
USACE / NAVFAC / AFCEA / NASA UFGS-32 01 17.16 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-02975 (August 2004)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 19 March 2007

SECTION TABLE OF CONTENTS

DIVISION 32 - EXTERIOR IMPROVEMENTS

SECTION 32 01 17.16

SEALING OF CRACKS IN BITUMINOUS PAVEMENTS

04/06

PART 1 GENERAL

- 1.1 REFERENCES
- 1.2 UNIT PRICES
 - 1.2.1 Measurement
 - 1.2.2 Payment
- 1.3 SYSTEM DESCRIPTION
- 1.4 SUBMITTALS
- 1.5 TEST REQUIREMENTS
- 1.6 EQUIPMENT
 - 1.6.1 Crack Cleaning Equipment
 - 1.6.1.1 Routing Equipment
 - 1.6.1.2 Concrete Saw
 - 1.6.1.3 Sandblasting Equipment
 - 1.6.1.4 Waterblasting Equipment
 - 1.6.1.5 Hand Tools
 - 1.6.2 Crack Sealing Equipment
- 1.7 DELIVERY AND STORAGE
- 1.8 ENVIRONMENTAL CONDITIONS

PART 2 PRODUCTS

- 2.1 SEALANTS
- 2.2 BACKUP MATERIALS

PART 3 EXECUTION

- 3.1 PREPARATION OF CRACKS
 - 3.1.1 Cracks
 - 3.1.1.1 Hairline Cracks
 - 3.1.1.2 Small Cracks
 - 3.1.1.3 Medium Cracks
 - 3.1.1.4 Large Cracks
 - 3.1.2 Existing Sealant Removal
 - 3.1.3 Routing
 - 3.1.4 Sawing

- 3.1.5 Sandblasting
- 3.1.6 Backup Material
- 3.1.7 Rate of Progress of Crack Preparation
- 3.2 PREPARATION OF SEALANT
- 3.3 INSTALLATION OF SEALANT
 - 3.3.1 Time of Application
 - 3.3.2 Sealing the Crack
- 3.4 CRACK SEALANT INSTALLATION TEST SECTION
- 3.5 CLEANUP
- 3.6 QUALITY CONTROL PROVISIONS
 - 3.6.1 Crack Cleaning
 - 3.6.2 Crack Seal Application Equipment
 - 3.6.3 Crack Sealant

-- End of Section Table of Contents --

USACE / NAVFAC / AFCEA / NASA UFGS-32 01 17.16 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-02975 (August 2004)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 19 March 2007

SECTION 32 01 17.16

SEALING OF CRACKS IN BITUMINOUS PAVEMENTS 04/06

NOTE: This guide specification covers the requirements for sealing cracks in bituminous pavements.

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 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).

PART 1 GENERAL

NOTE: For additional information concerning bituminous pavements, see UFC 3-250-03, "Bituminous Pavements Standard Practice."

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 509	(2006) Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM D 6690	(2006a) Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements
ASTM D 789	(2006a) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)

1.2 UNIT PRICES

NOTE: Paragraphs Measurement and Payment will be deleted for lump sum bidding.

1.2.1 Measurement

The quantity of each sealing item to be paid for shall be determined by actual measurement of the number of linear meters feet of in-place material that has been approved.

1.2.2 Payment

Payment shall be made at the contract unit bid prices per linear meter foot for the sealing items scheduled. The unit bid prices shall include the cost of all labor, materials, and the use of all equipment and tools required to complete the work.

1.3 SYSTEM DESCRIPTION

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

1.4 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. 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 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Installation of Sealant

Manufacturer's instructions [_____] days prior to the use of the material on the project. Installation of the material will not be allowed until the instructions are received.

SD-04 Samples

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

Samples of the materials [60] [_____] days prior to their use on the project. No material will be allowed to be used until it has been approved.

SD-06 Test Reports

Test Requirements

Reports of all tests. [Testing of the materials shall be performed in an approval independent laboratory and certified copies of the test reports shall be submitted and approved [_____] days prior to the use of the materials at the job site. Samples will be retained by the Government for possible future testing should the materials appear defective during or after application.]

1.5 TEST REQUIREMENTS

The crack sealant and backup material, when required, shall be tested for conformance with the referenced applicable material specification. [The materials will be tested by the Government. The cost of the first test of samples will be borne by the Government. If the samples fail to meet specification requirements, the Contractor shall replace the materials represented by the sample and the new materials shall be tested at the Contractor's expense.] Samples of materials shall be furnished, in sufficient quantity to be tested, upon request. Conformance with the requirements of the laboratory tests specified will not constitute final acceptance of the materials. Final acceptance will be based on the performance of the in-place materials.

1.6 EQUIPMENT

Machines, tools, and equipment used in the performance of the work required by this section shall be approved before the work is started and shall be maintained in satisfactory condition at all times.

1.6.1 Crack Cleaning Equipment

1.6.1.1 Routing Equipment

NOTE: Rotary impact routers that are equipped with vertical sided, carbide tipped bits have been used successfully to rout cracks in bituminous pavements. Impact routers that are not equipped with carbide tipped bits normally chip and damage the surrounding pavement and should not be permitted.

The routing equipment shall be a self-powered machine operating a power driven tool or bit specifically designed for routing bituminous pavements. The bit shall rotate about a vertical axis at sufficient speed to cut a smooth vertical-walled reservoir in the pavement surface and shall maintain accurate cutting without damaging the sides or top edges of the reservoir. The router shall be capable of following the trace of the crack without deviation. [The use of rotary impact routing devices will not be permitted for cleaning cracks.] [The use of rotary impact routing devices may be permitted if vertical-sided carbide tipped bits are used.]

1.6.1.2 Concrete Saw

A self-propelled power saw with small diameter (152 mm 6 inches or less) water-cooled diamond or abrasive saw blades shall be provided for cutting cracks to the depths and widths specified and for removing filler that is embedded in the cracks or adhered to the crack faces. The diameter of the saw blade shall be small enough to allow the saw to closely follow the

trace of the crack.

1.6.1.3 Sandblasting Equipment

NOTE: Sandblasting of cracks may not be permitted under certain conditions. Blowing sand and dust may either violate atmospheric pollution statutes, or may drift into areas where it would be objectionable. When sandblasting is prohibited, cleaning the cracks with waterblasting equipment or wire brushes may be substituted. If wire brushes are used, attention should be given to ensure that worn brushes are not used. Waterblasting equipment varies considerably with respect to design of wand, nozzle, water pressure, and water volume depending on the manufacturer. Consequently, the effectiveness of a particular set of equipment cannot be predicted. The Contractor should demonstrate his equipment to show that it will clean the crack satisfactorily before being allowed to proceed.

Sandblasting equipment shall include an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. The maximum nozzle opening shall not exceed 6.4 mm 1/4 inch. The air compressor shall be portable; and shall be capable of furnishing not less than 0.071 cubic meters/second 150 cfm and maintaining a line pressure of not less than 621 kPa 90 psi at the nozzle while in use. Compressor capability under job conditions shall be demonstrated before approval. The compressor shall be equipped with traps that will maintain the compressed air free of oil and water. The nozzle shall have an adjustable guide that will hold the nozzle aligned with the crack about 25 mm 1 inch above the pavement surface. The height, angle of inclination and the size of the nozzle shall be adjusted as necessary to secure satisfactory results.

1.6.1.4 Waterblasting Equipment

Waterblasting equipment shall include a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. The water tank and auxiliary resupply equipment shall be of sufficient capacity to permit continuous operations. The hose, wand, and nozzle shall be capable of cleaning the crack faces and the pavement surface on both sides of the crack for a width of at least 13 mm 1/2 inch. A pressure gauge mounted at the pump shall show at all times the pressure in kPapsi at which the equipment is operating.

1.6.1.5 Hand Tools

NOTE: In areas that have cracks larger than 37 mm (1-1/2 inches), it may be necessary to employ other types of small tools to remove damaged asphalt or crack sealant material. Such tools should be carefully evaluated for potential damaging effects to adjacent pavement prior to approval for use. For repairing bituminous pavements, the Designer is referred to Technical Manual 5-624.

Hand tools may be used, when approved, for removing defective sealant from cracks and repairing or cleaning the crack faces.

1.6.2 Crack Sealing Equipment

The unit applicators used for heating and installing the hot-poured crack sealant materials shall be mobile and shall be equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the crack to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording type thermometer for indicating the temperature of the sealant. The applicator unit design shall allow the sealant to circulate through the delivery hose and return to the inner kettle when not in use.

1.7 DELIVERY AND STORAGE

Materials delivered to the job site shall be inspected for defects, unloaded, and stored with a minimum of handling to avoid damage. Storage facilities shall be provided at the job site to protect materials from weather and to maintain them at the temperatures recommended by the manufacturer.

1.8 ENVIRONMENTAL CONDITIONS

The ambient air temperature and the pavement temperature within the joint wall shall be a minimum of 10 degrees C 50 degrees F and rising at the time of application of the materials. Sealant shall not be applied if moisture is observed in the crack.

PART 2 PRODUCTS

2.1 SEALANTS

NOTE: Select crack sealants based on the proposed use and local experience. ASTM D 3405 sealants are normally higher quality and more expensive than ASTM D 1190 materials. When the area will experience pedestrian traffic, ASTM D 3405 sealant should be specified because it has a higher modulus of elasticity and therefore should not adhere to pedestrians' shoes.

If the bituminous pavement is covered by a fuel-resistant pavement sealer, the cracks should be sealed using the above mentioned sealants and then covered by a fuel-resistant pavement sealer. Fuel-resistant crack sealants should not be used in asphalt pavements for compatibility reasons.

Sealants shall conform to ASTM D 6690, Type II or ASTM D 6690, Type I. Usage of sealing materials for sealing cracks in the various paved areas indicated on the drawings shall be as follows:

Area	Sealing Material
[]	[ASTM D 6690, Type II]
[]	[ASTM D 6690, Type I]

2.2 BACKUP MATERIALS

NOTE: The use of backup materials in bituminous pavements is to maintain a sealant reservoir depth of approximately 20 mm (3/4 inch). Backup material is not required in cracks with a sealant reservoir depth of less than 20 mm (3/4 inch).

Backup material shall be a compressible, nonshrinking, nonstaining, nonabsorptive material and shall be nonreactive with the crack sealant. The melting point of the backing material shall be at least 2 degrees C 5 degrees F greater than the maximum pouring temperature of the sealant being used, when tested in accordance with ASTM D 789. The material shall have a water absorption of not more than 5 percent by weight when tested in accordance with ASTM C 509. The backup material shall be 25 percent (plus or minus 5 percent) larger in diameter than the nominal width of the crack.

PART 3 EXECUTION

3.1 PREPARATION OF CRACKS

NOTE: In bituminous pavements that have large quantities of hairline cracks or cracks less than 6 mm (1/4 inch), a bituminous fog coat or a bituminous seal coat should be used to prevent water intrusion into the base material. The Designer is referred to Technical Manual 5-624, Section 32 12 11 BITUMINOUS SURFACE TREATMENT and Section 32 01 13 BITUMINOUS SEAL AND FOG COAT. If the pavement being sealed is to receive a hot asphalt concrete overlay, then small cracks should not be sealed. Medium and large cracks can be filled or sealed. Prior to the overlay, the cracks can be filled using a slurry mixture of sand and emulsion. It should be noted that this is a crack filler not a crack sealant; therefore, it should only be used when the pavement will receive an overlay. The cracks should be filled or sealed to a depth of 6 mm (1/4 inch) below the pavement surface to prevent "bleeding" of the material through the overlay. If the cracks are overfilled, the sealant material will be tracked onto the pavement.

Immediately before the installation of the crack sealant, the cracks shall be thoroughly cleaned to remove oxidized pavement, loose aggregate and foreign debris. The preparation shall be as follows:

3.1.1 Cracks

3.1.1.1 Hairline Cracks

Cracks that are less than 6 mm 1/4 inch wide [do not need to be sealed] [shall be sealed in accordance with Section [____]].

3.1.1.2 Small Cracks

Cracks that are 6 to 20 mm 1/4 to 3/4 inch wide shall be routed to a nominal width 3 mm 1/8 inch greater than the existing nominal width and to a depth not less than 20 mm 3/4 inch, [sandblasted] [waterblasted] [wire brushed] and cleaned using compressed air.

3.1.1.3 Medium Cracks

Cracks that are 20 to 50 mm 3/4 to 2 inches wide shall be [sandblasted] [waterblasted] [wire brushed] and cleaned using compressed air.

3.1.1.4 Large Cracks

Cracks that are greater than 50 mm 2 inches wide shall be repaired using pothole repair techniques instead of sealing.

3.1.2 Existing Sealant Removal

**NOTE: This paragraph shall be deleted and
subsequent paragraphs renumbered if the cracks have
never been sealed in the past.**

The in-place sealant shall be cut loose from both crack faces and to a depth shown on the drawings, using a concrete saw or hand tools as specified in paragraph EQUIPMENT. Depth shall be sufficient to accommodate any backup material that is required to maintain the depth of new sealant to be installed. Prior to further cleaning operations, all old loose sealant remaining in the crack opening shall be removed by blowing with compressed air.

3.1.3 Routing

Routing of the cracks shall be accomplished using a rotary router with a bit that is at least 3 mm 1/8 inch wider than the nominal width of the crack to remove all residual old sealant (resealing), oxidized pavement and any loose aggregate in the crack wall.

3.1.4 Sawing

Sawing of the cracks shall be accomplished using a power-driving concrete saw as specified in paragraph EQUIPMENT. The blade shall be stiffened as necessary with suitable dummy (or used) blades or washers. Immediately following the sawing operation, the crack opening shall be cleaned using a water jet to remove all saw cuttings and debris.

3.1.5 Sandblasting

NOTE: When waterblasting is required instead of

sandblasting, replace the word "sandblasting" with
"waterblasting."

The crack faces and the pavement surfaces extending a minimum of 13 mm 1/2 inch from the crack edges shall be sandblasted clean. A multiple-pass technique shall be used until the surfaces are free of dust, dirt, old sealant residue, or foreign debris that might prevent the sealant material from bonding to the asphalt pavement. After final cleaning and immediately prior to sealing, the cracks shall be blown out with compressed air and left completely free of debris and water. The Contractor shall ensure that sandblasting does not damage the pavement.

3.1.6 Backup Material

Backup material shall be used on all cracks that have a depth greater than 19 mm 3/4 inch. The backup material shall be inserted into the lower portion of the crack as shown on the drawings. The Contractor shall ensure that the backup material is placed at the specified depth and is not stretched or twisted during installation.

3.1.7 Rate of Progress of Crack Preparation

The stages of crack preparation which include routing, sandblasting of the crack faces, air pressure cleaning and placing of the backup material shall be limited to only that linear footage that can be sealed during the same day.

3.2 PREPARATION OF SEALANT

Hot-poured sealants shall not be heated in excess of the safe heating temperature recommended by the manufacturer as shown on the sealant containers. Sealant that has been overheated or subjected to application temperatures for over 4 hours or that has remained in the applicator at the end of the day's operation shall be withdrawn and wasted.

3.3 INSTALLATION OF SEALANT

3.3.1 Time of Application

Cracks shall be sealed immediately following final cleaning of the crack walls and following the placement of the backup material (when required). Cracks that cannot be sealed under the conditions specified, or when rain interrupts sealing operations, shall be recleaned and allowed to dry prior to installing the sealant.

3.3.2 Sealing the Crack

NOTE: Cracks should be slightly underfilled to preclude tracking the material onto the pavement surface. For airfield pavements, the sealant should be recessed 3 mm (1/8 inch) below the pavement surface; for roads, streets and parking lots, the sealant should be recessed 6 mm (1/4 inch). For pavements that are to receive an overlay, the sealant should be recessed a minimum of 6 mm (1/4 inch) and a maximum of 13 mm (1/2 inch) below the pavement surface.

Immediately preceding, but not more than 15 m 50 feet ahead of the crack sealing operations, a final cleaning with compressed air shall be performed. The cracks shall be filled from the bottom up to [3] [6] mm [1/8] [1/4] inch below the pavement surface. Excess or spilled sealant shall be removed from the pavement by approved methods and shall be discarded. The sealant shall be installed in a manner which prevents the formation of voids and entrapped air. Several passes with the applicator wand may be necessary to obtain the specified sealant depth from the pavement surface. Gravity methods or pouring pots shall not be used to install the sealant material. Traffic shall not be permitted over newly sealed pavement until authorized by the Contracting Officer. Cracks shall be checked frequently to ensure that the newly installed sealant is cured to a tack-free condition within 3 hours.

3.4 CRACK SEALANT INSTALLATION TEST SECTION

Prior to the cleaning and sealing of the cracks for the entire project, a test section at least 60 m 200 feet long shall be prepared using the specified materials and approved equipment, to demonstrate the proposed sealing of all cracks of the project. Following the completion of the test section and before any other crack is sealed, the test section will be inspected to determine that the materials and installation meet the requirements specified. If materials or installation do not meet requirements, the materials shall be removed and the cracks recleaned and resealed at no cost to the Government. When the test section meets the requirements, it may be incorporated into the permanent work and paid for at the contract unit price per linear foot for sealing items scheduled. All other cracks shall be sealed in the manner approved for sealing the test section.

3.5 CLEANUP

Upon completion of the project, unused materials shall be removed from the site and the pavement shall be left in a clean condition.

3.6 QUALITY CONTROL PROVISIONS

3.6.1 Crack Cleaning

Quality control provisions shall be provided during the crack cleaning process to correct improper equipment and cleaning techniques that damage the bituminous pavement in any manner. Cleaned cracks shall be approved prior to installation of the crack sealant.

3.6.2 Crack Seal Application Equipment

The application equipment shall be inspected to ensure conformance to temperature requirements and proper installation. Evidences of bubbling, improper installing, and failing to cure or set shall be cause to suspend operations until causes of the deficiencies are determined and corrected.

3.6.3 Crack Sealant

The crack sealant shall be inspected for proper cure and set rating, bonding to the bituminous pavement, cohesive separation within the sealant, reversion to liquid, and entrapped air and voids. Sealants exhibiting any of these deficiencies at any time prior to the final acceptance of the

project shall be removed from the crack, wasted, and replaced as specified herein at no additional cost to the Government.

-- End of Section --