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USACE / NAVFAC / AFCEC / NASA **UFGS-32 12 13 (May 2017)**

Preparing Activity: USACE **Superseding**
UFGS-32 12 10 (August 2008)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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05/17

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SECTION 32 12 13

BITUMINOUS TACK AND PRIME COATS
05/17

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NOTE: This guide specification covers the requirements for bituminous tack and prime coats for airfield pavements, roads, parking areas and general paving needs.

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).

****

PART 1 GENERAL

1.1 UNIT PRICES

****

NOTE: Delete unit price paragraphs when lump sum bidding is used. Edit submittal requirements accordingly.

****

1.1.1 Measurement

****

NOTE: When the bituminous material is measured in liters gallons, the appropriate ASTM method will be retained for the type of bituminous material specified. The quantity of material will be the

quantity of residual asphalt.
****

The bituminous material paid for will be the measured quantities of residual bituminous material used in the accepted work, provided that the measured quantities are not 10 percent over the specified quantities. Any amount of bituminous material more than 10 percent over the specified quantity will be deducted from the measured quantities. Express measured quantities in [metric tons 2000 pound tons] [liters at 15.6 degrees C gallons at 60 degrees F]. Correct volumes measured at temperatures other than 15.6 degrees C 60 degrees F in accordance with ASTM D1250 using a coefficient of expansion of 0.00045 per degree C 0.00025 per degree F for asphalt emulsion.

1.1.2 Payment

The quantities of bituminous material, determined as specified above, will be paid for at the respective contract unit prices. Payment will constitute full compensation for all operations necessary to complete the work as specified herein.

1.1.3 Waybills and Delivery Tickets

Submit waybills and delivery tickets, during progress of the work. Before the final statement is allowed, file with the Contracting Officer certified waybills and certified delivery tickets for all bituminous materials used in the construction of the pavement covered by the contract. These submittals are required for Unit Pricing bid only. Do not remove bituminous material from storage until the initial outage and temperature measurements have been taken. The delivery or storage units will not be released until the final outage has been taken.

1.2 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 ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS (AASHTO)

AASHTO T 102	(2009; R 2013) Standard Method of Test for Spot Test of Asphaltic Materials

ASTM INTERNATIONAL (ASTM)

ASTM D140/D140M	(2016) Standard Practice for Sampling Asphalt Materials
ASTM D946/D946M	(2020) Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
ASTM D977	(2019a; E 2019) Standard Specification for Emulsified Asphalt
ASTM D1250	(2019; E 2020) Standard Guide for Use of the Joint API and ASTM Adjunct for Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils: API MPMS Chapter 11.1
ASTM D2026/D2026M	(2015) Cutback Asphalt (Slow-Curing Type)
ASTM D2027/D2027M	(2019) Cutback Asphalt (Medium-Curing Type)
ASTM D2028/D2028M	(2015) Cutback Asphalt (Rapid-Curing Type)
ASTM D2397/D2397M	(2019a) Standard Specification for Cationic Emulsified Asphalt
ASTM D2995	(1999; R 2009) Determining Application Rate of Bituminous Distributors
ASTM D6373	(2016) Standard Specification for Performance Graded Asphalt Binder

U.S. GREEN BUILDING COUNCIL (USGBC)

LEED BD+C	(2009; R 2010) Leadership in Energy and Environmental Design(tm) Building Design and Construction (LEED-NC)

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, Air Force, and NASA projects. 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.

Choose the first bracketed item for Navy, Air Force and NASA projects, or choose the second bracketed item for Army projects.
****

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.][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-03 Product Data

Waybills and Delivery Tickets

Local/Regional Materials

SD-06 Test Reports

Sampling and Testing

1.4 QUALITY ASSURANCE

Certificates of compliance for asphalt materials delivered will be obtained and checked to ensure that specification requirements are met. Quantities of applied material will be determined. Payment will be for amount of residual asphalt applied. Tack coat materials will not be diluted. Prime coat materials when emulsions are used can be diluted on site with potable water up to 1 part emulsion to 1 part water.

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect the materials delivered to the site for contamination and damage. Unload and store the materials with a minimum of handling.

1.6 EQUIPMENT, TOOLS AND MACHINES

1.6.1 General Requirements

Equipment, tools and machines used in the work are subject to approval. Maintain in a satisfactory working condition at all times. Calibrate equipment such as asphalt distributors, scales, batching equipment, spreaders and similar equipment within 12 months of their use. If the calibration expires during project, recalibrate the equipment before work can continue.

1.6.2 Bituminous Distributor

Provide a self propelled distributor with pneumatic tires of such size and number to prevent rutting, shoving or otherwise damaging the surface being sprayed. Calibrate the distributer in accordance with ASTM D2995. Design and equip the distributor to spray the bituminous material in a uniform coverage at the specified temperature, at readily determined and controlled total liquid rates from 0.14 to 4.5 L/square meter 0.03 to 1.0 gallons per square yard, with a pressure range of 172.4 to 517.1 kPa 25 to 75 psi and with an allowable variation from the specified rate of not more than plus or minus 5 percent, and at variable widths. Include with the distributor equipment a separate power unit for the bitumen pump, full-circulation spray bars, tachometer, pressure gauges, volume-measuring devices, adequate heaters for heating of materials to the proper application temperature, a thermometer for reading the temperature of tank contents, and a hand hose attachment suitable for applying bituminous material manually to areas inaccessible to the distributor. The distributor will be capable of circulating and agitating the bituminous material during the heating process.

1.6.3 Heating Equipment for Storage Tanks

Use steam, electric, or hot oil heaters for heating the bituminous material. Provide steam heaters consisting of steam coils and equipment for producing steam, so designed that the steam cannot come in contact with the bituminous material. Fix an armored thermometer to the tank with a temperature range from 4.4 to 204.4 degrees C 40 to 400 degrees F so that the temperature of the bituminous material may be determined at all times.

1.6.4 Power Brooms and Power Blowers

Use power brooms and power blowers suitable for cleaning the surfaces to which the bituminous coat is to be applied.

1.7 ENVIRONMENTAL REQUIREMENTS

Apply bituminous coat only when the surface to receive the bituminous coat is dry. A limited amount of moisture (approximately 0.14 liter/square meter 0.03 gallon/square yard) can be sprayed on the surface of unbound material when prime coat is used to improve coverage and penetration of asphalt material. Apply bituminous coat only when the atmospheric temperature in the shade is 10 degrees C 50 degrees F or above and when the temperature has not been below 2 degrees C 35 degrees F for the 12 hours prior to application, unless otherwise directed.

PART 2 PRODUCTS

2.1 PRIME COAT

****

NOTE: Remove brackets from around the material to be allowed in the contract specifications and delete the other materials and references.

a. With growing environmental/safety regulations, an increasing number of states are prohibiting the use of cutback asphalts in favor of emulsified asphalt materials. For prime coat, cutback asphalt penetrates the unbound material better than emulsion and hence is often preferred if available. If cutback asphalts are used, one of the following types and grades is recommended (medium-curing type cutback asphalts are the most common type of cutbacks used as prime coat):

Slow-Curing Type (ASTM D2026/D2026M): SC-70, SC-250.

Medium-Curing Type (ASTM D2027/D2027M): MC-30, MC-70, MC-250.

Rapid-Curing Type (ASTM D2028/D2028M): RC-70, RC-250.

Selection of a particular type and grade should consider the nature of the surface to be treated. An open base course material will be penetrated readily, and all of the above types and grades can be considered except for the low viscosity MC-30. A tight surface will be penetrated as readily; therefore, the less viscous materials are recommended such as RC-70, MC-30, MC-70 and SC-70. Some caution might be urged in using RC-70 or RC-250 because the solvent may separate or be absorbed by the base course fines and leave the asphalt deposited on the surface. Cutback asphalts can be used in cold-weather construction with less concern than emulsions which contain water. Less viscous grades such as RC-70, MC-30 and MC-70 may be used for cold-weather construction.

b. The following types of emulsions can be used for prime coats:

Anionic Emulsions ASTM D977: SS-1, SS-1h.

Cationic Emulsions ASTM D2397/D2397M: CSS-1, CSS-1h.

Some state DOTs use an asphalt emulsion that is designed for prime coat. It is normally referred to as EA-P (standing for emulsified asphalt-prime). Emulsions generally do not penetrate very much into the underlying layer and these specially designed emulsions provide better penetration. This type of emulsion is preferred for prime coat if available.

Penetration and coating of prime coat material will be most efficient at approximately optimum moisture content. Water dilution of the emulsion is also sometimes required for prime coat to improve penetration but dilution of tack coat materials should not be allowed.

****

Provide asphalt conforming to one of the following grades:

2.1.1 Cutback Asphalt

Provide cutback asphalt conforming to [ASTM D2026/D2026M, Grade [SC-70] [SC-250]] [ASTM D2027/D2027M, Grade [MC-30] [MC-70] [MC-250]] [ASTM D2028/D2028M, Grade [RC-70] [RC-250]].

2.1.2 Emulsified Asphalt

Provide emulsified asphalt conforming to [ASTM D977, Type [SS-1] [SS1h]] [ASTM D2397/D2397M, Type [CSS-1] [CSS-1h]]. Asphalt emulsion can be diluted up to 1 part water to 1 part emulsion for prime coat use. Do not dilute asphalt emulsion for tack coat use.

2.2 TACK COAT

****

NOTE: Tack coat reduces water penetration into a pavement and should not be used in pervious pavement systems. When a pervious pavement system is specified, the tack coat is often deleted because it may seal the voids in the pervious pavement, but this has to be determined during design. If tack coat is not used, delete all references to tack coat in this section.

Emulsified asphalt grades are suitable for tack coat applications. Consider the following when evaluating alternate grades to be specified for the project:

a. Local practice as well as availability and cost of various grades within the area.

b. Where a rapid-setting emulsion is required, consider use of RS-1 and CRS-1.

c. For most applications, cationic and anionic emulsions will perform equally well. Anionic emulsions such as SS-1 may provide better adhesion to calcareous aggregates with pH less than 7, such as limestone. Cationic emulsions such as CSS-1 may provide better adhesion to siliceous aggregates with pH greater than 7, such as granite.

d. In warmer climates, consider the use of "h" grade emulsions with a harder base asphalt and lower penetration such as SS-1h and CSS-1h.

e. Grades SS-1h and CSS-1h are recommended for

airfields. The other grades can be considered for general use. Grades RS-1, SS-1, and SS-1h are the most widely used tack coat materials.

f. Several state DOTs have begun to use tack coats with reduced tracking to minimize spreading the tack coat all along the truck route. These are often proprietary materials. Before specifying, check with local DOT to determine their experience with these reduced tracking materials.

g. Note A in TABLE 1 of ASTM D2028/D2028M should be reviewed and the material specified by viscosity or penetration. Except for Navy projects, cutback asphalt grades recommended for tack are RC-70 and RC-250. In cold-weather construction, cutback asphalt can be used with less concern than emulsions which contain water.

h. Paving grade asphalts can also be used in tack coat applications. High heat is required to achieve spraying consistency for these materials. When asphalt cement is used, the tack coat grade should be the same grade as that for the asphalt mixture or the normal unmodified asphalt grade used for the local area by the DOT.

****

2.2.1 Asphalt Cement

****
NOTE: See Note h. above for guidance on selected grade of asphalt cement for use.
****

Provide asphalt cement conforming to [ASTM D946/D946M] or [ASTM D6373] Grade [_____].

2.2.2 Cutback Asphalt

Provide cutback asphalt conforming to ASTM D2028/D2028M, [Grade RC-70] [RC-250].

2.2.3 Emulsified Asphalt

Provide emulsified asphalt conforming to [ASTM D977, Type [RS-1] [MS-1] [HFMS-1] [SS-1] [SS1h]] [ASTM D2397/D2397M, Type [CRS-1] [CSS-1] [CSS-1h]]. For prime coats the emulsified asphalt can be diluted with up to 1 part emulsion to 1 part water. No dilution is allowed for tack coat applications. The base asphalt used to manufacture the emulsion is required to show a negative spot when tested in accordance with AASHTO T 102 using standard naphtha.

2.2.4 Local/Regional Materials

****

NOTE: Using local materials can help minimize transportation impacts, including fossil fuel consumption, air pollution, and labor. Using materials harvested and manufactured within a 800 km (500 mile) radius from the project site contributes to the following LEED credit: MR5. Coordinate with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. Use second option if Contractor is choosing local materials in accordance with Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING. Use second option for USACE projects. Army projects should include option, only if pursuing this LEED credit.

****

[Use Local/Regional Materials or products extracted, harvested, or recovered, as well as manufactured, within a [800] [_____] km [500] [_____] mile radius from the project site, if available from a minimum of three sources.] [See Section 01 33 29 SUSTAINABILITY REQUIREMENTS AND REPORTING for cumulative total local material requirements. Tack and prime coat materials may be locally available.] [Submit documentation indicating distance between manufacturing facility and the project site. Indicate distance of raw material origin from the project site. Indicate relative dollar value of local/regional materials to total dollar value of products included in project in accordance with LEED BD+C.]

PART 3 EXECUTION

3.1 PREPARATION OF SURFACE

****

NOTE: If the surface to be treated requires repair, the method of repair and extent of work involved should be shown or described.

****

Immediately before applying the bituminous coat, remove all loose material, dirt, clay, or other objectionable material from the surface to be treated by means of a power broom or blower supplemented with hand brooms. Apply treatment only when the surface is dry and clean.

3.2 APPLICATION RATE

The exact quantities within the range specified, which may be varied to suit field conditions, will be determined by the Contracting Officer.

3.2.1 Tack Coat

Apply bituminous material for the tack coat in quantities of not less than 0.14 L 0.03 gallons nor more than 0.46 L/square meter 0.10 gallons per square yard of residual asphalt onto the pavement surface as approved by the Contracting Officer. Do not dilute asphalt emulsion when used as a tack coat.

3.2.2 Prime Coat

Apply bituminous material for the prime coat in quantities of not less than 0.23 L 0.05 gallons nor more than 0.54 L/square meter 0.12 gallons per square yard of residual asphalt for asphalt emulsion up to a 1 to 1 dilution rate or for residual asphalt for cutback asphalt.

3.3 APPLICATION TEMPERATURE

3.3.1 Viscosity Relationship

Apply asphalt at a temperature that will provide a viscosity between 10 and 60 seconds, Saybolt Furol, or between 20 and 120 square mm/sec 20 and 120 centistokes, kinematic. Furnish the temperature viscosity relation to the Contracting Officer.

3.3.2 Temperature Ranges

****
NOTE: Normal spray application temperatures are provided. Edit and coordinate materials with Part 2 PRODUCTS. Retain material to be allowed in the specification and delete the other materials.
****

The viscosity requirements determine the application temperature to be used. The following is a normal range of application temperatures:

Cutback Asphalts	
MC-30	29-87 degrees C 85-190 degrees F
SC-70, MC-70, RC-70	50-107 degrees C 120-225 degrees F
SC-250, MC-250, RC-250	75-132 degrees C 165-270 degrees F
Asphalt Emulsion	
All Grades	20-70 degrees C 70-160 degrees F
Asphalt Cement	
All Grades	135-175 degrees C 275-350 degrees F

Some of these temperatures for rapid cure cutbacks are above the flash point of the material and care should be taken in their heating.

3.4 APPLICATION

****
NOTE: Prime coats are required for Navy projects. If the designer for Army jobs chooses not to specify a prime coat at the time of design, delete all references to a prime coat within this section. Generally a prime coat should be used but may be deleted in certain situations. For example, the prime coat may be deleted when it is necessary to

reduce construction time or when a drainage layer is used underneath the hot mix asphalt. Be careful about deleting a prime coat for thinner pavements (less than 4 inches) since its use is more critical for thinner sections.
****

3.4.1 General

Following preparation and subsequent inspection of the surface, apply the bituminous prime or tack coat with the bituminous distributor at the specified rate with uniform distribution over the surface to be treated. Properly treat all areas and spots, not capable of being sprayed with the distributor, with the hand spray. Until the succeeding layer of pavement is placed, maintain the surface by protecting the surface against damage and by repairing deficient areas at no additional cost to the Government. If required, spread clean dry sand to effectively blot up any excess bituminous material. No smoking, fires, or flames other than those from the heaters that are a part of the equipment are permitted within 8 meters 25 feet of heating, distributing, and transferring operations of cutback materials. Prevent all traffic, except for paving equipment used in constructing the surfacing, from using the underlying material, whether primed or not, until the surfacing is completed. The bituminous coat requirements are described herein.

3.4.2 Prime Coat

****
NOTE: Conditions where a prime coat may be beneficial include: preventing lateral movement of the unbound base during pavement construction, reducing lateral movement of the asphalt mixture during compaction over the unbound material, waterproofing during pavement construction, and forming a tight base to which the asphalt pavement will adhere. To specify the application of a prime coat, retain the first bracketed sentence and delete the text within the second set of brackets. Indicate prime coat on drawings.

If the prime coat will be retained as a Contractor's option, delete the first sentence and retain the bracketed text in the second set of brackets.
****

[Apply a prime coat at locations shown on the Drawings.] [The prime coat is required if it will be at least [7] [_____] days before the asphalt mixture is constructed on the underlying (base course, etc.) compacted material. The type of liquid asphalt and application rate will be as specified herein. Protect the underlying layer from any damage (water, traffic, etc.) until the surfacing is placed. If the Contractor places the surfacing within seven days, the choice of protection measures or actions to be taken is at the Contractor's option. Repair (recompact or replace) damage to the underlying material caused by lack of, or inadequate, protection by approved methods at no additional cost to the Government. If the Contractor opts to use the prime coat, apply as soon as possible after consolidation of the underlying material.] Apply the bituminous material uniformly over the surface to be treated at a pressure range of 172.4 to 517.1 kPa 25 to 75 psi; the rate will be as specified

above in paragraph APPLICATION RATE. To obtain uniform application of the prime coat on the surface treated at the junction of previous and subsequent applications, spread building paper on the surface for a sufficient distance back from the ends of each application to start and stop the prime coat on the paper and to ensure that all sprayers will operate at full force on the surface to be treated. Immediately after application remove and destroy the building paper.

3.4.3 Tack Coat

Apply tack coat at the locations shown on the drawings. A tack coat should be applied to every bound surface (asphalt or concrete pavement) that is being overlaid with asphalt mixture and at transverse and longitudinal joints. Apply the tack coat when the surface to be treated is clean and dry. Immediately following the preparation of the surface for treatment, apply the bituminous material by means of the bituminous distributor, within the limits of temperature specified herein and at a rate as specified above in paragraph APPLICATION RATE. Apply the bituminous material so that uniform distribution is obtained over the entire surface to be treated. Treat lightly coated areas and spots missed by the distributor by spraying with a hand wand or using other approved method. Following the application of bituminous material, allow the surface to cure without being disturbed for period of time necessary to permit setting of the tack coat. Apply the bituminous tack coat only as far in advance of the placing of the overlying layer as required for that day's operation. Maintain and protect the treated surface from damage until the succeeding course of pavement is placed.

3.5 CURING PERIOD

****

NOTE: Retain bracketed sentence if prime coat is specified.

****

Following application of the bituminous material and prior to application of the succeeding layer of asphalt mixture allow the bituminous coat to cure and water or volatiles to evaporate prior to overlaying. Maintain the tacked surface in good condition until the succeeding layer of pavement is placed, by protecting the surface against damage and by repairing and recoating deficient areas. [Allow the prime coat to cure without being disturbed for a period of at least 48 hours or longer, as may be necessary to attain penetration into the treated course. Furnish and spread enough sand to effectively blot up excess bituminous material.]

3.6 FIELD QUALITY CONTROL

Obtain certificates of compliance for all asphalt material delivered to the project. Obtain samples of the bituminous material under the supervision of the Contracting Officer. The sample may be retained and tested by the Government at no cost to the Contractor.

3.7 SAMPLING AND TESTING

Furnish certified copies of the manufacturer's test reports indicating temperature viscosity relationship for cutback asphalt or asphalt cement, compliance with applicable specified requirements, not less than 5 days before the material is required in the work.

3.7.1 Sampling

Unless otherwise specified, sample bituminous material in accordance with ASTM D140/D140M.

3.7.2 Calibration Test

Furnish all equipment, materials, and labor necessary to calibrate the bituminous distributor. Calibrate using the approved job material and prior to applying the bituminous coat material to the prepared surface. Calibrate the bituminous distributor in accordance with ASTM D2995.

3.7.3 Trial Applications

Before applying the spray application of tack or prime coat, apply three lengths of at least 30 meters 100 feet for the full width of the distributor bar to evaluate the amount of bituminous material that can be satisfactorily applied.

3.7.3.1 Tack Coat Trial Application Rate

Unless otherwise authorized, apply the trial application rate of bituminous tack coat materials in the amount of 0.23 L/square meter 0.05 gallons per square yard. Make other trial applications using various amounts of material as may be deemed necessary.

3.7.3.2 Prime Coat Trial Application Rate

Unless otherwise authorized, apply the trial application rate of bituminous materials in the amount of 0.66 L/square meter 0.15 gallon per square yard. Make other trial applications using various amounts of material as may be deemed necessary.

3.7.4 Sampling and Testing During Construction

Perform quality control sampling and testing as required in paragraph FIELD QUALITY CONTROL.

3.8 TRAFFIC CONTROLS

Keep traffic off surfaces freshly treated with bituminous material. Provide sufficient warning signs and barricades so that traffic will not travel over freshly treated surfaces.

-- End of Section --