

SECTION 07 51 00

BUILT-UP BITUMINOUS ROOFING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section includes bituminous built-up roofing, aggregate surfacing, with base flashing for repairs and alterations to existing construction.

1.2 RELATED WORK

- A. Wood cants, blocking, and wood edge strips: Section 06 10 00, ROUGH CARPENTRY.
- B. Wood sheathing: Section 06 10 00, ROUGH CARPENTRY.
- C. Metal base flashing, pipe flashing, counter flashing, : Section 07 60 00, FLASHING AND SHEET METAL.

1.3 APPLICABLE PUBLICATIONS

- A. Applicable publications listed below form a part of this Specification as referenced. Publications are referenced in the text by the number designation only.
- B. American Society for Testing and Materials (ASTM):
1. A167-99(R2004) Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip
 2. B209-07 Aluminum and Aluminum-Alloy Sheet and Plate
 3. D41-05 Asphalt Primer Used in Roofing, Dampproofing and Waterproofing
 4. D43-00(R2006) Coal Tar Primer Used in Roofing, Dampproofing and Waterproofing
 5. D227-03 Coal-Tar Saturated Organic Felt Used in Roofing and Waterproofing
 6. D312-00(R2006) Asphalt Used in Roofing
 7. D448-08 Sizes of Aggregate for Road and Bridge Construction
 8. D450-07 Coal-Tar Pitch Used in Roofing, Dampproofing and Waterproofing
 9. D751-06 Test Methods for Coated Fabrics
 10. D1863-05 Mineral Aggregate Used on Built-Up Roofs
 11. D2178-04 Asphalt Glass Felt Used in Roofing and Waterproofing
 12. D3884-07 Abrasion Resistance of Textile Fabrics (Rotary Platform Double-Head Method)
 13. D3909-97(R2004) Asphalt Roll Roofing (Glass Felt) Surfaced with Mineral Granules

14. D4586-07 Asphalt Roof Cement, Asbestos Free
15. D4601-04 Asphalt Coated Fiberglass Base Sheet Used In Roofing
16. D4897-01 Asphalt Coated Glass Fiber Venting Base Sheet Used in Roofing
17. D6163-00 Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements
18. F1667-05 Driven Fasteners: Nails, Spikes, Staples

C. FM Global (FMG):

1. P7825C-05 Approval Guide Building Materials
2. 4450: Approved Standard for Class 1 Insulated Steel Deck Roofs
3. 4470: Approved Standard for Class 1 Roof Coverings

D. National Roofing Contractors Association (NRCA):

1. "Quality Control Guidelines for the Application of Built-up Roofing."
2. "The NRCA Roofing and Waterproofing Manual"

1.4 WARRANTY

- A. Work performed to repair or alter the existing roof shall be approved by the manufacturer.

1.5 QUALITY CONTROL

- A. Applicator Qualifications: Installer experienced in installation of systems similar in complexity to that required for this Project, including specific requirements indicated:

1. Work shall be performed by installer approved in writing by roofing material manufacturer.
2. Work shall comply with printed instructions of the roofing materials manufacturer.

B. Product/Material Qualifications:

1. Provide manufacturer's label on each container or certification with each load of bulk bitumen, indicating Flash Point (FP), Finished Blowing Temperature (FBT), Softening Point (SP), Equiviscous Temperature (EVT).
2. Provide manufacturer's certification that field applied bituminous coatings and mastics, and field applied roof coatings comply with limits for Volatile Organic Compounds (VOC) per the National Volatile Organic Compound Emission Standards for Architectural Coatings pursuant to Section 183(e) of the Clean Air Act with limits as follows:
 - a. Bituminous Coatings and Mastics: 500 g/l (4.2#/gal.).
 - b. Roof Coatings: 250 g/l (2.1#/gal.).
3. Obtain products from single manufacturer or from sources recommended by manufacturer for use with roofing system.

- C. Comply with the recommendations of the NRCA "Roofing and Waterproofing Manual" applicable to built-up roofing for storage, handling and installation.

D. FMG Listing: Provide roofing membrane, base flashing, and component materials that comply with requirements in FMG 4450 and FMG 4470 as part of a roofing system and that are listed in FMG "Approval Guide" for Class 1 or noncombustible construction, as applicable. Identify materials with FMG markings.

1. Fire/Windstorm Classification: Class 1A-90.
2. Hail Resistance: MH .

1.6 SUBMITTALS

A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.

B. Product Data:

1. Asphalt materials, each type.
2. Coal-tar materials, each type.
3. Roofing cement, each type.
4. Fastening requirements.

C. Certificates:

1. Indicate materials and method of application of roofing system meet requirements of FMG.
2. Statements of qualification for manufacturers and installers.
3. Inspection Report: Copy of roofing system manufacturer's inspection report certifying completed roofing complies with manufacturer's warranty requirements.

D. Warranty: As specified in Part 1 of this Section:

1. Warranty sample form with specific language to address Contract provisions.

E. Contract Close-out Submittals:

1. Maintenance Manuals.
2. Warranty signed by installer and manufacturer.

1.7 DELIVERY, STORAGE AND MARKING

A. Deliver roofing materials to the site in original sealed packages or containers marked with the name and brand or trademark of the manufacturer or seller.

B. Keep roofing materials dry and store in a dry, weather-tight facility or under canvas covers. Do not use polyethylene or plastic covers to protect materials. Store above ground or deck level on wood pallets. Cover ground under pallet stored materials with plastic.

1. Store rolled materials (felts, base sheets, and paper) on end. Do not store hems on top of rolled materials.
2. Aggregates shall be maintained surface dry as defined by ASTM D1863.

C. Protect from damage due to handling, weather and construction operations before, during and after installation.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.
- B. Environmental Controls: Refer to Section 01 57 19, TEMPORARY ENVIRONMENTAL CONTROLS.
- C. Protection of interior spaces: Refer to Section 01 00 00, GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.1 ROOFING SYSTEM

- A. Install built-up roofing membrane system according to roofing system manufacturer's written instructions and applicable recommendations of NRCA "Quality Control Guidelines for the Application of Built-up Roofing."
- B. Glass sheet, asphalt bitumen, mineral surfaced.
 - 1. Substrate: Roof Insulation Cast-In-Place Concrete.
 - 2. Components: Quantity.
 - a. Ventilating Base Sheet: 1 Ply.
 - b. Ply Sheet: 3 Plies
 - c. Mineral Surfaced Cap Sheet: 1 Ply
 - d. Asphalt Between Substrate and First Ply: 10-17.5 kg/10 meters 20-35 lbs/100 sq. ft.
 - e. Asphalt Between Each Ply 10-17.5 kg/10 sq. meters 20-35 lbs/100 sq. ft.
 - 3. Provide asphalt quantities within the indicated ranges, unless recommended otherwise in the roofing materials manufacturer's printed data.

2.2 MATERIALS

- A. Primer: ASTM D41.
- B. Venting Base Sheet: ASTM D4897, Type II, venting, nonperforated, heavyweight, asphalt-impregnated and coated, glass-fiber base sheet with coarse granular surfacing or embossed venting channels on bottom surface.
- C. Asphalt: ASTM D312, Type III or IV for roof membrane. Use Type I for pour coat unless specified otherwise.
- D. Ply Sheet/Backer Sheet: ASTM D2178, Type VI, heavy-duty ply sheet.
- E. Cap Sheet: ASTM D3909, asphalt-impregnated and coated, glass-fiber cap sheet, with white coarse mineral-granule top surfacing and fine mineral surfacing on bottom surface.
- F. Roof Cement: ASTM D4586, Type I [Type II].
- G. Flashing Sheet: ASTM D6163, Type I or II, glass-fiber-reinforced, SBS-modified asphalt sheet; granular surfaced; suitable for application method specified.

2.3 COAL-TAR MATERIALS

- A. Primer: ASTM D43.
- B. Organic Felt: ASTM D227, except bitumen shall be low fuming, non-blooming type.
- C. Coal-Tar Bitumen: ASTM D450, Type III.
- D. Roof Cement: Roofing manufacturer's standard, asbestos free.

2.4 MISCELLANEOUS MATERIALS

- A. Aggregate:
 - 1. ASTM D1863, except the use of crushed stone is prohibited.
 - 2. Slag or gravel. Use slag on slopes over 1:10 (1 inch per foot).
- B. Modified Asphaltic Insulation Adhesive: Insulation manufacturer's recommended modified asphaltic, asbestos-free, cold-applied adhesive formulated to attach roof insulation crickets to substrate or to another insulation layer.
- C. Tapered Roof Insulation Crickets:
 - 1. Fabricate of mineral fiberboard, polyisocyanurate, perlite board, or cellular glass. Use only one insulation material for tapered sections. Use only factory-tapered insulation.
 - 2. Cut to provide high and low points with crickets and slopes as shown.
 - 3. Minimum slope 1:24 (1/2 inch per 12 inches).

2.5 FASTENERS

- A. Nails and Staples: ASTM F1667.
- B. Nails for Securing built-up Flashing and Base Sheets to Wood Nailers and Deck:
 - 1. Zinc coated steel roofing nails with minimum head diameter of 10 mm (3/8 inch) through metal discs at least 25 mm (1 inch) across.
 - 2. One-piece nails with an integral flat cap at least 24 mm (15/16 inch) across.
- C. Fasteners for Securing Dry Felt Edge Strips to Wood Nailer and Decks:
 - 1. Zinc coated steel roofing nails, 16 mm (5/8 inch) minimum head diameter.
 - 2. Staples, Flat top Crown, zinc coated may be used.
- D. Nails for Plywood:
 - 1. Use annular thread type at least 19 mm (3/4 inch) penetration of plywood.
 - 2. 16 mm (5/8 inch) minimum head diameter.
 - 3. Nails with flat cap at least 24 mm (15/16 inch) across.
- E. Nails for Securing Base Sheet to Poured Gypsum Roof Deck:
 - 1. Special shaped nail providing diverging or hooking point.
 - 2. Flat cap not less than 32 mm (1-1/4 inch) across.

3. Withdrawal resistance of not less than 18 Kg (40 pounds) per fastener.

2.6 PROTECTION MAT OR SEPARATION SHEETS

A. Protection Mat:

1. Water pervious; either woven or non-woven pervious sheet of long chain polymeric filaments or yarns such as polypropylene, black polyethylene, polyester, or polyamide; or, polyvinylidene-chloride formed into a pattern with distinct and measurable openings.
2. Filter fabric equivalent opening size (EOS): Not finer than the U.S.A. Standard Sieve Number 120 and not coarser than the U.S.A. Standard Sieve Number 100. EOS is defined as the number of the U.S.A. Standard Sieve having openings closest in size to the filter cloth openings.
3. Edges of fabric selvaged or otherwise finished to prevent raveling.
4. Abrasion resistance:
 - a. Abrade in conformance with ASTM D3884 using rubber-hose abrasive wheels with 1 kg load per wheel and 1000 revolutions.
 - b. Result; 25 kg (55 pounds) minimum in any principle direction.
5. Puncture strength:
 - a. ASTM D751 - tension testing machine with ring clamp; steel ball replaced with a 8 mm (5/16 inch) diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.
 - b. Result; 57 kg (125 pounds) minimum.
6. Non-degrading under a wet or humid condition within minimum 4° C (40° F) to maximum 66° C (150° F) when exposed to ultraviolet light.
7. Minimum sheet width: 2400 mm (8 feet).

2.7 BALLAST AND PAVERS

A. Aggregate:

1. Conform to ASTM D1863.
2. Gradation conform to ASTM D448:
 - a. Size 2 for 146 kg/m² (30 pounds per square foot) or more.
 - b. Size 3 for 122 kg/m² (25 pounds per square foot) or more.
 - c. Size 5 for 73 kg/m² (15 pounds per square foot) or more.
 - d. Size 6 for 49 kg/m² (10 pounds per square foot) or more.

PART 3 - EXECUTION

3.1 GENERAL

- A. Do not apply if deck will be used for subsequent work platform, storage of materials, or staging or scaffolding will be erected thereon.
- B. Phased construction is not permitted. The complete installation of roofing system is required in the same day except for area where temporary protection is required when work is stopped. Complete installation includes pavers and ballast for ballasted systems.

3.2 EXAMINATION

- A. Verification of Conditions: Examine substrates, areas and conditions under which Work is to be performed and identify conditions detrimental to proper or timely completion:
 - 1. Do not proceed until unsatisfactory conditions, including moisture, have been corrected.
 - 2. Do not install roofing materials over wet insulation.
 - 3. Do not install roofing materials unless roof openings, wood nailers, edge venting, insulation board, flashing, curbs, and roof joints are constructed.
 - 4. Do not install roof materials unless deck and/or insulation provides designed drainage to working drains.
- B. Insulating Concrete: Allow deck to dry before installing materials.
- C. Do not apply roof system if roofed deck will be used as a work platform.
- D. Existing Intake Louvers:
 - 1. Use large fans during placement to direct airflow away from existing intake louvers.
 - 2. If required to install roof near intake louvers after work hours, it shall be done so without additional cost to the Government.

3.3 PREPARATION

- A. Sweep substrate to broom clean condition. Remove all dust, dirt and debris.
- B. Remove surface irregularities that may damage materials or cause installation defects.
- C. Prime concrete deck or precast units.
 - 1. Keep primer back 100 mm (4 inches) from joints in precast units.
- D. Cover wood sheathing, gypsum, gypsum plank and cement wood fiber plank with a layer of asphalt building paper.
- E. Coordinate operations with roof insulation and sheet metal work to permit continuous roofing operations.

3.4 INSTALLATION

- A. Comply with roofing system manufacturer's written instructions and applicable recommendations of NRCA "Quality Control Guidelines for the Application of Built-up Roofing."
- B. Cooperate with inspection and test agencies required to perform services in connection with built-up roofing system installation.
- C. General:
 - 1. Provide uniform and positive adhesion between all installed materials, including adhesion to insulation or substrate, and between each ply of felt.
 - 2. Substrate Penetrations: Do not allow bitumen to penetrate joints or enter building. Where mopping is applied directly to a substrate, tape joints. When applying steep asphalt, hold mopping back 50 mm (2 inches) from each

side of joint.

D. Asphalt Coal-Tar Products Schedule:

1. Use asphalt only with asphalt-saturated or asphalt-impregnated felts.
2. Use Type I asphalt for pour coats up to 1:10 (1 inch per foot) slope.
3. Coats on slopes over 1:10 (1 inch per foot).
4. Use asphalt roof cement with asphalt products.
5. Use coal tar and coal tar roof cement with coal-tar-saturated felts, except asphalt-saturated felt base flashing with asphalt roof cement may be used in conjunction with coal-tar roofing.

E. Bitumen Schedule:

1. Per square, unless otherwise specified.
2. Between substrate and plies of organic felt:
 - a. Coal tar, 9 to 14 Kg (20 to 30 pounds).
3. Between substrate and plies of glass fiber felts asphalt, 9 to 14 kg (20 to 30 pounds).
4. Glaze Coats:
 - a. Coal tar, 9 to 14 Kg (20 to 30 pounds).
5. Pour Coats:
 - a. Coal tar, 32 to 36 Kg (70 to 80 pounds).

F. Heating Bitumen:

1. Heat the asphalt to the equiviscous temperature (EVT) plus or minus 4 degrees C (25 degrees F) at the time of application.
 - a. Do not heat asphalt greater than 38 C (100 degrees F) above the EVT.
 - b. When the EVT is not furnished do not heat asphalt above 246 C (475 degrees F) for Type I and 275 C (525 degrees) F for Type II and IV, with an application not less than 218 C (425 degrees F) and 246 C (475 degrees F) respectively.
2. Do not heat coal-tar bitumen above 218 C (425 degrees F) with an application temperature ranging from 163 C (325 degrees F) to 204 C (400 degrees F).
3. Do not heat bitumen above the flash point temperature.
4. Provide heating kettles with a thermometer kept in operating condition. Attend, during heating, to insure the bitumen is heated within the temperatures specified.
5. Do not mix different types of bitumen in kettle.

G. Terminations:

1. Where cants occur at vertical surfaces, cut off plies of membrane 50 mm (2 inches) above top of cant strip, (except at prefabricated curbs, scuttles and other roof accessories having integral cants) extend membrane over cant and up vertical surface to top of curb or blocking.
2. Where wood blocking occurs at penetrations to receive base flashing, nail a continuous strip of 400 mm (16 inch) wide, loose applied organic felt

envelope over the blocking before the first ply sheet is applied.

- a. Install strip on top of venting base sheet.
- b. After membrane is installed, turn the dry felt back over the roofing and secure in place with hot bitumen before gravel stops or metal flanges extending onto the membrane are installed.

H. Base Sheet:

1. One ply of venting base sheet. Fasten base sheet down dry on deck. Lap and seal with roof cement.

I. Roof Ply Installation:

1. Install, asphalt, glass fiber feltcoal tar bitumen, organic felt construction. Base sheet is not considered a ply.
2. Extend the first ply 100 mm (4 inches) beyond the insulation and the second ply 75 mm (3 inches) beyond the first. Lap ends 75 mm (3 inches) with joints broken 450 mm (18 inches) in each ply.

J. Laps for felts and base sheet:

1. Base sheet, lapped 50 mm (2 inches).
2. Four plies of felt with 230, 460, 690 and 900 mm (9, 18, 27 and 36 inch) starting widths, lapped 700 mm (27-1/2 inches).
3. End joints of felt and base sheet, lapped 50 mm (2 inches). Stagger end joints in relation to joints in adjacent and proceeding plies.

K. Flashing:

1. Apply flashing on top of built-up roofing, up face of cant and vertical surfaces, at least 200 mm (8 inches) above the roof, full height beneath counter flashing or top of curb flashing:
 - a. At cants, extend to top of cant and cut off.
2. Except at metal cants, secure top edge of base flashing with nails on a line approximately one inch below top edge, spaced not more than 200 mm (8 inches) on center.
 - a. Cover all nail heads with roof cement.
 - b. Cover the top of the base flashing with counter flashing as specified in Section 07 60 00, FLASHING AND SHEET METAL. At the cants secure the top edge of the flashing with fascia compression clamp as specified in Section 07 60 00, FLASHING AND SHEET METAL.
3. Install flashing using longest pieces practicable. Complete splices between flashing and main roof sheet before bonding to vertical surface. Seal splice not less than 76 mm (3 inches) beyond fasteners that attach membrane to blocking. Apply bonding adhesive to both flashing and surface to which flashing is being adhered per manufacturer recommendations. Nail top of flashing 300mm (12 inches) on center under metal counter flashing or cap.
4. Install flashing over cants to make system watertight.

3.5 REPAIR AND ALTERATIONS TO EXISTING ROOF

- A. Areas to be altered or repaired, remove loose aggregate and aggregate not firmly embedded where new penetrations occur or repairs are required:

1. Remove aggregate 900 mm (3 feet) beyond areas to be cut.
 - a. Clean, dry and store aggregate away from roof area until ready to reuse.
 - b. Remove unsuitable and excess aggregate not used from Project.
- B. Cut and remove existing roof membrane for new work to be installed. Clean cut edges and install a temporary seal to cut surfaces. Use roof cement and one layer of 7 Kg (15 pound) felt strip cut to extend 150 mm (6 inches) on each side of cut surface. Bed strip in roof cement and cover with roof cement to completely embed the felt.
- C. Bend up cap flashing or temporarily remove at built-up base flashing to be repaired. Brush and scrape away deteriorated and loose bitumen, felts or surface material of built-up base flashing.
- D. Repairs to existing membrane and base flashing:
 1. Remove temporary patches prior to starting new work.
 2. Blisters and fish mouths:
 - a. Cut blisters open and turn membrane back to fully adhered portion. Cut fish mouths so membrane can be turned back and subsequently laid flat.
 - b. Heat membrane to facilitate bending and to dry surface of exposed blister areas.
 - c. Mop turned back membrane in hot bitumen. Roll to insure full adhesion and embedment in substrate.
 - d. Cover cut areas with two plies of felt. Extend first ply 100 mm (4 inches) beyond cut area edge. Extend second 100 mm (4 inches) beyond first ply. Mop down in hot bitumen as specified for new work. Resurface to match existing.
 3. Exposed Felts:
 - a. Cut away exposed deteriorated edges of sheets.
 - b. Glaze coat felt edges.
 - c. Resurface to match existing.
 4. Built-up Base Flashing:
 - a. Restore felts and cap sheet removed, lapping 100 mm (4 inches) over existing.
 - b. Install new felts and cap sheet as specified for new work.
 5. Horizontal Metal Flanges:
 - a. Remove loose, buckled or torn stripping.
 - b. Remove loose fasteners and install new fasteners.
 - c. Restrip flanges as specified for new work.
 6. Resurfacing:
 - a. Over repaired membrane, embed aggregate as specified for new work.
 - b. Cover all membrane areas. Do not leave any exposed membrane surface.
- E. Match existing roofing materials and construction. Use bitumen compatible

with existing for roof repair and alteration.

- F. Perform alterations, maintenance and repairs to roof membrane immediately after membrane has been cut or damaged, with permanent new work as specified in this specification. Repair items damaged in surface preparation and aggregate removal.
- G. Installation of Roof Crickets:
 - 1. Install roof insulation in accordance with roofing system manufacturer's written instructions.
 - 2. Install roof insulation in accordance with requirements of FM Approval's Listing for specified roofing system.
 - 3. Base Sheet: Where required by roofing system, install one lapped base sheet specified in Division 07 roofing section by mechanically fastening to roofing substrate prior to installation of insulation.
 - 4. Cant Strips: Install //preformed insulation cant strips// //wood cant strips specified in Division 06 Section ROUGH CARPENTRY// at junctures of roofing system with vertical construction.
 - 5. Use same insulation as existing for roof repair and alterations unless specified otherwise.

3.6 INSTALLATION OF BALLAST SYSTEM

- A. Install as soon as roof membrane is laid.
- B. Replace any aggregate that is disturbed during alterations at the rate and size to match the existing aggregate.

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