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UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 23 June 2005

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08/04

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SECTION 02761

FUEL-RESISTANT (COAL TAR) SEALER 08/04

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

Comments and suggestions on this guide specification are welcome and should be directed to the technical proponent of the specification. A listing of technical proponents, including their organization designation and telephone number, is on the Internet.

Recommended changes to a UFGS should be submitted as a Criteria Change Request (CCR).

Use of electronic communication is encouraged.

Brackets are used in the text to indicate designer choices or locations where text must be supplied by the designer.

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 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 C 136	(2004) Sieve Analysis of Fine and Coarse Aggregates
ASTM C 142	(1997; R 2004) Clay Lumps and Friable Particles in Aggregates
ASTM D 140	(2001) Sampling Bituminous Materials
ASTM D 2939	(2003) Emulsified Bitumens Used as Protective Coatings
ASTM D 5727	(2000) Emulsified Refined Coal Tar (Mineral Colloid Type)
ASTM D 75	(2003) Sampling Aggregates

1.2 UNIT PRICES

NOTE: Delete this paragraph when lump sum bidding is used.

1.2.1 Waybills and Delivery Tickets

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

1.2.2 Method of Measurement

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

1.2.2.1 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. The proper coefficient of volumetric expansion per degree C F, as supplied by the manufacturer, shall be used for all binder volume calculations.

1.2.2.2 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.

1.2.2.3 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.

1.2.3 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.

1.3 SUBMITTALS

NOTE: Review submittal description (SD) definitions in Section 01330 SUBMITTAL PROCEDURES and edit the following list to reflect only the submittals required for the project. Submittals should be kept to the minimum required for adequate quality control.

A "G" following a submittal item indicates that the submittal requires Government approval. Some submittals are already marked with a "G". Only delete an existing "G" if the submittal item is not complex and can be reviewed through the Contractor's Quality Control system. Only add a "G" 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.

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.] The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealer Mixture

A copy of the mixture proportions that meet all the requirements of this specification.

SD-06 Test Reports

Sealer Materials[; G][; G, [_____]]

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 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.

1.4.1 Mixing

Mixing of the sealer shall be accomplished in a mobile batch mixer of a type approved by the Contracting Officer. The mixer shall be 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.

1.4.2 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.

1.4.2.1 Squeegee Application

A variable-width mechanical-type squeegee shall be attached to the mobile-application vehicle to place the slurry. The attached squeegee shall be maintained 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. The squeegee shall be

capable of adjustments to ensure a uniform spread, and the mobile-application vehicle shall discharge the sealer to provide satisfactory application. The vehicle shall be provided with a water tank, pump, and spray bar for fogging the pavement surface ahead of the spreader box. The spreader box shall be kept clean, and buildup of sealer and aggregate on the squeegee and spreader box shall not be permitted.

1.4.2.2 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. Sprayer equipment shall include a separate power unit, agitated tank, spray bar, hand spray wand, and suitable pump and plumbing for handling sealer and aggregate.

1.4.3 Cleaning Equipment

Cleaning equipment shall consist 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.

1.4.4 Hand Tools

Hand tools shall consist of hand squeegees, shovels, and other equipment as necessary to perform the work.

1.5 SAMPLING AND TESTING

1.5.1 Sampling

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

Aggregate samples shall be furnished in accordance with ASTM D 75. Samples of coal-tar emulsion, unless otherwise specified, shall be in accordance with ASTM D 140. Additional samples of materials shall be furnished as required.

1.5.2 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.

Sealer Materials shall be tested to establish compliance with the specified requirements. Quality control testing shall be performed by an approved commercial testing laboratory or by Contractor testing, subject to approval by the Contracting Officer.

1.5.3 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.

Equipment, materials, and labor shall be furnished as necessary to calibrate equipment used to place the sealer. Calibrations shall be made 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.

1.5.4 Trial Application

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

1.6 DELIVERY AND STORAGE

Materials delivered to the site shall be inspected for contamination and damage, unloaded, and stored with a minimum of handling. Aggregates shall be covered or stored to keep them dry. The coal-tar emulsion shall be stored according to the manufacturer's recommendations. Materials determined by the Contracting Officer to be contaminated, damaged, or which fail to meet specification requirements shall be removed from the jobsite and replaced at no additional cost to the Government.

1.7 WEATHER LIMITATIONS

Sealer shall not be applied 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. No sealer shall be placed 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.

The aggregate shall be either a natural or manufactured angular aggregate and shall be composed of clean, hard, durable, uncoated particles free from clay and other objectionable material when tested in accordance with ASTM C 142. The aggregate shall fall within one of the gradation ranges given in Table I, when tested in accordance with ASTM C 136. 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	PERCENT PASSING		
	COARSE	MEDIUM	FINE
1.180 mm (No. 16)	100	100	100
0.850 mm (No. 20)	85-100	98-100	100
0.600 mm (No. 30)	25-85	85-100	98-100
0.425 mm (No. 40)	5-25	25-85	85-100
0.300 mm (No. 50)	2-10	5-25	25-85
0.212 mm (No. 70)	--	2-10	5-25
0.150 mm (No. 100)	0-2	0-4	2-10
0.106 mm (No. 140)	--	0-2	0-2

Note: Minimum sealer mixture application rate
liter/square meter
(gallon/square yard)

0.30 0.20 0.15

2.2 WATER

The water added to the sealer mixture shall be potable. 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

The base coal-tar emulsion (mineral colloid type) shall meet the requirements of ASTM D 5727.

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.

The polymer additive used shall be the type and make as 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 D 2939) 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 (gallons) per liter (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.

The exact proportions of coal tar, water, [polymer additive,] and aggregate to be used in the preparation of the sealer shall be determined by laboratory mix design and shall be furnished by the Contractor from a laboratory approved by the Contracting Officer. The sealer mixture shall meet the requirements as specified in Table II. The sealer components shall be mixed 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 D 2939
Resistance to Kerosene	No penetration or loss of adhesion	ASTM D 2939

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 PREPARATION OF SURFACE

Prior to application of the sealer mixture, the existing pavement surface shall be cleaned and unsatisfactory areas repaired. Failed pavement, base, subbase, or subgrade material shall be removed and replaced 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.

3.1.1 Cracks

Cracks in the surface not due to structural deficiencies shall be treated 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. Any excess materials shall be removed from the pavement surface.

3.1.2 Vegetation

Vegetation existing in the cracks shall be removed by [a heat lance] [sand blasting] [water blasting] [a power driven brush] and the cracks treated with a herbicide. The type of herbicide and method of application will

require approval by the Contracting Officer.

3.1.3 Oil or Fuel Contaminated Areas

Grease-contaminated and oil-contaminated areas shall be cleaned or removed and replaced 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.

3.1.4 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.**

The pavement surface shall be prepared as specified above and sprayed with a thin coat of 3 parts water to 1 part coal-tar emulsion. The tack coat shall be applied at a rate of 0.23 to 0.45 L/square meter 0.05 to 0.10 gallons/square yard.

3.2 MIXING AND APPLICATION OF SEALER

3.2.1 Mixing

3.2.1.1 Mechanical Mixing

The sealer shall be mixed 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. The sealer mixture shall show no signs of uncoated aggregate, segregation, or premature breaking of the emulsion when applied to the pavement surface.

3.2.1.2 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.

3.2.2 Mechanical Application

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

3.2.2.1 Squeegee

Sufficient quantities of the sealer mixture shall be fed into the spreader to obtain uniform and complete pavement coverage. The spreader shall be operated at such a forward speed that the amount of sealer mixture in the spreader shall remain essentially constant. The sealer shall be applied in such a manner that the minimum thickness will equal that given in Table I. A minimum of two coats shall be applied with aggregate at the minimum

application rate consistent with the size of the aggregate used. Each application shall be thoroughly cured before another application is placed. No oversized aggregate particles shall be allowed in the sealer mixture, and no buildup of cured sealer mixture shall be allowed to collect in the spreader. Streaks shall not be left in the finished surface.

3.2.2.2 Spray

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

3.2.3 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 shall be sprayed by the wand to provide complete and uniform coverage. These areas shall be tacked and fogged as required prior to placing sealer by hand.

3.2.4 Wetting Pavement Surface

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

Immediately prior to application of the sealer mixture, the surface of the pavement shall be moistened with a fog spray of water from the spray bar on the sealer machine. No free water shall be on the surface of the pavement following the fog spray. The rate of application of the fog spray shall be adjusted during the day to suit pavement temperature, surface texture, humidity, and dryness of the pavement surface.

3.2.5 Joints

Longitudinal joint between adjacent lanes shall have no visible overlaps, pinholes, or uncovered areas. Thick spots caused by overlapping shall be smoothed immediately with hand squeegees 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 must be cured sufficiently to support the spreader box.

3.3 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.

Sealed pavement shall be protected from traffic by barricades and markers until the seal has cured a minimum of [_____] hours. The Contractor at no cost to the Government shall repair areas damaged by traffic or from the effects of adverse weather conditions.

3.4 RETEST AND REJECTION

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

3.5 CLEANUP

Upon completion of work, all trash, discarded seal material, or other refuse shall be collected and removed from the site and disposed of as approved by the Contracting Officer.

-- End of Section --