

ITEM P-631 REFINED COAL TAR EMULSION WITH ADDITIVES, SLURRY SEAL SURFACE TREATMENT

631-1.1 GENERAL. This item shall consist of a mixture of refined coal tar emulsion, mineral aggregate, additives, and water properly proportioned, mixed and applied as a slurry seal on new or existing (aged) asphalt concrete pavement.

MATERIALS

631-2.1 Refined Coal Tar Emulsion. A refined coal tar emulsion prepared from a high temperature refined coal tar conforming to the requirements of ASTM specification D 490 for grade 11-12. The use of oil and water gas tar is not allowed. Base refined coal tar emulsion must conform to all requirements of Federal Specification R-P-355.

631-2.2 Aggregate. The aggregate shall be washed dry silica sand or boiler slag free of dust, trash, clay, organic materials or other deleterious substances. The aggregate shall meet the gradation in Table 1, when tested in accordance with ASTM C 136.

TABLE 1. GRADATION OF AGGREGATES*

Sieve Size		Percent Retained	
		Minimum	Maximum
#20 or coarser	(0.850 mm)	0	2
#30	(0.600 mm)	0	12
#40	(0.425 mm)	2	60
#50	(0.300 mm)	5	60
#70	(0.212 mm)	5	60
#100	(0.150 mm)	5	30
#140	(0.106 mm)	0	10
#200	(0.075 mm)	0	2
Finer than #200		0	0.3

* Table 1 represents the maximum range of aggregate gradations. In all cases the refined coal tar emulsion supplier is to give written approval of the aggregate used in the mix design.

631-2.3 Additive. As specified by the coal tar emulsion manufacturer.

Additives are one or more ingredients that can be added to a specific refined coal tar emulsion, water and/or sand mixture to improve the coatings final properties. These properties include durability, fuel resistance, drying time, color uniformity, and/or length of cure time. Additives may also be used to modify the wet mixture’s viscosity to improve aggregate suspension.

The type of additive to be used should be specified by the coal tar emulsion manufacturer and will depend on which final properties are desired.

The engineer should specify the desired properties.

631-2.4 Water. Water for mixing shall be potable, free of harmful soluble salts, and at least 50°F (10° C).

631-2.5 Crack Sealant. Crack sealant shall be certified for compatibility with the refined coal tar emulsion by the manufacturer of the refined coal tar emulsion, and approved by the engineer.

631-2.6 Oil Spot Primer. Oil spot primer shall be certified for compatibility with the refined coal tar emulsion by the manufacturer of the refined coal tar emulsion, and approved by the engineer.

631-2.7 Pavement Primer. Pavement primer shall be certified for compatibility with the refined coal tar emulsion by the manufacturer of the refined coal tar emulsion, and approved by the engineer.]

COMPOSITION AND APPLICATION

631-3.1 Composition. The refined coal tar emulsion seal coat is to consist of a mixture of refined coal tar emulsion, water, additive and aggregate, and be proportioned as shown in Table 2. The composition must have written approval of the coal tar emulsion manufacturer.

631-3.2 Job Mix Formula. The contractor shall submit the recommended formulation of water, emulsion, aggregate and application rate proposed for use to a testing laboratory together with sufficient materials to verify the formulation at least [] days prior to the start of operations. The mix design shall be within the range shown in Table 2. No seal coat shall be produced for payment until a job mix formula has been approved by the Engineer. The formulation shall pass the fuel resistance test in Appendix A.

The job mix formula for each mixture shall be in effect until modified in writing by the Engineer.

Improper formulations of coal-tar pitch emulsion seal produce coatings that crack prematurely or do not adhere properly to the pavement surface. A minimum of 5 days is recommended for job mix approval.

**TABLE 2.
COMPOSITION OF MIXTURE PER 100 GAL OF REFINED COAL TAR EMULSION**

Application	Refined Coal Tar Emulsion	Water	Additive	Aggregate	Formula Rate of Application of Mix per Square Yard (Liters)	
					Minimum Gallons (Liters)	Maximum Gallons (Liters)
Prime Coat (where required) as specified by the coal tar emulsion manufacturer.						
1st Seal Coat	100 (379)	25-70 (95-265)	2-6 (7.6-22.7)	300-700 (136-318)	0.12 (0.54)	0.20 (0.91)
2nd Seal Coat	100 (379)	25-70 (95-265)	2-6 (7.6-22.7)	300-700 (136-318)	0.12 (0.54)	0.20 (0.91)

The numbers shown in Table 2 represent the maximum recommended range of values. In all cases, the refined coal tar emulsion supplier is to give written approval of specific composition numbers to be used in the mix design.

Some specifications covering this type of coating have allowed sand loadings in excess of 10 pounds per gallon of refined coal tar emulsion. These coatings have not performed well in the field due to poor fuel resistance and loss of adhesion and are not recommended.

631-3.3 Application Rate. Application rates are not to exceed 0.20 gal/yd.²/coat (0.91 liters/m²/coat), and at no time are total coats to exceed 0.51 gal/yd² (2.3 liters/m²).

631-3.4 Test Section. Prior to full production, the Contractor shall prepare a quantity of mixture in the proportions shown in the approved mix design. The amount of mixture shall be sufficient to place a test section a minimum of 250 square yards at the rate specified in the job mix formula. The area to be tested will be designated by the Engineer and will be located on a representative section of the pavement to be seal coated. The actual application rate will be determined by the Engineer during placement of the test section and will depend on the condition of the pavement surface.

The test section shall be used to verify the adequacy of the mix design and to determine the application rate. The same equipment and method of operations shall be used on the test section as will be used on the remainder of the work.

If the test section should prove to be unsatisfactory, the necessary adjustments to the job mix formula, mix composition, application rate, placement operations, and equipment shall be made. Additional test sections shall be placed and evaluated, if required. Full production shall not begin without the Engineer's approval. Acceptable test sections shall be paid for in accordance with paragraph 631-7.1.

The test section affords the Contractor and the Engineer an opportunity to determine the quality of the mixture in place as well as the performance of the equipment.

The application rate depends on the surface texture.

If operational conditions preclude placement of a test section on the pavement to be seal coated, it may be applied on a pavement with similar surface texture.

The only test required on the composite mix placed in the field is the viscosity test. The fuel resistance test may be specified, however, this test takes 96 hours to run.

CONSTRUCTION METHODS

631-4.1 Weather Limitations. The seal coat shall not be applied when the surface is wet or when the humidity or impending weather conditions will not allow proper curing. The seal coat shall be applied only when the atmospheric or pavement temperature is 50°F (10°C) and rising and is expected to remain above 50°F (10°C) for 24 hours, unless otherwise directed by the Engineer.

631-4.2 Equipment and Tools. The Contractor shall furnish all equipment, tools, and machinery necessary for the performance of the work.

a. Distributors. Distributors or spray units used for the spray application of the seal coat shall be self-propelled and capable of uniformly applying 0.12 to 0.55 gallons per square yard (0.54 to 2.5 liters per square meter) of material over the required width of application. Distributors shall be equipped with removable manhole covers, tachometers, pressure gauges, and volume-measuring devices.

The mix tank shall have a mechanically powered, full-sweep, mixer with sufficient power to move and homogeneously mix the entire contents of the tank.

The distributor shall be equipped with a positive placement pump so that a constant pressure can be maintained on the mixture to the spray nozzles.

b. Mixing Equipment. The mixing machine shall have a continuous flow mixing unit capable of accurately delivering a predetermined proportion of aggregate, water, and emulsion, and of discharging the thoroughly mixed product on a continuous basis. The mixing unit shall be capable of thoroughly blending all ingredients together and discharging the material to the spreader box without segregation.

c. Spreading Equipment. Spreading equipment shall be a mechanical-type squeegee distributor attached to the mixing machine, equipped with flexible material in contact with the surface to prevent loss of slurry from the spreader box. It shall be maintained to prevent loss of slurry on varying grades and adjusted to assure uniform spread. There shall be a lateral control device and a flexible strike-off capable of being adjusted to lay the slurry at the specified rate of application. The spreader box shall have an adjustable width. The box shall be kept clean; coal-tar emulsion and aggregate build-up on the box shall not be permitted.

d. Hand Squeegee or Brush Application. The use of hand spreading application shall be restricted to places not accessible to the mechanized equipment or to accommodate neat trim work at curbs, etc. Material that is applied by hand shall meet the same standards as that applied by machine.

e. Calibration. The Contractor shall furnish all equipment, materials and labor necessary to calibrate the equipment. It shall be calibrated to assure that it will produce and apply a mix that conforms to the job mix formula. Commercial equipment should be provided with a method of calibration by the manufacturer. All calibrations shall be made with the approved job materials prior to applying the seal coat to the pavement. A copy of the calibration test results shall be furnished to the Engineer.

631-4.3 Preparation Of Existing Asphalt Pavement Surfaces. Existing asphalt pavements indicated to be seal coated shall be prepared as follows:

- Patch bituminous pavement surfaces that have been softened by petroleum derivatives or have failed due to any other cause. Remove damaged pavement to the full depth of the damage and replace with new bituminous concrete similar to that of the existing pavement. If a solvent containing cold-applied material is used, complete patching a minimum of 90 days prior to the planned application of the sealer to permit solvent to escape before sealing.
- Remove all vegetation and debris from cracks to a minimum depth of 1". If extensive vegetation exists treat the specific area with a concentrated solution of a water-based herbicide approved by the engineer. Fill all cracks, ignoring hairline cracks (< 1/4" wide) with a crack sealant. Wider cracks (over 1 1/2" wide (38.4 mm)), along with soft or sunken spots, indicate that the pavement or the pavement base should be repaired or replaced as stated above.
- Clean pavement surface immediately prior to placing the prime coat or seal coat by sweeping, flushing well with water leaving no standing water, or a combination of both, so that it is free of dust, dirt, grease, vegetation, oil or any type of objectionable surface film.
- Remove oil or grease that has not penetrated the asphalt pavement by scraping or by scrubbing with a detergent, then wash thoroughly with clean water. After cleaning, treat these areas with the oil spot primer.
- To insure adhesion to sound but oxidized pavements, mix and apply a prime coat of a type and at a rate recommended by the coal tar emulsion manufacturer, after all loose aggregate is removed.

631-4.4 Preparation Of New Asphalt Pavement Surfaces. New asphalt pavements indicated to be seal coated shall be prepared as follows:

- Cure new asphalt pavement surfaces so that there is no concentration of oils on the surface.
- A period of at least 60 days at +70°F daytime temperatures must elapse between the placement of a hot mixed asphalt concrete surface course and the application of the seal coat.
- Perform a water-break-free test to confirm that the surface oils have degraded and dissipated. (Cast one gallon of clean water out over the surface. The water should sheet out and wet the surface uniformly without crawling or showing oil rings.) If asphalt does not pass this test, additional time must be allowed for extra curing and retesting prior to sealing.
- Where oil spot priming is needed, remove oil or grease that has not penetrated the asphalt pavement by scraping or by scrubbing with a detergent, then wash thoroughly with clean water. After cleaning, treat these areas with the oil spot primer.
- To ensure adhesion to sound but oxidized pavements, mix and apply a prime coat of a type and at a rate recommended by the coal tar emulsion manufacturer, after all loose aggregate is removed.

631-4.5 MIXING. Blend the coal tar emulsion mixture in the equipment described in paragraph 631-4.2 using the ingredients described in Table 2. The mixing must produce a smooth homogeneous mixture of uniform consistency. (Consult coal tar emulsion supplier for its recommended order of addition of the ingredients.) During the entire mixing and application process, no breaking, segregating or hardening of the emulsion, nor balling or lumping of the sand is to be permitted. Continue to agitate the seal coating mixture in the mixing tank at all times prior to and during application so that a consistent mix is available for application.

Small additional increments of water may be needed to provide a workable consistency, but in no case is the water content to exceed the specified amount.

631-4.6 Application of Slurry Seal Coat. The aggregate filled slurry seal coat shall be applied at a uniform rate determined in paragraph 631-3.4.

In order to provide maximum adhesion, the pavement shall be dampened with a fog spray of water if recommended by the supplier. No standing water shall remain on the surface.

If a prime coat is required, mix and apply the prime coat as specified in paragraph 631-4.3 for existing pavements or paragraph 631-4.4 for new pavements.

Apply the first coat uniformly to obtain the rate determined in paragraph 631-3.4.

Each coat shall be allowed to dry and cure initially before applying any subsequent coats. The initial drying shall allow evaporation of water of the applied mixture, resulting in the coating being able to sustain light foot traffic. The initial curing shall enable the mixture to withstand vehicle traffic without damage to the seal coat.

Apply the second coat in the same manner as outlined for the first coat.

Additional coats shall be applied over the entire surface as directed by the engineer.

The finished surface shall present a uniform texture.

The final coat shall be allowed to dry a minimum of eight hours in dry daylight conditions before opening to traffic, and initially cure enough to support vehicular traffic without damage to the seal coat.

Where marginal weather conditions exist during the eight hour drying time, additional drying time shall be required. The length of time shall be as specified by the supplier. The surface shall be checked after the additional drying time for trafficability before opening the section to vehicle traffic.

Where striping is required, the striping paint utilized shall meet the requirements of P-620, shall be compatible with the seal coat and as recommended by the coal tar emulsion manufacturer.

QUALITY CONTROL

631-5.1 CONTRACTOR'S CERTIFICATION. The Contractor shall furnish the manufacturer's certification that each consignment of emulsion shipped to the project meets the requirements of Federal specification R-P-355, except that the water content shall not exceed 50 percent. The certification shall also indicate the solids and ash content of the emulsion and the date the tests were conducted. The certification shall be delivered to the Engineer prior to the beginning of work. The manufacturer's certification for the emulsion shall not be interpreted as a basis for final acceptance. Any certification received shall be subject to verification by testing samples received for project use.

The Contractor shall also furnish a certification demonstrating a minimum of three years experience in the application of coal-tar emulsion seal coats.

631-5.2 INSPECTION. The Owner shall have an independent technical consultant on the job site at the beginning of operations for application of coal-tar emulsion seal coats. The consultant shall have knowledge of the materials, procedures, and equipment described in this specification and shall assist the Contractor regarding proper mixing of the component materials and application of the seal coat. The consultant shall have a minimum of 3 years experience in the use of coal-tar seal coats. Documentation of this experience shall be furnished to the Engineer prior to the start of operations. The cost of the technical consultant shall be paid for by the Owner.

631-5.3 SAMPLING. A minimum of one sample per day shall be tested for the properties of Table 2. A random sample of approximately one-quarter of the composite mix will be obtained daily by the contractor and stored in a glass container. The containers shall be sealed against contamination and retained in storage by the Owner for a period of six months. Samples shall be stored at room temperature and not be subjected to freezing temperatures.

A sample of undiluted coal-tar emulsion shall be obtained from each consignment shipped to the job.

631-5.4 ENGINEER'S RECORDS. The Engineer will keep an accurate record of each batch of materials used in the formulation of the seal coat.

METHOD OF MEASUREMENT

631-6.1 The refined coal tar emulsion with additives shall be measured by the [gallon (liter)] [ton (kg)]. Only the actual quantity of undiluted refined coal tar emulsion with additives will be measured for payment.

631-6.2 Aggregate shall be measured by the ton (kg) of dry aggregate.

BASIS OF PAYMENT

631-7.1 Payment shall be made at the contract unit price per [gallon (liter)] (ton (kg)) for the refined coal tar emulsion with additives and at the contract price per ton (kg) for aggregate.

These prices shall be full compensation for furnishing all materials, preparing, mixing, and applying these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under:

Item P-631-7.1 Refined Coal Tar Emulsion with Additives for Slurry Coat—per [gallon (liter)]
[ton (kg)]

Item P-631-7.2 Aggregate—per ton (kg) of dry aggregate.

TESTING REQUIREMENTS

ASTM C 67 Sampling and Testing Brick and Structural Clay Tile

ASTM C 136 Sieve or Screen Analysis of Fine and Coarse Aggregates

ASTM D 160 Practice of Sampling Bituminous Materials

ASTM D 2939 Standard Test Methods for Emulsified Bitumens used as Protective Coatings.

MATERIAL REQUIREMENTS

ASTM D 490 Standard Specification for Road Tar

ASTM D 692 Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures

ASTM C 3699 Kerosene

ASTM D 4866 Standard Performance Specification for Coal Tar Pitch Emulsion Pavement
Sealer Mix Formations Containing Mineral Aggregates and Optional Polymeric
Admixtures

FED SPEC R-P-355 Pitch, Coal-tar Emulsion (Coating for Bituminous Pavements) ASTM D 5727
Emulsified Refined Coal Tar (Mineral Colloid Type)

APPENDIX A

FUEL RESISTANCE TEST

ITEM P-631

FUEL RESISTANCE TEST ITEM P-631 TEST METHODS CRITERION

1. Scope

This method determines the resistance of the coal tar emulsion seal coat to kerosene.

2. Apparatus

- 2.1 2 6" X 6" square 16 gauge sheet metal masks with a 4" x 4" square center removed.
- 2.2 6" X 6" unglazed white ceramic tile with an absorption rate of 10-18 percent (determined in accordance with ASTM C 67).
- 2.3 Brass ring, 2" diameter and 2" high.
- 2.4 Kerosene meeting requirements of ASTM D 3699.
- 2.5 Silicone rubber sealant.

3. Procedure

- 3.1 Immerse the ceramic tile in distilled water for a minimum of ten minutes.
- 3.2 Remove excess water from the tile to produce a damp surface before applying the seal coat.
- 3.3 Using the mask described in 2.1 apply one layer of the coal tar emulsion mixture to the tile. Spread even with the top of the mask using a spatula or other straight edge.
- 3.4 Allow the sample to cure for 96 hours at 77 ± 2 degrees F. and 50 ± 10 percent relative humidity.
- 3.5 Position a second mask on top of the first mask.
- 3.6 Apply a second coat of coal tar emulsion mixture. Spread even with the top of the second mask.
- 3.7 Cure as in step 3.4.
- 3.8 After curing, affix the brass ring to the seal coat on the tile with silicone rubber sealant.
- 3.9 Fill the brass ring with kerosene.
- 3.10 After 24 hours, remove the kerosene from the brass ring, blot dry and immediately examine the film for softness and loss of adhesion. Immediately after the film is examined, break the tile in half, exposing that part of the tile whose film was subjected to the kerosene.
- 3.11 Evaluate for penetration of kerosene through the sealer and loss of adhesion.

4. Report

- 4.1 Report the results as pass or fail. Visible evidence of leakage or discoloration shall constitute failure of the fuel resistance test.

Criterion: A "pass" rating in the fuel resistance test is required prior to full production.

END OF ITEM P-631
