
USACE / NAVFAC / AFCEA / NASA UFGS-32 13 73 (April 2006)

Preparing Activity: USACE Replacing without change
UFGS-02762 (July 2004)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated 1 April 2006

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04/06

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SECTION 32 13 73

COMPRESSION JOINT SEALS FOR CONCRETE PAVEMENTS 04/06

NOTE: This guide specification covers the requirements for polychloroprene compression seals used for sealing joints of rigid pavements for airfields, roads, streets, hardstands, and other 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

NOTE: For U.S. Air Force pavements, the engineer will specify the uncompressed width of the seals to be used, and the width of the saw cut reservoir including tolerances. The minimum sawed joint seal reservoir width will be 13 mm (1/2 inch). The specified uncompressed seal width will be twice the specified nominal saw cut reservoir width, i.e., for a 13 mm (1/2 inch) wide joint seal reservoir saw cut, a 25 mm (1 inch) uncompressed width joint seal should be specified.

Total joint opening and movement must be considered when specifying the size of the joint and seal. The engineer should carefully consider all factors affecting the proper sizing of the joint seal to

assure the seal remains within the allowable compression range and that the working range of the proposed seal is always greater than the total movement of the joints. The computational procedures in TM 5-822-11/AFP 88-6, Chapter 7, Appendix C, should be followed. Factors to be considered are saw cut reservoir width including tolerances, maximum pavement thermal expansion and contraction, pavement shrinkage during curing and pavement temperature limitations during joint seal reservoir sawing.

Compression joint seal size, general shape and dimensional tolerances, especially uncompressed seal width, must be shown on the drawings or specified in this section. Manufacturer's literature is helpful in determining the seal size with the anticipated joint movement.

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 D 2628	(1991; R 2005) Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements
ASTM D 2835	(1989; R 2003) Lubricant for Installation of Preformed Compression Seals in Concrete Pavements

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 548

(1988) Standard Specification for Jet-Fuel
and Heat Resistant Preformed
Polychloroprene Elastomeric Joint Seals
for Rigid Pavements

1.2 SAFETY

NOTE: Delete this paragraph if liquid oxygen (LOX) equipment, storage, or piping is not within the project area and renumber subsequent paragraphs. If LOX equipment, storage, or piping is within the project area, the designer will use continuously reinforced concrete slabs in the 7.6 meter (25 feet) clear area of LOX to reduce the number of joints. If joints cannot be eliminated within the clear area, then the joints in the area should be thoroughly cleaned and sealed with a LOX compatible sealant that has been approved by Headquarters, U.S. Army Corps of Engineers (CEMP-ET) or the appropriate Air Force Major Command. The Major Command or CEMP-ET should be contacted to obtain a list of approved materials.

A MIXTURE OF LOX AND ANY ORGANIC MATERIAL IS
EXTREMELY FLAMMABLE, AND MAY SELF-IGNITE OR EXPLODE.

Compression joint seals shall not be placed within 7.5 meters 25 feet of liquid oxygen (LOX) equipment, LOX storage, or LOX piping.

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. 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

Equipment

List of proposed equipment to be used in the performance of construction work, including descriptive data, [_____] days prior to use on the project.

Manufacturer's Instructions

Where installation procedures are required in accordance with the manufacturer's recommendations, printed copies of manufacturers' instructions, [_____] days prior to use on the project.

SD-04, Samples

Compression Seals[; G][; G, [_____]]

Regardless of testing responsibility, 2.7 meter 9 foot long samples of the materials, [60] [_____] days prior to use on the project. Printed directions from the manufacturer on recommended installation criteria shall be furnished with the samples plus the manufacturer's certification that the selected seal is recommended for the installation on this project.

SD-06 Test Reports

Test Requirements

Certified copies of test results, [_____] days prior to use of material on the project.

1.4 TEST REQUIREMENTS

Each lot of compression joint seal and lubricant/adhesive shall be sampled, identified, and tested for conformance with the applicable material specification. A lot of compression seal shall consist of 1 day's production or 6,000 meters 20,000 linear feet for each cross section, whichever is less. A lot of lubricant/adhesive shall consist of 1 day's production. [Samples of the compression joint seal and lubricant/adhesive material shall be submitted and will be tested by the Government. No

material shall be used at the project prior to receipt of written notice that the materials meet the laboratory requirements. The cost of testing the samples from each original lot supplied will be borne by the Government. If the samples fail to meet specification requirements, the materials represented by the sample shall be replaced and the new materials tested. A cost of [_____] for Government testing of each lot of replacement material will be charged to the Contractor] [Testing of the compression joint seal and lubricant/adhesive material shall be the responsibility of the Contractor and shall be performed in an approved independent laboratory, and certified copies of the test reports shall be submitted for approval [_____] days prior to the use of the materials at the jobsite. Samples of each lot of material shall also be submitted and will be retained by the Government for possible future testing should the materials appear defective during or after application]. The Contractor shall furnish additional samples of materials, in sufficient quantity to be tested, upon request. Final acceptance will be based on conformance to the specified test requirements and the performance of the in-place materials.

1.5 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.

1.5.1 Joint Cleaning Equipment

1.5.1.1 Concrete Saw

A self-propelled power saw with water-cooled diamond saw blades shall be provided for cutting joints to the depths and widths specified and for removing filler, existing old joint seal, or other material embedded in the joints or adhered to the joint faces.

1.5.1.2 Sandblasting Equipment

NOTE: Sandblasting equipment with a 6 mm (1/4 inch) nozzle requires at least 3880 liters (137 cubic feet) per minute of air to function efficiently. A larger nozzle would not serve any useful purpose in cleaning a joint.

Sandblasting equipment shall include an air compressor, hose, and a long-wearing venturi-type nozzle of proper size, shape, and opening. The maximum nozzle opening should not exceed 6 mm 1/4 inch. The air compressor shall be portable and shall be capable of furnishing not less than 4200 liters 150 cubic feet per minute and maintaining a line pressure of not less than 620 kPa 90 psi at the nozzle while in use. 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 joint about 25 mm 1 inch above the pavement surface and will direct the blast to clean the joint walls. The height, angle of inclination, and the size of the nozzle shall be adjusted as necessary to ensure satisfactory results.

1.5.1.3 Waterblasting Equipment

Waterblasting equipment shall include a trailer-mounted water tank, pumps,

high-pressure hose, a wand with safety release cutoff controls, nozzle, and auxiliary water resupply equipment. The water tank and auxiliary water resupply equipment shall be of sufficient capacity to permit continuous operations. The pumps, hoses, wand, and nozzle shall be of sufficient capacity to permit the cleaning of both walls of the joint and the pavement surface for a width of at least 13 mm 1/2 inch on either side of the joint.

A pressure gauge mounted at the pump shall show at all times the pressure in kPa psi at which the equipment is operating.

1.5.2 Sealing Equipment

NOTE: Single-axle type seal application equipment should not be permitted; this tool tends to cause excessive stretching and may cut or distort the seal. The following subparagraph may be added only for road, parking lot, and street pavements less than 1800 square meters (2,000 square yards), and for airfield and tracked pavements less than 450 square meters (500 square yards) in area:

"The hand operated joint seal application equipment shall be a two-axle, four-wheel machine that shall include means for compressing and inserting the compression seal into the joint and a reel capable of holding one full spool of compression seal. Auxiliary equipment shall be provided to coat both sides of the joint or the seal with lubricant/adhesive just prior to the installation of the compression seal."

Equipment used to install the compression seal shall place the compression seal to the prescribed depths within the specified tolerances without cutting, nicking, twisting, or otherwise damaging the seal. The equipment shall be capable of placing the seal with not more than two percent longitudinal stretch or compression of the seal during installation. The machine shall be an automatic self-propelled joint seal application equipment and engine powered. The machine shall include a reservoir for the lubricant/adhesive, a device for conveying the lubricant/adhesive in the proper quantities to the sides of the compression seal or the sidewalls of the joints, a reel capable of holding one full spool of compression seal, and a power-driven apparatus for feeding the joint seal through a compression device and inserting the seal into the joint. The equipment shall also include a guide to maintain the proper course along the joint being sealed. The machine shall at all times be operated by an experienced operator.

1.6 TRIAL JOINT SEAL AND LUBRICANT/ADHESIVE INSTALLATION

Prior to the cleaning and sealing of the joints for the entire project, a test section at least 69 meters 200 feet long shall be prepared at a designated location in the project pavement, using the specified materials and the approved equipment to demonstrate the proposed joint preparation and sealing of all types of joints in the project. Following the completion of the trial length and before any other joint is sealed, the trial joints will be inspected by the Government 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 joints shall be recleaned and resealed at no cost to the Government. No other joints shall be sealed until the test installation has been approved. If the trial section is approved, it may be incorporated into the permanent work. Other joints shall be sealed in the manner approved for sealing the trial joint.

1.7 DELIVERY AND STORAGE

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

1.8 ENVIRONMENTAL CONDITIONS

The ambient temperature and the pavement temperature within the joint wall shall be at least 2 degrees C 35 degrees F and rising at the time of installation of the materials. Sealant installation will not be allowed if moisture or foreign material is observed in the joint.

1.9 MEASUREMENT

NOTE: Paragraphs MEASUREMENT and PAYMENT will be
deleted for lump sum bidding.

The quantity of each sealing item to be paid for will be determined by measuring the length of in-place material that has been approved.

1.10 PAYMENT

Payment will be made at the contract unit bid prices per unit length for the sealing items scheduled, including approved trail joint installation. The unit bid prices shall include the cost of all labor, materials, the use of all equipment, and tools required to complete the work.

PART 2 PRODUCTS

2.1 COMPRESSION SEALS

NOTE: Select the applicable statement for testing
and determining specification compliance and delete
the inapplicable statement. The first statement
will be selected for all projects except where the
project is less than 1200 meters (4,000 linear feet)
of compression joint seal material. When the
project requires less than this amount of seal
material, the first statement can be deleted and the
second statement used. The cost of testing can be
obtained from U.S. Army Engineer Waterways
Experiment Station.

The actual width of the joint seal should be at the option of the Contractor. However, for guidance on unusual circumstances, or for resealing joints in existing pavement that have to be sawed out to an extra width, see TM 5-822-11/AFP 88-6, Chapter 7,

**"Standard Practice for Sealing Joints and Cracks in
Rigid and Flexible Pavements."**

Compression joint seal materials shall be a vulcanized elastomeric compound using polychloroprene as the only base polymer. The material and manufactured seal shall conform to [ASTM D 2628] [ASTM D 2628 and COE CRD-C 548 where jet fuel and/or heat blast resistance is required]. The joint seal shall be a labyrinth type seal. The uncompressed depth of the face of the compression seal (that is to be bonded to the joint wall) shall be greater than the uncompressed width of the seal, except that for seals 25 mm 1 inch or greater in width, the depth need be only 25 mm 1 inch or greater. The actual width of the uncompressed seal for construction and contraction joints shall be [21 or 25] [] mm [0.75 or 1] [] inches and for expansion joints shall be [32] [] mm 1.25 [] inches. The tolerance on the seal shall be plus 3 mm or minus 1.5 mm plus 1/8 inch or minus 1/16 inch.

2.2 LUBRICANT/ADHESIVE

Lubricant/adhesive used for the compression elastomeric joint seal shall be a one-component compound conforming to ASTM D 2835.

PART 3 EXECUTION

NOTE: Joint openings of uniform cross section are essential to satisfactory installation of the compression joint seal. Openings must be sawed to provide smooth vertical faces of consistent width, within specified tolerances. Nonuniformity in width or roughness will cause variations in resistance of the joint seal to insertion and will result in irregular depth of insertion, stretching, and a tendency of the joint seal to twist so that the top of the seal is not at the surface.

The proper preparation of joints with respect to the size of joint opening, required cleanliness of vertical and parallel joint faces, and uniform contact between the seal and the joint face can not be overemphasized. The neglect of any facet of these operations can result and has resulted in poor performance of joint seals. For the repair of concrete pavements adjacent to the joints, refer to TM 5-822-9/AFM 88-6, Chapter 10, and Section 32 01 28 PATCHING OF RIGID PAVEMENTS.

3.1 PREPARATION OF JOINTS

Immediately before installation of the compression joint seal, the joints shall be thoroughly cleaned to remove laitance, filler, existing sealer, foreign material and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed. Cleaning shall be by sandblasting or waterblasting and shall extend along pavement surfaces at least 13 mm 1/2 inch on either side of the joint. After final cleaning and immediately prior to sealing, the joints shall be blown out with compressed air and left completely free of debris and water. The Contractor shall

demonstrate that the selected cleaning operation meets the cleanliness requirements. Any irregularity in the joint face which would prevent uniform contact between the joint seal and the joint face shall be corrected prior to the installation of the joint seal.

3.1.1.1 Sawing

NOTE: Requirements are based on giving the Contractor the option of using either nominal 21 mm (13/16 inch) or 25 mm (1 inch) wide compression seal. The designer will select the required values from columns (3) and (4) of the following tables, based on the geographical area and the nominal sealant width to be used for this project.

The first table is metricated, followed by a similar tabulation in I-P units.

Area	(1) Expected Pavement Temperature Range in Service Degrees C	(2) Nominal Uncompressed Sealant Width Millimeters	(3) Nominal Saw Cut Millimeters	(4) Allowable Pavement Temperature Range for Sawing Degrees C
Southwest Desert Area	-10 to +71	20.6 25.4	12.7 14.3	10 to 46 12 to 82
Southern U.S.	-18 to +57	20.6 25.4	12.7 14.3	-1 to +44 -1 to +77
Other Contiguous U.S.	-35 to +57	20.6	14.3	-4 to +60
Alaska and Similar Areas	-57 to +44	20.6* 25.4	11.1 12.7	10 to +42* 15 to +71

* Note in the project specifications that this seal shall not be installed in a saw cut less than 11 mm and thus cannot be used in this area if sawing must be done at temperatures less than +10 degrees C.

Area	(1) Expected Pavement Temperature Range in Service Degrees F	(2) Nominal Uncompressed Sealant Width Inches	(3) Nominal Saw Cut Inches	(4) Allowable Pavement Temperature Range for Sawing Degrees F
Southwest Desert Area	+10 to +160	13/16 1	8/16 9/16	+50 to +115 +55 to +180
Southern U.S.	0 to +135	13/16	8/16	+30 to +110

Area	(1) Expected Pavement Temperature Range in Service Degrees F	(2) Nominal Uncompressed Sealant Width Inches	(3) Nominal Saw Cut Inches	(4) Allowable Pavement Temperature Range for Sawing Degrees F
		1	9/16	+30 to +170
Other	-30 to +135	13/16	8/16	+25 to +80
Contiguous U.S.		1	9/16	+25 to +140
Alaska and	-70 to +110	13/16*	7/16	+50* to +105
Similar Areas		1	8/16	+60 to +160

* Note in the project specifications that this seal shall not be installed in a saw cut less than 7/16 inches and thus cannot be used in this area if sawing must be done at temperatures less than +50 degrees F.

The above tables are based on the following:

- a. Tolerance from nominal specified width of uncompressed seal plus 3.2 mm (1/8 inch) and minus 1.6 mm (1/16 inch).
- b. Tolerance from nominal saw cut width plus or minus 1.6 mm (1/16 inch).
- c. Compression seal must be compressed at least 20 percent of its uncompressed width at all times.
- d. Compression seal must never be compressed more than 60 percent of its uncompressed width at any time (narrowest opening in hot weather must be at least 40 percent of uncompressed seal width).

For unusual conditions and for resealing joints in existing pavements where the prepared joint is extra wide, the designer will have to compute values to insert in the blanks using the procedures given in TM 5-822-11/AFP 88-6, Chapter 7, and the parameters given above. (Before the compression seal is used for resealing joints in existing pavements, it is common practice to resaw the joints, which will give a wider cavity. Width of sawing should be held to the same tolerance as specified for new pavements).

Joints shall be cleaned and opened to the specified width and depth by sawing. Immediately following the sawing operation, the joint faces and opening shall be thoroughly cleaned using a water jet to remove saw cuttings or debris remaining on the faces or in the joint opening. Compression seal shall be installed within 3 calendar days of the time the joint cavity is sawed. Depth of the joint cavity shall be per manufacturer's instructions. The saw cut for the joint seal cavity shall

be centered over the joint line. The nominal width of the sawed joint seal cavity shall be as follows; the actual width shall be within a tolerance of plus or minus 1.5 mm 1/16 inch:

- a. If a nominal 20.6 mm 13/16 inch wide compression seal is furnished, the nominal width of the saw cut shall be [_____] mm inches when the pavement temperature at the time of sawing is between [_____] and [_____] degrees C F. If the pavement temperature at the time of sawing is above this range, the nominal width of the saw cut shall be decreased 1.5 mm 1/16 inch. If the pavement temperature at the time of sawing is below this range, the nominal width of the saw cut shall be increased 1.5 mm 1/16 inch.
- b. If a nominal 25.4 mm 1 inch wide compression seal is furnished, the nominal width of the saw cut shall be [_____] mm inches when the pavement temperature at the time of sawing is between [_____] and [_____] degrees C F. If the pavement temperature at the time of sawing is above this range, the nominal width of the saw cut shall be decreased 1.5 mm 1/16 inch. If the pavement temperature at the time of sawing is below this range, the nominal width of the saw cut shall be increased 1.5 mm 1/16 inch.
- c. The pavement temperature shall be measured in the presence of the Contracting Officer. Measurement shall be made each day before commencing sawing and at any other time during the day when the temperature appears to be varying from the allowable sawing range.

3.1.2 Sandblast Cleaning

NOTE: Delete this paragraph and paragraph entitled
"Sandblasting Equipment" when sandblasting is
prohibited.

A multiple pass sandblasting technique shall be used until the surfaces are free of dust, dirt, curing compound, or any residue that might prevent ready insertion or uniform contact of the seal and bonding of the lubricant/adhesive to the concrete.

3.1.3 Waterblast Cleaning

NOTE: Waterblasting equipment varies considerably
with respect to design of wand, nozzle, water
pressure, and water volume depending upon the
manufacturer. Consequently, the effectiveness of a
particular set of equipment cannot be predicted.
The joints may be waterblasted the previous day and
cleaned with compressed air immediately prior to
sealing. The joints should be inspected to insure
no foreign debris remains in the joint before
sealing.

A multiple pass waterblast technique shall be used until the surfaces are free of dust, dirt, curing compound, or any residue that might prevent ready insertion or uniform contact of the seal and bonding of the

lubricant/adhesive to the concrete.

3.1.4 Rate of Progress

Sandblasting or waterblasting of joint faces shall be limited to the length of joint that can be sealed during the same workday.

3.2 INSTALLATION OF THE COMPRESSION SEAL

NOTE: Temperatures of the pavement and the atmosphere are not as critical for the installation of compression joint seals as they are for poured sealants. Therefore, lower temperatures are acceptable, and under some conditions sealing can proceed satisfactorily at temperatures lower than 2 degrees C (35 degrees F). However, joints should be dry to obtain maximum cementing of the lubricant/adhesive to the concrete and manufacturers should be contacted for special instructions under cold conditions.

3.2.1 Time of Installation

Joints shall be sealed immediately within 3 calendar days of sawing the joint seal cavity and following concrete cure and the final cleaning of the joint walls. Open joints ready for sealing that cannot be sealed under the specified conditions shall be provided with an approved temporary seal to prevent infiltration of foreign material. When rain interrupts the sealing operations, the joints shall be washed, air pressure cleaned, and allowed to dry prior to installing the lubricant/adhesive and compression seal.

3.2.2 Sequence of Installation

Longitudinal joints shall be sealed first, followed by transverse joints. Seals in longitudinal joints shall be installed so that all transverse joint seals will be intact from edge to edge of the pavement. Intersections shall be made monolithic by use of joint seal adhesive and care in fitting the intersection parts together. Extender pieces of seal shall not be used at intersections. Any seal falling short at the intersection shall be removed and replaced with new seal at no additional cost to the Government. Seals that are required to change direction by more than 20 degrees, may require a poured sealant at the intersection. Poured sealant shall be per compression seal manufacturer's instructions.

3.3 SEALING OF JOINTS

NOTE: Stretching of the compression joint seal beyond the specified maximum must never be permitted, as breaks in the seal could occur later. It is also possible that if the maximum is exceeded, when the longitudinal joints are cut to install the transverse joints that the joint seal material will return to its natural length leaving openings in the final product. Conversely, placing the seal so that the compression seal is compressed longitudinally is also undesirable, as this practice tends to cause

unsightly undulations and may exceed depth of installation tolerances.

If tracked vehicles are to use the pavement, the minimum depth of the seal should be 6 mm (1/4 inch) below the surface of the pavement to prevent treads of tracked vehicles from damaging the compression seal. Depth of installation will be revised to read "10 mm, plus or minus 3 mm" ("3/8 inch, plus or minus 1/8 inch.") On airfield pavements a shallower depth of installation may be desired by the using agency, to reduce the accumulation of dust and debris on top of the compression seal, which could be ingested by aircraft engines. In such cases, the depth of installation will be changed to read "5 mm, plus or minus 3 mm" ("3/16 inch, plus or minus 1/8 inch,") if requested in writing by the using service major command. It is also recommended when the compression seal in the longitudinal intersections are being cut that a knife blade be used to reduce the possibility of damage to the compression seal on either side of the intersection.

The sides of the joint seal or the sides of the joint shall be covered with a coating of lubricant/adhesive and the seal installed as specified. Butt joints and seal intersections shall be coated with liberal applications of lubricant/adhesive. Lubricant/adhesive spilled on the pavement shall be removed immediately to prevent setting on the pavement. The in-place joint seal shall be in an upright position and free from twisting, distortion, and cuts. Adjustments shall be made to the installation equipment and procedure, if the stretch exceeds 1 percent. Any seal exceeding 2 percent stretch shall be removed and replaced. The joint seal shall be placed at a uniform depth within the tolerances specified. In-place joint seal which fails to meet the specified requirements shall be removed and replaced with new joint seal at no cost to the Government. The compression joint seal shall be placed to a depth of 6 mm 1/4 inch, plus or minus 3 mm 1/8 inch, below the pavement surface except when the joint is beveled or has a radius at the surface, or unless otherwise directed. For beveled joints or joints with a radius at the surface, the compression joint seal shall be installed at a depth of 3 mm 1/8 inch, plus or minus 3 mm 1/8 inch, below the bottom of the edge of the bevel or radius. No part of the seal shall be allowed to project above the surface of the pavement or above the edge of the bevel or radius. The seal shall be installed in the longest practicable lengths in longitudinal joints and shall be cut at the joint intersections to provide continuous installation of the seal in the transverse joints. The lubricant/adhesive in the longitudinal joints shall be allowed to set for 1 hour prior to cutting at the joint intersections to reduce the possibility of shrinkage. For all transverse joints, the minimum length of the compression joint seal shall be the pavement width from edge to edge.

3.4 CLEAN-UP

Upon completion of the project, all unused materials shall be removed from the site, any lubricant/adhesive on the pavement surface shall be removed, and the pavement shall be left in clean condition.

3.5 QUALITY CONTROL PROVISIONS

3.5.1 Application Equipment

The application equipment shall be inspected to assure uniform application of lubricant/adhesive to the sides of the compression joint seal or the walls of the joint. If any equipment causes cutting, twisting, nicking, excessive stretching or compressing of the seal, or improper application of the lubricant/adhesive, the operation shall be suspended until causes of the deficiencies are determined and corrected.

3.5.2 Procedures

3.5.2.1 Quality Control Inspection

Quality control provisions shall be provided during the joint cleaning process to prevent or correct improper equipment and cleaning techniques that damage the concrete in any manner. Cleaned joints shall be approved by the Government prior to installation of the lubricant/adhesive and compression joint seal.

3.5.2.2 Conformance to Stretching and compression Limitations

Conformance to stretching and compression limitations shall be determined. The top surface of the compression seal shall be marked at 305 mm 1 foot intervals in a manner clear and durable to enable length determinations of the seal. After installation, the distance between the marks shall be measured on the seal. If the stretching or compression exceeds 2 percent, the seal shall be removed and replaced with new joint at no additional cost to the Government. The seal shall be removed up to the last correct measurement. The seal shall be inspected a minimum of once per [30] [120] meters [100] [400] feet of seal for compliance to the shrinkage or compression requirements. Measurements shall also be made at the same interval to determine conformance with depth and width of installation requirements. Compression seal that is not in conformance with specification requirements shall be removed and replaced with new joint seal at no additional cost to the Government.

3.5.2.3 Pavement Temperature

The pavement temperature shall be determined by placing a thermometer in the initial saw cut for the joint and the reading shall be recorded. The thermometer shall remain in the joint for an adequate time to provide a control reading.

3.5.3 Final Inspection

The joint sealing system (compression seal and lubricant/adhesive) shall be inspected for proper rate of cure and bonding to the concrete, cuts, twists, nicks and other deficiencies. Seals exhibiting any defects, at any time prior to final acceptance of the project, shall be removed from the joint, wasted, and replaced in a satisfactory manner.

-- End of Section --