on rooftop. Include the second bracketed option for hot asphalt and kettle operations. When both torch and hot asphalt are specified include both bracketed options.
****

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

[Provide a minimum of two 10 liter 2.65 gallon containers of water and clean rags. Provide one fully charged minimum 9.072 kg 20 pound CO2 and not less than two 9.072 kg 20 pound ABC (dry chemical) fire extinguishers in separate, easily accessible locations on the roof and one ABC extinguisher within 3.048 meters 10 foot of each torch work area at all times.

][Provide a minimum of one portable fully charged 9.072 kg 20 pound CO2 and one 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 a minimum of one multipurpose 2-A:20-B:C portable fire extinguisher on the roof being covered or repaired.

][3.2.1.1.2 Kettle Placement

****
NOTE: Include this section for hot-mopped applied systems.
****

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.

]3.2.1.1.3 Additional Fire- and Safety-Related Procedures

In addition to other fire- and safety-related requirements herein, comply with the following safety procedures:

****
NOTE: Include items a. thru j. for torch applied and hot-mopped applied systems.
****

a. Fuel containers, burners, and related appurtenances of roofing equipment in which liquefied petroleum gas is used for heating are to comply with the requirements of NFPA 58. Ensure proper ventilation around LP-Gas cylinders to avoid potential gas or vapor accumulation. Provide mechanical ventilation to force air movement if necessary.

b. Locate fuel containers having capacities greater than one pound 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 or torch is not in use.

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

g. Perform all inspections necessary prior to start of work shift and during work shift to identify fire hazard conditions and address fire prevention measures with all responsible personnel.

h. Project supervisor at beginning of each work shift is required to make daily inspections with the facility manager of all conditions and operations which could present hazards during[torching][hot-mopped] applications and issue directives to address all such concerns and items of the work and existing conditions. Inspection for hazards must include, but are not limited to, underdeck mounted or routed items, combustible construction adjacent to roof work or directly under roof deck, gas and electrical lines, conduit, flammable rooftop exhaust or vapors, lint exhaust, and grease discharge.

i. 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[torch-applied][hot-mopped applied] materials in the area. Install protective fire retardant blankets and shields at building walls, eaves, parapets, and equipment curbs constructed of combustible materials within 0.9144 meter 3 foot radius of the area of[torch work][hot-mopped kettle] prior to commencement of the work.

j. When working around intakes and openings, temporarily disconnect and block to prevent[flame of torch][fumes from kettle] from being drawn into the opening.[Provide non-combustible shielding or flame guard protection where gaps or voids occur in the construction in area of torch work.]

****

NOTE: Include items k. thru q. only for hot-mopped applied systems.

****

k. 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.

l. 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.

m. 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.

n. 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.

o. Ensure asphalt bucket used by roofers or workers in similar trades is 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. Fasten the bail 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.

p. Provide safety barriers and caution signs at all skylights or other roof holes.

q. 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.

****

NOTE: Include items r. thru ab. only for torch applied systems.

****

r. All torches must be UL Listed.

s. Single burner, low output (less than 105,000 Btu) Detail Torch must be used for flashing work.

t. Do not torch apply roof membrane when combustible roof decking is present.

u. Torch flame must not be directly applied to or come in direct contact with wood surfaces, other combustible substrate construction, flammable or easily ignited materials. Cover and protect wood and other combustible substrate construction from contact with torch flame or use alternate membrane application methods.

v. When torching roof membrane and starting a roll or ending the membrane at a wall, roof edge, approaching a penetration or combustible substrate construction or concealed construction condition do not use direct torching technique.

w. Do not direct torch flame toward unprotected combustible substrate construction, concealed materials behind sheet metals or other surface cladding, or toward unsealed surface gaps or voids in construction.

x. Avoid torching in an area that conceals the path of the torch flame.

y. Keep stored materials a minimum of 20 feet from lit torches.

z. A lit torch must not be left unattended.

aa. Do not lay or direct a torch over roof edge, coping, or parapet.

ab. Shut off gas to torch, burn residual gas in hose, and disconnect hose from torch when not in use.

3.2.1.2 Fire Watch

Ensure all personnel on the roof during[torch application][hot-mopped application] are properly trained to use a fire extinguisher.

Provide trained and dedicated personnel to conduct fire watch. Fire watch personnel must have no other duties during conduct of fire watch.

3.2.1.2.1 Fire Watch Time and Access Requirements

Provide a fire watch during torch applications, during all breaks, during work shift weather impacted work stoppage, at the end of each work shift, and as otherwise necessary to detect potential fire conditions. Provide additional intermittent fire watch as deemed necessary based on job conditions.

Provide a fire watch at the end of each work shift for a minimum of two hours after completion of all torch work or hot-mopped kettle operations. Maintain the fire watch for additional time required to ensure no potential ignition conditions exist. Fire watch must include exterior and interior unless otherwise approved by the Contracting Officer based on interior restrictions. Plan and coordinate with Contracting Officer for Government escort for interior fire watch and access to interior spaces as necessary and permissible.

3.2.1.2.2 Fire Watch Procedures

Utilize heat sensing meters to scan for hot spots in the work.[For torch applications, provide and utilize a minimum of one calibrated thermal imaging camera, minimum 160 by 120 thermal IR resolution capable of detecting infrared (IR) spectrum heat emission that could indicate a potential fire during the fire watch to verify cool, safe, and non-combustible conditions exist. Provide a minimum duration fire watch of 2 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 for possible smoldering elements. Ensure camera has a manufacturer's certificate of calibration, and use the camera in compliance with Installation security policies.]

Do not leave the rooftop unattended during breaks or stoppage of application 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.

[3.2.1.3 Open Flame Application (Torch) Equipment

****
NOTE: Include this section for torch applications.
****

Only NRCA/MRCA CERTA certified roofing applicators are allowed to operate any torching equipment. Verify that all such applicators maintain and are currently carrying a valid Certified Roofing Torch Applicator (CERTA) card.Site Safety and Health Officer (SSHO), roofing superintendent and foreman, and roofing contractor share responsibility for assuring all torch operators are CERTA certified. Non-certified operators may result in dismissal of all responsible individuals.

][3.2.1.4 Wind Conditions

****
NOTE: Include this section for torch applications.
****

Use wind shields with all torching operations to prevent flame spread and distortion and increase distance from hazards when winds are occurring that affect flame control. Use torch trolley 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. At a minimum cease all torching when sustained winds are in excess of 12 MPH and use shields with wind gusts at or exceeding 10 MPH.

]3.2.2 Protection of Property

3.2.2.1 Protective Coverings

****
NOTE: Include bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

Install protective coverings at paving and building walls adjacent to hoists[, tankers][, 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.

[3.2.2.2 Bitumen Stops

****
NOTE: Include paragraph when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

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.

][3.2.3 Equipment

****
NOTE: Select equipment references as applicable to the project. Delete paragraphs that are not applicable.
****

[3.2.3.1 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.

][3.2.3.2 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.

][3.2.3.3 Open Flame Application Equipment

****
NOTE: Include this requirement when torch-applied modified bitumen sheet roofing is specified or when torch application of base flashing is permitted.
****

Utilize torches and other open flame equipment specifically designated for use in application of modified bitumen materials and approved by the modified bitumen sheet manufacturer. Ensure open flame equipment is not ignited (burning) when left unattended. Provide and maintain a fire extinguisher adjacent to open flame equipment on the roof. Specific requirements for fire watches and burn permits exist. Review these requirements at the preroofing conference.

Single burner, low output (less than 105,000 Btu) Detail Torch must be used for any allowable torch-applied membrane flashing work. All handheld torches must have an integral torch stand to direct lit torch flame away from roof surface if torch is momentarily set down. Torches must be extinguished before setting torch head on, leaning on, or propping against any surface.

]3.2.3.4 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.

][3.2.4 Heating of Asphalt

****
NOTE: Include paragraph when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

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 1 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.

[3.2.4.1 Temperature Limitations for Asphalt

****
NOTE: Include paragraph when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

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 above 274 degrees C 525 degrees F for longer than four consecutive hours. Do not heat asphalt within 4 degrees C 25 degrees F of 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.

]]3.2.5 Priming of Surfaces

Prime all surfaces 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.

3.2.5.1 Priming of Concrete and Masonry Surfaces

****
NOTE: Include this paragraph when roofing and flashing are applied directly to concrete or masonry surfaces.
****

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

3.2.5.2 Priming of Metal Surfaces

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

3.2.6 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. Ensure the edges of seams are straight and flat so that they may be seamed to one another without forming fish mouths or wrinkles. Discard damaged or defective materials.

3.2.7 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. Torches must not be used to ensure clean, dry surfaces prior to membrane applications if the roof deck is combustible. Torches must not be used to clean or dry surfaces of combustible substrate construction. Torch flame must not contact or be directed toward unprotected combustible substrate construction.

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 in a watertight manner 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[except for cold adhesive applications and] 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 Manufacturer prior to cap sheet installation.

3.3.2 Temporary Roofing and Flashing

****

NOTE: Include requirements for temporary roofing and flashing when construction will require considerable work on roof, such as, installing cooling towers, antennas, pipes, ducts, solar collectors, or other equipment, and temporary roofing is considered necessary to ensure that permanent roofing is not damaged during construction.

****

Provide watertight temporary roofing and flashing where considerable work by other trades, such as installing[cooling towers,][antennas,][pipes,][ducts,] [_____,] is performed on the roof or where construction scheduling or weather conditions require protection of the building's

interior before permanent roofing system is 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

****

NOTE: Specify the applicable application method(s) and distinguish any varying requirements or options related to membrane and base flashing. In general manufacturer may allow torching of base flashing membrane provided that the roof deck is non-combustible and combustible substrate construction is fully covered and protected from contact with torch flame. Manufacturer may also allow base flashing to be set in cold adhesive or hot mopped asphalt; however, some methods may or may not be desirable for a specific project installation.

****

[3.3.3.1 Hot Asphalt Application of Modified Bitumen Membrane

****

NOTE: Include paragraph when hot-mopped membranes are used or base sheets are hot-mopped.

****

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 is 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.

][3.3.3.2 Torch Applied[Heat Welded] Modified Bitumen Membrane[Flashing]

****

NOTE: Include the first bracketed sentence if base flashing may be torch-applied. Include requirement to roll lap areas with weighted roller when heat welding technique is specified.

Delete the first bracketed sentence and the bracketed reference to "torch" when the roof deck is combustible.

Where heat welding is specified, coordinate with

language in "Description of Roof Membrane System" and other parts of this specification.

****

[Base flashing membrane may be torch applied with single burner, low output (less than 105,000 Btu) Detail Torch only.]Ensure substrate membrane surfaces are warmed naturally or with hot air blower[or by torch] during the installation. Apply heat evenly to underside of roll membrane being installed and exposed side lap area of previously installed sheet. Provide for slight, uniform flow of bitumen in front of roll and full width of roll as the material is being rolled or set into place. Apply uniform positive pressure to ensure membrane is fully adhered and all laps are sealed. Prior to forming lap over granulated surfaces, embed granules of the receiving sheet by heating and troweling-in the granules to form a uniform black compound surface.[Roll all lap areas with a weighted roller immediately after forming lap. Provide for visual bleed out of compound in lap areas.][Avoid overheating the membrane or burning through to membrane reinforcement. Inspect and ensure all lap areas are fully sealed.]

Do not torch in areas of poor or no visibility (curbs, corners, eaves, expansion joints, flashing, other voids and small penetrations) which could allow a torch flame to ignite combustible material(s) hidden from view or within the underside of the roof deck or building interior. Use cold finish applications in these areas whenever possible and per manufacturer's printed instructions, NRCA RoofMan, MRCA R&NW manual for "cold adhered" materials.

][3.3.3.3 Cold Adhesive Applied Modified Bitumen Membrane

Apply cold adhesive in strict accordance with manufacturer's published instructions and precautions regarding materials compatibility, application method, rate of application, lap seal measures, cure time between adhesive applications of subsequent plies, and environmental conditions. Apply cold adhesive with airless sprayer or 6.35 mm 1/4 inch saw-toothed rubber squeegee, trowel or brush to prepared surfaces in accordance with membrane manufacturer's application instructions for the roof membrane or flashing conditions involved. Fully cover substrate with adhesive. Roll or lay membrane in adhesive in accordance with manufacturer's recommendations and within the time limitations of adhesive application. Broom, brush, or hand rub the membrane to ensure full contact with adhesive. Seal laps with adhesive or by heat fusing with hot air welder as required by membrane manufacturer or to maintain watertight conditions on a daily basis. Minimize traffic on installed membrane during the adhesive cure and set time. Avoid material storage on installed membrane until adhesive has fully cured and set.

][3.3.4 [Ventilating]Base Sheets

****

NOTE: Include this paragraph when ventilating base sheets are specified in the paragraph DESCRIPTION OF ROOF MEMBRANE SYSTEM and in the absence of rigid board roof insulation if venting is necessary due to deck or substrate conditions. Include mechanical attachment or top mop requirements as applicable. Where rigid board roof insulation is a component of the roof system, ventilating base sheets should be specified in the roof insulation section 07 22 00

ROOF AND DECK INSULATION.

Partially attached venting base sheets may limit wind uplift resistance of the roof system.

****

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 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.][Spot or strip mop non-perforated sheet or top mop perforated sheet with a full, continuous mopping of hot asphalt.]

]3.3.5 Modified Bitumen Base Sheet Application

****

NOTE: Select the applicable application method. Delete other options. Delete requirements for adhered base sheets where the sheet is mechanically fastened through to nailable deck. Apply base sheets at right angles to roof slope, except on insulated roofs where nailers (insulation stops) have been applied at right angles to slope and on decks sloped 1 inch per foot or more, apply felts parallel to roof slope. Include requirements for applying felts to barrel-type roofs only when applicable.

****

[Submit Base Sheet attachment instructions, including manner of attachment and pattern and frequency of attachments required in field of roof, corners, and perimeters to provide for the specified wind resistance.][Fully adhere base sheets in accordance with membrane manufacturer's printed instructions.]Ensure laps areas of base sheet are fully sealed. Roll and broom in the base sheet to ensure full contact with the[hot asphalt][adhesive] application. 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][parallel to the roof slope][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

****

NOTE: On slopes up to 1:12 (1 inch per foot), specify membrane application perpendicular to slope of roof. On slopes greater than or equal to 1:12 (1

inch per foot), specify membrane application parallel to roof slope.

****

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.][Apply membrane layers parallel to slope of roof.] 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 or when cold-applied adhesive is used. 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

****

NOTE: Include the option of hot asphalt or torch application or cold applied adhesives of cap sheet where permissible. Torch applied cap sheet can be applied over hot mopped membrane plies provided that the roof deck is non-combustible. Torch application of cap sheet may reduce instances of cap sheet blistering. Cold applied adhesives can be used with combustible or non-combustible roof deck and materials. For cold applied adhesives, a primer may be required if recommended by the manufacturer.

Where finished appearance of the roof is of consequence, include the bracketed requirement for granule application in areas of adhesive bleed out.

****

Ensure underlying applied membrane is 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 or torch apply 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.][Apply cold adhesive primer as recommended by manufacturer.][Apply cold applied adhesive as recommended by manufacturer at the required thickness, spread rates and during acceptable weather conditions. Apply the required membrane adhesive ahead of the membrane before the adhesive skins over. Apply sufficient adhesive to ensure bleed out at all laps. Set cap sheet in the cold adhesive before adhesive skins over.] Cut at a 45 degree

angle across selvage edge of cap membrane overlapped in end lap areas prior to applying overlapping cap membrane.[Apply matching granules in any areas of adhesive bleed out while the adhesive is still tacky.] Minimize traffic on newly installed cap sheet membrane.

[3.3.6.2 Backnailing of Cap Sheet

****
NOTE: Include this paragraph for roof slopes greater than or equal to 1:6 (2 inches per foot). Coordinate with insulation Section 07 22 00 ROOF AND DECK INSULATION and nailer requirements Section 06 10 00 ROUGH CARPENTRY to allow for backnailing of the membrane.
****

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 are required to 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][adhesive] bleed out while the[asphalt is still hot][adhesive is still tacky].] 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.

Adhere to specified requirements for flashing a combustible substrate construction.

3.3.7.1 Liquid Applied Flashing Installation

Follow manufacturer's substrate preparation and flashing system application instructions and guidelines. Substrate must be clean and dry and free from any condition that would be detrimental to the adhesion of the primer to the substrate. Remove rust and oxidation layers from metal substrates. Apply an even base coat of liquid applied flashing to the flashing area. Work reinforcement fabric layer into the wet base coat using a roller or brush to fully embed the fabric and remove trapped air. Overlap fabric a minimum of 50 mm 2 inches at each overlap. Apply an even, generous top coat of liquid applied flashing immediately following embedment of the fabric to ensure full saturation of the reinforcement. A minimum 200 mm 8-inch overlap onto the surface of roof membrane is required. The reinforced liquid flashing membrane should terminate a minimum of 200 mm 8 inches above the horizontal when applied in a vertical orientation.

3.3.7.2 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.

Adhere to specified requirements for flashing a combustible substrate construction.

3.3.7.2.1 Membrane and Strip Flashing at Combustible Substrate Construction

****

NOTE: Include the following paragraphs when membrane flashing or strip flashing must be applied over combustible substrate construction such as wood curbs, wood lined parapets, edge nailers, embedded attachment nailers, and similar type conditions.

****

Torch-applied application directly onto combustible substrate construction is prohibited. Provide alternate application method to include, but not limited to:

a. Cold-adhesive applied membrane flashing;

b. Hot asphalt applied membrane flashing;

[c. Torch-and-flop technique;]

[d. Substrate Cover - Completely cover combustible substrate with air-impermeable self-adhering membrane liner compatible with subsequent torch application of flashing membrane layer or cover with mechanically fastened base sheet and self-adhering membrane liner compatible with subsequent torch application of flashing membrane layer. Ensure full laps seals of self-adhering membrane covers prior to torch applications.

][Torch flashing applications must only use Detail Torch.

] Application must adhere to the specified requirements and manufacturer's detailed instructions for the method of installation.

[3.3.7.2.2 Torch-and-Flop Technique

Cut membrane into short manageable length. Pre-cut and dry fit flashing membrane prior to application. Flip membrane over, align and position near but no closer than three feet from install location. Torch underside of membrane to melt underside bitumen. Flop membrane in place, position, and rub with gloved hand to assure adhesion before heated bitumen cools. Ensure torch flame is not directed at and does not come in contact with combustible substrate construction.

][3.3.7.3 Membrane Flashing at Roof Drain

****
NOTE: Include this paragraph when roof drains are indicated.
****

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. Ensure trim stripping is installed flush with inside of clamping ring.

][3.3.7.4 Pre-fabricated Curbs

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

]3.3.7.5 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.

3.3.7.6 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][Section 05 51 33 METAL LADDERS][Section 05 52 00 METAL RAILINGS][Section 05 51 00 METAL STAIRS]. 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

****
NOTE: Delete FIELD APPLIED SURFACING and associated paragraphs if factory-applied granule surfaced membrane is specified. Otherwise, include only the applicable surfacing, delete all others.
****

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 and bitumen material manufacturer's recommendations. Adhere to membrane and coating manufacturers' recommended membrane weathering time prior to field application of coatings.

]]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.

3.3.14 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.

3.4 FIELD QUALITY CONTROL

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

[3.4.1 Test for Surface Dryness

****
NOTE: Include paragraph or bracketed requirement when hot-mopped membranes are used or base sheets are hot-mopped to non-nailable substrates.
****

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

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

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

c. Allow a minimum 28-day cure time for new concrete decks. Prior to installing any roof system on a concrete deck, conduct a surface dryness test per ASTM D4263 and a subsurface test per ASTM F2170. For proper surface conditions, the deck is acceptable for roof system application when there is no visible moisture on underside of plastic sheet after 24 hours of probe insertion. Relative humidity probes drill-to depth should be placed at 40 percent for fluted metal supported concrete decks and 20 percent for decks drying from top and bottom such as an elevated structural slab not on a metal deck and after supporting concrete pour forms have been removed.

]3.4.2 Construction Monitoring

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

a. All safety requirements are followed to include but not limited to fall protection and fire safety.

[b. Odor mitigation and control measures are implemented.

] c. Materials comply with the specified requirements.

d. Materials are not installed in adverse weather conditions.

All materials are properly stored, handled, and protected from

moisture or other damages.

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

f. Surface Preparations are as required.

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

h. Nailers and blocking are provided where and as needed.

i. Rigid board roof insulation applied with staggered and offset joints between layers. Gaps between boards are within gap tolerance, as applicable.

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

k. The proper number, type, and spacing of fasteners are installed.

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

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

n. Each applied membrane ply surface is inspected, cleaned, dry, and repaired as necessary prior to subsequent sheet installation.

o. Lap areas of all plies are completely sealed.

p. Membrane plies are fully adhered without ridges, wrinkles, kinks, fishmouths, or other voids or delamination.

q. Installer adheres to specified and detailed application parameters.

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

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

[3.4.2.1 Manufacturer's Inspection

****
NOTE: Include this paragraph when manufacturer's inspection of work is required. Use bracketed option in second paragraph to specify minimum number of required visits. The minimum and default is three visits during installation. To help determine if more than three visits should be specified, divide the total project roof area in squares by 100 and round to the nearest whole number. Coordinate this requirement with Section 01 45 00 QUALITY CONTROL paragraph QUALITY CONTROL (QC) SPECIALISTS - Experience Matrix.
****

The roofing material manufacturer's technical representative must visit the work site to inspect ongoing work. Inspections are to include observing installation technique and verifying the quality of work-in-place for compliance with the manufacturer's instructions. Deficiencies identified by the manufacturer's technical representative must be corrected and re-inspected by the manufacturer's technical representative.

3.4.2.1.1 Frequency

The manufacturer's technical representative must visit the work site to inspect and document ongoing work a minimum of [3][_____] separate occasions during the course of the installation. One visit must occur during the first 20 squares of installation, one at substantial completion of the roof work, and all others during different periods of installation. Notify the Contracting officer a minimum of 5 working days prior to each visit by the manufacturer's technical representative.

3.4.2.1.2 Field Inspection Report

Document inspection results in a report prepared and signed by the manufacturer's technical representative for each visit. Submit the report to the Contracting Officer with the contractor's daily Quality Control report. The manufacturer's field inspection report must include a description of ongoing work observed and whether the inspected work was satisfactory or unsatisfactory. The final report must include certification by the manufacturer's technical representative that the work was performed in accordance with the manufacturer's instructions and contains no deficiencies. Submit the final manufacturer's field inspection report to the Contracting Officer within 5 working days of the final visit.

][3.4.3 Samples of Roofing

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NOTE: This requirement is included for optional enforcement at the discretion of the Contracting Officer. It is not the intent to require cut samples on all roof projects.

****

Take field cut samples, 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 may 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.

][3.4.4 Roof Drain Test

****

NOTE: Include this paragraph when roof drains are required. Consult with structural engineer to verify loading capability of roof structural system.

****

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.

]3.5 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

****

NOTE: Include this paragraph when roof insulation is a substrate for the modified bitumen sheet roofing.

****

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 CLOSEOUT ACTIVITIES

[3.6.1 Infrared Inspection

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NOTE: This optional requirement should be included only under special circumstances and on roof systems conducive to effective infrared scanning, or as otherwise instructed. This section may be necessary at project locations where infrared inspections cannot be performed during construction due to climate or other adverse conditions.

****

Prior to the installation of gravel surfacing or cap sheet, the Contractor is required to inspect the roof surface using infrared (IR) scanning as specified in ASTM C1153. Where the IR inspection indicates moisture intrusion, replace wet insulation and damaged or deficient materials or construction in a manner to provide watertight construction and maintain the specified roof system warranties.[Coordinate infrared inspections with building envelope commissioning activities.]

]3.6.2 Instructions to [Government][Contractor] 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.

Submit copies of Safety Data Sheets for maintenance/repair materials. Submit 20 year "No-Dollar-Limit" warranty for labor and materials.

3.6.3 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. Provide a card measuring 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 --