
USACE / NAVFAC / AFCEC / NASA UFGS-32 12 37 (August 2008)

Preparing Activity: USACE Superseding
UFGS-32 12 37 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated October 2015

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SECTION 32 12 37

FUEL-RESISTANT (COAL TAR) SEALER
08/08

NOTE: This guide specification covers the requirements for fuel-resistant (coal tar) sealer for bituminous pavements in parking and maintenance areas.

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 items(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 this paragraph when lump sum bidding is used.

1.1.1 Waybills and Delivery Tickets

Submit copies of waybills and delivery tickets during the progress of the work. Before the final statement is allowed, submit certified waybills and delivery tickets for all materials used in the work covered by this section. Do not remove remaining coal-tar emulsion, additive, or aggregate until measurements of the quantities used have been made.

1.1.2 Method of Measurement

NOTE: When other methods of measurement are desired or necessary, this paragraph will be modified accordingly.

1.1.2.1 Coal-tar Emulsion

The amount of coal-tar emulsion to be paid for will be measured by the number of liters gallons of the material used in the accepted work. Use the proper coefficient of volumetric expansion per degree C F, as supplied by the manufacturer, for all binder volume calculations.

1.1.2.2 Additive Materials

Additive materials include any additives or modifiers added to the coal-tar sealer mixture. The materials may be measured by volume or weight.

1.1.2.3 Aggregate

The amount of aggregate to be paid for will be the number of dry metric 2,000 pound tons placed and accepted as part of the coal-tar sealer mixture in the completed work.

1.1.3 Payment

Quantities of coal-tar sealer, additives, and aggregate determined as specified will be paid for at the respective contract unit prices. Such payment will constitute full compensation for all operations necessary to complete the work as specified herein.

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 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.

ASTM INTERNATIONAL (ASTM)

ASTM C136/C136M	(2014) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C142/C142M	(2010) Standard Test Method for Clay Lumps and Friable Particles in Aggregates
ASTM D140/D140M	(2015) Standard Practice for Sampling Bituminous Materials
ASTM D2939	(2003) Emulsified Bitumens Used as Protective Coatings
ASTM D5727/D5727M	(2000; E 2011; R 2011) Emulsified Refined Coal Tar (Mineral Colloid Type)
ASTM D75/D75M	(2014) Standard Practice for Sampling Aggregates

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project.

The Guide Specification technical editors have designated 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 submittals requiring Government approval on Army projects, a code of up to three characters within the submittal tags may be used following the "G" designation 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.

An "S" following a submittal item indicates that the submittal is required for the Sustainability Notebook to fulfill federally mandated sustainable requirements in accordance with Section 01 33 29 SUSTAINABILITY REPORTING.

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" designation; submittals not having a "G" designation are for [Contractor Quality Control approval.] [information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government.] Submittals with an "S" are for inclusion in the Sustainability Notebook, in conformance to Section 01 33 29 SUSTAINABILITY REPORTING. Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealer Mixture

SD-06 Test Reports

Sealer Materials; G[, [_____]]

1.4 QUALITY ASSURANCE

1.4.1 Sampling

NOTE: Insert the appropriate sampling method where bituminous binders are not used. Follow manufacturer's recommendations.

Furnish aggregate samples in accordance with ASTM D75/D75M. Samples of coal-tar emulsion, unless otherwise specified, shall be in accordance with ASTM D140/D140M. Furnish additional samples of materials as required.

1.4.2 Testing

NOTE: An approved testing laboratory is required to meet the testing requirements of this specification. The Contractor testing, when accepted, should only be used for quality control on the job and not for the initial mixture design.

Coordinate this paragraph with the specified requirements in paragraph Composition.

Test Sealer Materials to establish compliance with the specified requirements. Perform quality control testing by an approved commercial testing laboratory or by Contractor testing, subject to approval by the Contracting Officer. Submit samples or certified test results of the materials, [_____] days prior to the beginning of work. No material will be used until it has been approved.

1.4.3 Calibration Test

NOTE: Calibration of all equipment used to place sealer will allow the Government to determine the

application rate and thereby the total quantity of material placed per unit area of pavement.

Furnish equipment, materials, and labor as necessary to calibrate equipment used to place the sealer. Make calibrations with the approved job materials prior to applying the sealer materials to the prepared surface. The manufacturer shall provide a method of calibration for all commercial equipment.

1.4.4 Trial Application

Prior to applying the sealer mixture, place a test section at least 30 meters 100 feet long and two squeegee widths wide using the approved materials and equipment. Place the sealer mixture in accordance with the specified requirements. Determine the rate of application for compliance to specification requirements. If the test section does not conform to the specification requirements, make necessary adjustments, and construct additional test sections at the Contractor's expense for conformance to the specifications. Where test sections do not conform to the specification requirements, remove the sealer mixture by milling, grinding, or another approved method. Test sections that conform to all specification requirements may become part of the accepted sealed surface.

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for contamination and damage, unload, and store them with a minimum of handling. Cover or store aggregates to keep them dry. Store the coal-tar emulsion according to the manufacturer's recommendations. Remove from the jobsite materials determined by the Contracting Officer to be contaminated, damaged, or failing to meet specification requirements and replace them at no additional cost to the Government.

1.6 WEATHER LIMITATIONS

Do not apply sealer if air or pavement temperatures are below 10 degrees C 50 degrees F or if there is any possibility that the sealer will freeze before it has cured, unless otherwise directed by the Contracting Officer. Do not place any sealer when rain or other impending weather conditions will prevent proper curing of the sealer mixture.

PART 2 PRODUCTS

2.1 AGGREGATE

NOTE: All of the gradations given below in Table I can produce a satisfactory sealer mixture. Generally, the larger the aggregate particles in the mixture are, the coarser or more skid resistant the final surface. This can vary, based on the total amount of aggregate in the sealer mixture. The selection of a gradation should be based on recommendations from the coal-tar emulsion manufacturer.

Table I lists the suggested minimum application rates for the three aggregate gradation ranges.

These rates are based on the mixture requirements to embed the largest aggregate particle to at least one-half its thickness.

Provide aggregates which are either natural or manufactured angular aggregate composed of clean, hard, durable, uncoated particles free from clay and other objectionable material when tested in accordance with ASTM C142/C142M. The aggregate shall fall within one of the gradation ranges given in Table I, when tested in accordance with ASTM C136/C136M. The actual gradation can fall anywhere within the types listed, provided that at least 70 percent of the aggregate falls within two consecutive sieve sizes as given in Table I.

TABLE I. AGGREGATE GRADATION RANGES AND CORRESPONDING MINIMUM SEALER MIXTURE APPLICATION RATES			
SIEVE SIZE, mm	PERCENT PASSING		
	COARSE	MEDIUM	FINE
1.180No. 16	100	100	100
0.850No. 20	85-100	98-100	100
0.600No. 30	25-85	85-100	98-100
0.425No. 40	5-25	25-85	85-100
0.300No. 50	2-10	5-25	25-85
0.212No. 70	--	2-10	5-25
0.150No. 100	0-2	0-4	2-10
0.106No. 140	--	0-2	0-2
Minimum sealer mixture application rate liter/square meter gallon/square yard	0.30	0.20	0.15

2.2 WATER

Add only potable water to the sealer mixture. The temperature of the water added during mixing shall be at least 10 degrees C 50 degrees F. The pH of the water shall conform to the requirements of the coal tar emulsion manufacturer.

2.3 COAL-TAR EMULSION

Provide base coal-tar emulsion (mineral colloid type) meeting the requirements of ASTM D5727/D5727M.

2.4 POLYMER ADDITIVE

NOTE: Delete this paragraph when a polymer additive or any other modifier is not to be used in the coal-tar sealer mixture. The most common type of polymer material used for coal-tar sealers is an acrylonitrile-butadiene rubber. This polymer is supplied as an emulsion. Silicon, up to 3 percent by volume of polymer additive, may be used, if recommended by the emulsion manufacturer.

Use the type and make of polymer additive recommended by the coal-tar emulsion manufacturer.

2.5 SEALER MIXTURE

NOTE: The mixture components can be the same for either squeegee or spray applications. The resistance to kerosene test (ASTM D2939) will limit the amount of aggregate that can be added per gallon of emulsion. The use of a polymer has not shown to give improved performance in all instances. The polymer will increase the viscosity of the sealer mixture, however, allowing more aggregate to be held in suspension. The amount of polymer additive, if used, should usually range from 1 to 3 liters per liter gallons per gallon of coal-tar emulsion. The amount of aggregate should range from 0.24 to 0.60 kg per liter 2 to 5 lbs per gallon of emulsion.

Submit a copy of the mixture proportions that meet all the requirements of this specification. Determine the exact proportions of coal tar, water, [polymer additive,] and aggregate to be used in the preparation of the sealer by laboratory mix design furnished by the Contractor from a laboratory approved by the Contracting Officer. The sealer mixture shall meet the requirements as specified in Table II. Mix the sealer components to produce a homogeneous mixture that adequately suspends the aggregate in the mix.

TABLE II. PHYSICAL PROPERTIES OF SEALER MIXTURES		
Property	Requirement	Referenced Test Method
Drying time, firm set	8 hours maximum	ASTM D2939
Resistance to Kerosene	No penetration or loss of adhesion	ASTM D2939

PART 3 EXECUTION

NOTE: Traffic marking paint need not be removed from streets, roads, or parking areas unless the

paint is loose and flaking off. Large painted areas, such as those that occur on airfield pavements, may have to be removed prior to applying the sealer mixture to obtain satisfactory bond to the pavement. If traffic paint removal is not required, the reference to traffic paint removal in this paragraph will be deleted.

Scrubbing with detergents cannot satisfactorily clean asphalt pavements that are heavily saturated with oil or grease. Although a clean surface may be obtained, the oil and grease below the surface will migrate to the top and will bleed through the sealer mixture, or will cause the sealer mixture to lose bond to the pavement. When the amount of contaminants is not severe, the surface of the pavement may be treated with a commercially available bonding material to provide satisfactory service. In general, full-depth replacement of contaminated asphalt pavement surfaces is the only reliable method of correction. This requirement for full-depth removal and replacement of contaminated asphalt concrete can be placed in the main body of the specifications.

When a herbicide is required, the type and method of application will depend upon factors such as type of plants to be destroyed, weather conditions, time restraints, etc. Previous local construction practices that were successful should be used as a guide.

Use the paragraph on tack coat only when the pavement surface is porous (possibly due to raveling) and aged.

The following paragraphs will require editing according to the condition of the pavement to be sealed.

3.1 SYSTEM EQUIPMENT

Machines, tools, and equipment used in the performance of the work will be approved before the work is started and shall be maintained in satisfactory condition.

3.1.1 Mixing

Mix the sealer in a mobile batch mixer of a type approved by the Contracting Officer. Provide a mixer capable of producing a uniform mixture of coal-tar emulsion [, additives,] and aggregate. The mixing unit shall have suitable mixing blades to combine the predetermined quantities of materials into a homogeneous slurry.

3.1.2 Application

NOTE: A decision must be made to apply the sealer

by spraying or by squeegeeing, based partially upon the condition of the pavement prior to sealing.

Manufacturer's recommendations should be followed when determining the method of application. Spraying applies an even distribution of material throughout the application area. Application with a squeegee will allow for the filling of slight imperfections, depressions, or cracks. When desired, the initial squeegee application may be followed by a second spray application.

The following paragraphs should be edited depending upon the application method selected.

3.1.2.1 Squeegee Application

Attach a variable-width mechanical-type squeegee to the mobile-application vehicle to place the slurry. Maintain the attached squeegee with flexible material in contact with the pavement surface to control application and prevent excessive loss of sealer mixture from the spreader on varying grades and crown. Provide a squeegee capable of adjustments to ensure a uniform spread; the mobile-application vehicle shall discharge the sealer to provide satisfactory application. Provide the vehicle with a water tank, pump, and spray bar for fogging the pavement surface ahead of the spreader box. Keep the spreader box clean; buildup of sealer and aggregate on the squeegee and spreader box will not be permitted.

3.1.2.2 Spray Application

The spray vehicle may be self-propelled or towed, designed and equipped to apply a uniform mixture of sealer and aggregate at rates ranging from 0.45 to 3.17 L/square meter 0.10 to 0.70 gallons/square yard. Include with sprayer equipment a separate power unit, agitated tank, spray bar, hand spray wand, and suitable pump and plumbing for handling sealer and aggregate.

3.1.3 Cleaning Equipment

Provide cleaning equipment consisting of power brooms, power blowers, power vacuums, air compressors, hand brooms, and other equipment as needed. The equipment shall be suitable for cleaning the surface and cracks in the existing pavement.

3.1.4 Hand Tools

Provide hand tools consisting of hand squeegees, shovels, and other equipment as necessary to perform the work.

3.2 PREPARATION OF SURFACE

Prior to application of the sealer mixture, clean the existing pavement surface and repair unsatisfactory areas. Remove failed pavement, base, subbase, or subgrade material and replace them with new materials. Areas patched or repaired with asphalt cold mix should be cured for 90 days, while those repaired with hot-mix asphalt should cure for 30 days prior to seal coating the surface.

3.2.1 Cracks

Treat cracks in the surface, not due to structural deficiencies, as outlined below: Cracks less than or equal to 6 mm 1/4 inch wide should be cleaned with compressed air. Cracks larger than 6 mm 1/4 inch but less than 19 mm 3/4 inch in width shall be cleaned with compressed air and filled with an approved crack sealer. Cracks larger than 19 mm 3/4 inch wide shall be cleaned with compressed air and filled by squeegeeing in a mixture of aggregate and sealer. The final surface of the filled cracks shall be flush or up to 3 mm 1/8 inch below the pavement surface. Remove any excess materials from the pavement surface.

3.2.2 Vegetation

Remove vegetation existing in the cracks by [a heat lance] [sand blasting] [water blasting] [a power driven brush] and treat the cracks with a herbicide. The type of herbicide and method of application will require approval by the Contracting Officer.

3.2.3 Oil or Fuel Contaminated Areas

Clean grease-contaminated and oil-contaminated areas, or remove and replace with new asphalt pavement as directed by the Contracting Officer. Areas not removed shall be cleaned by scrubbing with a detergent and flushing with water. Areas, which cannot be satisfactorily cleaned by this manner, may be primed with material especially manufactured to provide a surface suitable for sealing.

3.2.4 Tack Coat

NOTE: Delete this paragraph where application of a tack coat is not part of the manufacturer's recommended procedure. Tack coats are normally used only on very dry and porous pavement surfaces.

Prepare the pavement surface as specified above and spray it with a thin coat of 3 parts water to 1 part coal-tar emulsion. Apply the tack coat at a rate of 0.23 to 0.45 L/square meter 0.05 to 0.10 gallons/square yard.

3.3 MIXING AND APPLICATION OF SEALER

3.3.1 Mixing

3.3.1.1 Mechanical Mixing

Mix the sealer as described in paragraph EQUIPMENT. The sealer mixture shall be of the desired consistency with no segregation when deposited on the surface of the pavement. Provide the sealer mixture with no signs of uncoated aggregate, segregation, or premature breaking of the emulsion when applied to the pavement surface.

3.3.1.2 Hand Mixing

Where small amounts of sealer are required, making mechanical mixing uneconomical, mixing may be accomplished by hand. The preparation requirements are the same as given in the preceding paragraph for mechanical mixing.

3.3.2 Mechanical Application

**NOTE: This paragraph may have to be amended
depending upon the manufacturer's recommendations.**

3.3.2.1 Squeegee

Feed sufficient quantities of the sealer mixture into the spreader to obtain uniform and complete pavement coverage. Operate the spreader at such a forward speed that the amount of sealer mixture in the spreader remains essentially constant. Apply the sealer in such a manner that the minimum thickness will equal that given in Table I. Apply a minimum of two coats with aggregate at the minimum application rate consistent with the size of the aggregate used. Thoroughly cure each application before another application is placed. Do not allow oversized aggregate particles in the sealer mixture; no buildup of cured sealer mixture shall be allowed to collect in the spreader. Do not leave streaks in the finished surface.

3.3.2.2 Spray

If the sealer is applied by spraying, provide a coating thickness equal to that required for squeegee application. Apply the sealer in at least two coatings. Variation in the specified rate shall not vary by more than plus or minus 5 percent. Thoroughly cure each coating before another coating is applied.

3.3.3 Hand Application

**NOTE: Close attention should be given during hand
squeegee spreading of an emulsion sealer mixture.
Overworking will sometimes cause partial breaking of
the emulsion before the final spreading is
completed; this results in a nonuniform material
that will have poor appearance and low durability.**

Areas which cannot be reached with the application equipment, or areas with minor defects shall have the sealers applied with hand squeegees or sprayed by the wand to provide complete and uniform coverage. Tack and fog these areas, as required, prior to placing sealer by hand.

3.3.4 Wetting Pavement Surface

**NOTE: Wetting of the surface is recommended on hot,
sunny days, generally when the pavement surface
temperature approaches or exceeds 38 degrees C 100
degrees F. Eliminate this paragraph when the
emulsion manufacturer recommends against it.**

Immediately prior to application of the sealer mixture, moisten the surface of the pavement with a fog spray of water from the spray bar on the sealer machine. Do not allow free water on the surface of the pavement following the fog spray. Adjust the rate of application of the fog spray during the

day to suit pavement temperature, surface texture, humidity, and dryness of the pavement surface.

3.3.5 Joints

Longitudinal joint between adjacent lanes shall have no visible overlaps, pinholes, or uncovered areas. Smooth immediately with hand squeegees thick spots caused by overlapping before the sealer mixture cures. Overlaps, which occur at transverse joints, shall also be smoothed before the sealer mixture cures, so that a uniform surface is obtained which contains no breaks or discontinuities. Joints should be made while the first coat is still workable. If fresh working is not possible, the previous coat shall be cured sufficiently to support the spreader box.

3.4 CURING

NOTE: Before traffic is permitted, a thorough cure must be ensured. Manufacturer's recommendations should be followed in setting cure times. Normally, 8 hours is sufficient for the curing. Generally, the thicker the coating applied, the longer the required cure period.

Protect sealed pavement from traffic by barricades and markers until the seal has cured a minimum of [_____] hours. Repair, at no cost to the Government, areas damaged by traffic or from the effects of adverse weather conditions.

3.5 RETEST AND REJECTION

If the results of any test do not conform to the requirements of this specification, reject the sealer. Retesting of nonconforming materials or new materials shall be at the Contractor's expense and at the Contracting Officer's discretion.

3.6 CLEANUP

Upon completion of work, collect and remove from the site all trash, discarded seal material, or other refuse and dispose of it as approved by the Contracting Officer.

-- End of Section --