Preparing Activity: NAVFAC Superseding
UFGS-32 01 19.61 (April 2006)

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated July 2023
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SECTION 32 01 19.61

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SECTION 32 01 19.61

SEALING OF JOINTS IN RIGID PAVEMENT
11/19

NOTE: This guide specification covers the requirements for field molded sealants in sealing or resealing joints in rigid pavements on airfields, roads, streets, and other areas.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

NOTE: When crack repair is involved, edit accordingly, including the section title. This specification should not be used for liquid oxygen compatible joint seals.

NOTE: The following information shall be shown on the project drawings:

1. Spacing, width, and type of joints in concrete pavements to be sealed.

2. Typical details of existing joints.

3. Depth of existing sealant to be removed for each type of joint, if not specified.

4. Detail of type of joint to be refaced or widened with a concrete saw. Show extent of new width and depth of sawing to provide the proper shape factor of the void space in the joint. For materials, other than silicone, the ratio of the depth to width (d/w) of the sealant reservoir should generally be not less than 1 nor greater than 1.5. For silicone sealant a depth to width ratio of approximately 0.5 is preferred. Depending upon the width of the refaced joint, the thickness of the sealant bead should be between 6 and 13 mm 1/4 and 1/2 in. Following are the recommended details for silicone sealants:

Refaced Joint Width	10 mm	13 mm	19 mm	25 mm
Recess Below Surface	6 mm	6 mm	6 mm	13 mm
Thickness of Sealant	6 mm	6 mm	10 mm	13 mm
Backer Rod Diameter	13 mm	16 mm	22 mm	31 mm
Total Depth of Joint	25 mm	28 mm	38 mm	56 mm

Refaced Joint Width	3/8"	1/2"	3/4"	1"
Recess Below Surface	1/4"	1/4"	1/4"	1/2"
Thickness of Sealant	1/4"	1/4"	3/8"	1/2"
Backer Rod Diameter	1/2"	5/8"	7/8"	1 1/4"
Total Depth of Joint	1"	1 1/8"	1 1/2"	2 1/4"

5. Location and type of bond breaker or back-up.

6. Identify type of sealant based on proposed use of pavements. (See note in paragraph entitled "Joint Sealant.")

7. For joint details see UFC 3-260-02, "Pavement Design for Airfields".

****

PART 1 GENERAL

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NOTE: In preparing Contract specifications for concrete pavements, use UFC 3-250-04 Standard Practice for Concrete Pavements.

****

1.1 UNIT PRICES

****

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

****

1.1.1 Measurement

Determine the quantity of each sealing item to be paid for by actual measurement of the number of linear m ft of in-place material that has been approved.

1.1.2 Payment

Make payment at the Contract unit bid prices per linear meter foot for the sealing items scheduled. Include the cost of labor, materials, and the use of equipment and tools required to complete the work in the unit bid price.

1.2 REFERENCES

****

NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (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 C603	(2014; R 2019) Standard Test Method for Extrusion Rate and Application Life of Elastomeric Sealants
ASTM C639	(2015; R 2020)Standard Test Method for Rheological (Flow) Properties of Elastomeric Sealants
ASTM C661	(2015; R 2022) Standard Test Method for Indentation Hardness of Elastomeric-Type

	Sealants by Means of a Durometer
ASTM C679	(2015; R 2022) Standard Test Method for Tack-Free Time of Elastomeric Sealants
ASTM C719	(2014; R 2019) Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle)
ASTM C792	(2023) Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
ASTM C793	(2023) Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
ASTM C920	(2018) Standard Specification for Elastomeric Joint Sealants
ASTM C1016	(2014; R 2022) Standard Test Method for Determination of Water Absorption of Sealant Backing (Joint Filler) Material
ASTM C1193	(2016) Standard Guide for Use of Joint Sealants
ASTM D412	(2016; R 2021) Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
ASTM D789	(2015) Determination of Relative Viscosity and Moisture Content of Polyamide (PA)
ASTM D903	(1998; R 2017) Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
ASTM D5249	(2010; R 2016) Standard Specification for Backer Material for Use with Cold-and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints
ASTM D5329	(2016) Standard Test Methods for Sealants and Fillers, Hot-Applied, for Joints and Cracks in Asphalt Pavements and Portland Cement Concrete Pavements
ASTM D5893/D5893M	(2016) Standard Specification for Cold Applied, Single Component, Chemically Curing Silicone Joint Sealant for Portland Cement Concrete Pavements
ASTM D6690	(2015) Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

U.S. ARMY CORPS OF ENGINEERS (USACE)

COE CRD-C 525	(1989) Corps of Engineers Test Method for Evaluation of Hot-Applied Joint Sealants for Bubbling Due to Heating

1.3 SUBMITTALS

****

NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G." Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a “G” to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets following the "G" classification, with a code of up to three characters 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.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

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" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-03 Product Data

Sealants

Submit catalog cuts, specifications, Safety Data Sheets and other information documenting conformance to Contract requirements.

Manufacturer's Recommendations

SD-04 Samples

****
NOTE: Liquid joint sealer proposed for use in airfield pavements should be tested by the U.S. Army Corps of Engineer, Waterways Experiment Station, P. O. Box 631, Vicksburg, MS 39180, Attn: Larry Lynch, telephone: (601) 634-4274, before acceptance. Project Managers should assure that sufficient funds (approximately $1500) are available and that the 45 day testing time requirement has been taken into account when establishing contract completion time. For small projects involving approximately less than 3,000 m 10,000 linear ft of joint sealing, the requirement for testing may be waived provided that a Factory Test Report is submitted. In no case should materials not meeting the applicable specification be accepted.
****

Sealants

Provide for testing a 19-L 5-gal sample of each sealant with associated primer to the Contracting Officer a minimum of 60 days prior to its use on the job. Provide factory-sealed containers with a factory applied label showing the following information:

Name of sealant

Identification of component, or primer

Specification number and type

Manufacturer's name

Manufacturer's lot and batch number

Date of Manufacture (month and year)

Shelf life retest date (month and year)

List of hazardous components

Quantity of material in container (volume)

Storage instructions

Instructions for use

Blocking Media/Backup Materials

Backer Rod

Bond Breaking Tapes

SD-06 Test Reports

****

NOTE: Liquid joint sealer proposed for use in airfield pavements should be tested by the U.S. Army Corps of Engineer, Waterways Experiment Station, P. O. Box 631, Vicksburg, MS 39180, Attn: Larry Lynch, telephone: (601) 634-4274, before acceptance. Project Managers should assure that sufficient funds (approximately $1500) are available and that the 45 day testing time requirement has been taken into account when establishing contract completion time. For small projects involving approximately less than 3,000 m 10,000 linear ft of joint sealing, the requirement for testing may be waived provided that a Factory Test Report is submitted. In no case should materials not meeting the applicable specification be accepted.

****

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NOTE: Factory test report should be required for joint seals on projects when the Government testing is waived.

****

[Sealants

] SD-07 Certificates

Equipment List

SD-08 Manufacturer's Instructions

Sealants

Provide instructions that include, but not limited to: storage requirements, ambient temperature and humidity ranges, and moisture condition of joints for successful installation; requirements for preparation of joints; safe heating temperature; mixing instructions; installation equipment and procedures; application and disposal requirements; compatibility of sealant with filler material; curing requirements; and restrictions to be adhered to in order to reduce hazards to personnel or to the environment. Submit instructions at least 30 days prior to use.

1.4 QUALITY ASSURANCE

1.4.1 Test Requirements

****

NOTE: Select the applicable statement for testing and determining specification compliance and delete the inapplicable statement. Select the first statement for projects except where the project is less than 200 L 50 gal or 200 kg 440 lbs of material. When the project requires less than 200 L 50 gal or 200 kg 440 lbs of sealant, the first statement can be deleted and the sealant and back-up material may be accepted on certified certificate that contains the test data showing compliance with

the laboratory test requirements. The cost of testing can be obtained from U.S. Army Corps of Engineer Division Laboratories or Waterways Experiment Station.
****

Test the sealant and backup or separating material for conformance with the referenced material specification.[The materials will be tested by the Government. Do not use material at the project prior to receipt of written notice that the materials meet the laboratory requirements. The cost of the first test of samples will be borne by the Government. If the samples fail to meet specification requirements, replace the materials represented by the sample and test the new materials at the Contractor's expense.][Perform testing of the materials in an approved independent laboratory and submit certified copies of the test reports for approval [_____] days prior to the use of the materials at the job site. Submit samples to be retained by the Government for possible future testing if the materials appear defective during or after application.] Conformance with the requirements of the laboratory tests specified does not constitute final acceptance of the materials. Base final acceptance on the performance of the in-place materials. Submit samples of the materials (sealant, primer if required, and backup material), in sufficient quantity for testing and approval [_____] days prior to the beginning of work. Do not use material until it has been approved.

1.4.2 Trial Joint Sealant Installation

Prior to cleaning and sealing the joints for the entire project, prepare a test section at least 60 m 200 ft long using the specified materials and approved equipment, so as to demonstrate the proposed joint preparation and sealing of the types of joints in the project. Following the completion of the test section and before any other joint is sealed, inspect the test section to determine that the materials and installation meet the requirements specified. Inspect joint seal test section.[Provide written notice of deficiencies and required corrections or adjustments in the joint seal installation procedures.] Correct deficiencies and obtain approval of test section prior to installing joint seals. If it is determined that the materials or installation do not meet the requirements, remove the materials, and reclean and reseal the joints at no cost to the Government. Permit the test section meeting the requirements to be incorporated into the permanent work and paid for at the Contract unit price per linear foot for sealing items scheduled. Prepare and seal other joints in the manner approved for sealing the test section. Notify the Contracting Officer upon completion of the test section.

1.5 DELIVERY, STORAGE, AND HANDLING

Inspect materials delivered to the site for visible damage, and unload and store with a minimum of handling. Deliver joint materials in original sealed containers and protect from freezing or overheating. Provide jobsite storage facilities capable of maintaining temperature ranges within manufacturers recommendations.

1.6 ENVIRONMENTAL REQUIREMENTS

Do not proceed with work when weather conditions detrimentally affect the quality of cleaning joints or applying sealants. Proceed with joint preparation and sealing only when weather conditions are in accordance

with manufacturer's instructions. Install joint sealant to dry surfaces and protect sealant and bond breakers from moisture.

1.7 TRAFFIC CONTROL

Do not permit vehicular or heavy equipment traffic on the pavement in the area of the joints being sealed during the protection and curing period of the sealant. Permit traffic on the pavement at the end of the curing period.

PART 2 PRODUCTS

2.1 SEALANTS

****

NOTE: Select joint sealants based on the proposed use and local experience. Specify ASTM D6690 (Type II or Type III) sealants for areas that do not receive fuel spillage, engine blast and heat exposure (i.e., areas where aircraft warm up the engines). Type III contains the requirements of Type II and has additional requirements for a water immersed bond test and an oven-aged resilience test. ASTM D6690 (Type II or Type III) sealants are normally used on roadways, vehicle parking lots, and on some aircraft taxiways. Test ASTM D6690 sealants in accordance with ASTM D5329 and COE CRD-C 525 in addition to the appropriate specification.

Permit ASTM D5893/D5893M sealants to be specified in place of ASTM D6690 sealants. ASTM D5893/D5893M covers silicone sealants that provide improved life-cycle cost benefits. Permit silicone sealant to be used for general purpose sealing and re-sealing of joints in concrete pavements not subject to severe jet fuel or lubricant spillage. Silicone swells up under fuel spills. This may result in an unsatisfactory seal in aircraft or vehicle servicing areas where spillage is frequent.

****

Use materials for sealing cracks in accordance with ASTM D6690 and ASTM D5893/D5893M based on the type of area as follows:

Area	Sealing Material
[_____]	[ASTM D6690, Type II and ASTM D5329/ COE CRD-C 525]
[_____]	[ASTM D6690, Type III and ASTM D5329/ COE CRD-C 525]
[_____]	[ASTM D5893/D5893M]

Use self leveling, non-acid curing silicone sealant meeting the following requirements in accordance with ASTM C920 or ASTM C1193:

TEST	TEST METHOD	REQUIREMENTS
Weight Loss	ASTM C792 Modified (see Note 1 below)	10 percent max.
Flow	ASTM C639 (Type I)	Smooth and level
Extrusion Rate	ASTM C603	30 sec. max.
Tack Free Time	ASTM C679	5 hours max.
Hardness (Shore 00) (see Note 2 below)	ASTM C661	30 - 80
Tensile Stress at 150 Percent Elongation (see Note 2 below)	ASTM D412 (Die C)	200 kPa 30 psi max.
Percent Elongation (see Note 2 below)	ASTM D412 (Die C)	700 min.
Accelerated Weathering	ASTM C793	Pass 5000 hours
Bond and Movement Capability	ASTM C719	Pass 10 cycles at plus 50 percent movement (no adhesion or cohesion failure)
Peel	ASTM D903	Minimum 140 kPa 20 psi of width with at least 75 percent cohesive failure

NOTES:
1. Percent weight loss of wet (uncured) sample after placing in forced-draft oven maintained at 70 degrees plus 2 degrees C 158 degrees plus 1 degree F for two hours.

2. Specimen cured 21 days at 23 degrees C plus 2 degrees C 73 degrees plus 1 degree F and 50 percent plus 5 percent humidity.

ACCELERATED WEATHERING FACTORY TEST REPORT. For the Accelerated Weathering test, in lieu of testing of actual sealant to be used on the project, it is permitted to submit a report of a factory test, performed within two years of Contract award.

2.2 PRIMERS

Use primers in accordance with the recommendation of the manufacturer.

2.3 BOND BREAKERS

2.3.1 Blocking Media/Backup Materials

****

NOTE: The use of a bond breaking separation tape or backup material in the joint may prevent an adverse reaction between incompatible materials, maintain the desired configuration (shape factor of the material), and act as a bond breaker to prevent excessive stresses from being placed on the sealant during pavement movement. Therefore, the separating or backup material should be carefully selected and

installed to form an effective and durable support for the sealant. Separating or blocking media should be placed to a depth below the pavement approximately equal to the width of the joint. This is to achieve a shape factor (ratio of the depth of the sealant to the width of the joint) of 1. ASTM D5893/D5893M sealants sometimes require a shape factor of 0.5 instead of 1. This is equivalent to a width-to-depth ratio of 2:1 and requires the standard joint detail to be modified. If an ASTM D5893/D5893M sealant is to be used the placement depth of the bond breaking separating tape or backup material should be adjusted accordingly. Drawings should be included in the Contract drawings to indicate application details.
****

Provide backup (joint filler) material that is a compressible, nonshrinking, nonstaining, nonabsorbing, nonreactive material with the sealant. Use backup material compliant with ASTM D5249. Use material with a melting point at least 3 degrees C 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. Use material with a water absorption of not more than 5 percent of the sample weight when tested in accordance with ASTM C1016. Use backup (joint filler) material that is 25 plus or minus 5 percent larger in diameter than the nominal width of the crack. Use blocking media consistent with the sealant manufacturer's installation instructions.

2.3.2 Bond Breaking Tapes

Provide a bond breaking tape or separating material that is a flexible, nonshrinkable, nonabsorbing, nonstaining, and nonreacting adhesive-backed tape. Use material with a melting point at least 3 degrees C 5 degrees F greater than the pouring temperature of the sealant being used when tested in accordance with ASTM D789. Use bond breaker tape approximately 3 mm 1/8 in wider than the nominal width of the joint and that does not bond to the sealant. Use bond breaking tape consistent with the sealant manufacturer's installation instructions.

PART 3 EXECUTION

3.1 EXECUTING EQUIPMENT

Submit equipment list and description of the equipment to be used and a statement from the supplier of the sealant that the proposed equipment is acceptable for installing the specified sealant. Use equipment for heating, mixing, and installing seals in accordance with the instructions provided by the sealant manufacturer. Provide equipment, tools, and accessories necessary to clean existing joints and install liquid joint sealants. Maintain machines, tools, and other equipment in proper working condition. Submit a list of proposed equipment to be used in performance of construction work including descriptive data, [_____] days prior to use on the project.

3.1.1 Joint Cleaning Equipment

3.1.1.1 Tractor-Mounted Routing and Plowing Tool

Use routing tools for removing old sealant from the joints, of such shape and dimensions and so mounted on the tractor that do not damage the sides

of the joints. Use tools designed to be adjusted to remove the old material to varying depths and widths as required. Use equipment capable of maintaining accurate cutting depth and width control. Use a joint plow equipped with a spring or hydraulic mechanism to release pressure on the tool prior to spalling the concrete. Do not permit the use of V-shaped tools or rotary impact routing devices. Permit the use of hand-operated spindle routing devices to clean and enlarge random cracks.

3.1.1.2 Concrete Saw

Provide a self-propelled power saw, with water-cooled diamond or abrasive saw blades, for cutting joints to the depths and widths specified, for refacing joints, cleaning sawed joints where sandblasting does not provide a clean joint, widening, or deepening existing joints as specified without damaging the sides, bottom, or top edge of joints. Permit single or gang type blades with one or more blades mounted in tandem for fast cutting. Select saw adequately powered and sized to cut specified opening with not more than two passes of the saw through the joint.

3.1.1.3 Sandblasting Equipment

****
NOTE: Sandblasting equipment with a 6 mm 1/4 in nozzle requires at least 65 L per second 137 cubic ft per minute of air to function efficiently.
****

Include with the sandblasting equipment an air compressor, hose, and long-wearing venturi-type nozzle of proper size, shape and opening. Do not permit the maximum nozzle opening to exceed 6 mm 1/4 in. Use a portable air compressor capable of providing not less than 71 L/s 150 cfm and maintaining a line pressure of not less than 620 kPa 90 psi at the nozzle while in use. Demonstrate compressor capability, under job conditions, before approval. Use a compressor equipped with traps that maintain the compressed air free of oil and water. Use a nozzle with an adjustable guide that holds the nozzle aligned with the joint approximately 25 mm 1 in above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle to secure satisfactory results.

3.1.1.4 Waterblasting Equipment

****
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. Delete this paragraph if waterblasting is not used.
****

Include with the waterblasting equipment a trailer-mounted water tank, pumps, high-pressure hose, wand with safety release cutoff control, nozzle, and auxiliary water resupply equipment. Provide water tank and auxiliary resupply equipment of sufficient capacity to permit continuous operations. Use a nozzle with an adjustable guide that holds the nozzle aligned with the joint approximately 25 mm 1 in above the pavement surface. Adjust the height, angle of inclination and the size of the nozzle to obtain satisfactory results. Use a pressure gauge mounted at the pump that shows the pressure in kPa psi at which the equipment is

operating.

3.1.1.5 Air Compressor

Use a portable air compressor capable of operating the sandblasting equipment and capable of blowing out sand, water, dust adhering to sidewalls of concrete, and other objectionable materials from the joints. Use a compressor that provides air at a pressure not less than 620 kPa 90 psi and a minimum rate of 0.07 cubic m of air per second 150 cubic ft of air per minute at the nozzles and free of oil.

3.1.1.6 Vacuum Sweeper

Use a self-propelled, vacuum pickup sweeper capable of completely removing loose sand, water, joint material, and debris from pavement surface.

3.1.1.7 Hand Tools

****
NOTE: Where spalled joint edges have not been repaired prior to any previous sealing, it may be necessary for the Contractor to employ other types of small tools for the repair work. Such tools should be carefully evaluated for potential spalling effects prior to approval for use. For repairing concrete pavements adjacent to joints, the designer is referred to Section 32 01 29.61 PARTIAL DEPTH PATCHING OF RIGID PAVING, and to Technical Manual 5-822-9.
****

Permit the use of hand tools, such as brooms and chisels, when approved, for removing defective sealant from a crack and repairing or cleaning the crack faces.

3.1.2 Sealing Equipment

****
NOTE: Delete the inappropriate paragraphs.
****

Use joint sealing equipment of a type required by the sealant manufacturer's installation instructions. Use equipment capable of installing sealant to the depths, widths and tolerances indicated. Do not proceed with joint sealing when malfunctions are noted until the malfunctions are corrected.

3.1.2.1 Hot-Poured Sealing Equipment

Use mobile unit applicators equipped with a double-boiler, agitator-type kettle with an oil medium in the outer space for heat transfer for heating and installing ASTM D6690 joint sealant materials; a direct-connected pressure-type extruding device with a nozzle shaped for inserting in the joint to be filled; positive temperature devices for controlling the temperature of the transfer oil and sealant; and a recording thermometer for indicating the temperature of the sealant. Use an applicator unit designed so that the sealant circulates through the delivery hose and returns to the inner kettle when not in use.

3.1.2.2 Cold-Applied, Single-Component Sealing Equipment

****

NOTE: Some ASTM D5893/D5893M sealants cure when exposed to moisture. When the sealant is moisture sensitive it is necessary to use Teflon-lined hoses to prevent the sealant from curing in the hoses.

****

Use equipment for installing ASTM D5893/D5893M single component joint sealants that consists of an extrusion pump, air compressor, following plate, hoses, and nozzle for transferring the sealant from the storage container into the joint opening. Use a nozzle with dimensions that allows the tip of the nozzle to extend into the joint to allow sealing from the bottom of the joint to the top. Maintain the initially approved equipment in good working condition, serviced in accordance with the supplier's instructions, and unaltered in any way without obtaining prior approval. Use lined hoses and seals to prevent moisture penetration and withstand pumping pressures. Use equipment free of contamination from previously used or other type sealant. Permit use of small hand-held air-powered equipment (i.e., caulking guns) for small applications.

3.2 SAFETY

****

NOTE: Delete this paragraph if liquid oxygen (LOX) equipment, storage, or piping is not within the project area. Joint sealant should not be used within 8 m 25 ft of any LOX equipment or storage.

If LOX equipment, storage, or piping is within the project area, use continuously reinforced concrete slabs in the 8 m 25 ft clear area of LOX to reduce the number of joints. If joints cannot be eliminated within the 8 m 25 ft clear area, clean the joints in the area and leave unsealed. DO NOT PERMIT LOX TO MIX WITH ANY ORGANIC MATERIAL.

Specify sandblasting of joint walls as a light cleaning method following sawing of joints. Sandblasting sometimes causes minor deterioration around the joint area. Secure station permission before sandblasting. If necessary, insert a cross-reference to Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

****

Do not place sealant within 8 m 25 ft of LOX equipment, LOX storage, or LOX piping. Clean joints in this area and leave them unsealed.

In accordance with the provisions of the Contract respecting "Accident Prevention," take appropriate measures to control worker exposure to toxic substances during the work. Provide personnel protective equipment as required. Make Material Safety Data Sheets (Department of Labor Form OSHA-20 or comparable form) available on the site.

[Perform sandblasting operations in accordance to paragraph entitled "Abrasive Blasting" of Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

]3.3 PREPARATION OF JOINTS

****

NOTE: The proper preparation of joints with respect to size of joint opening, required cleanliness of concrete surfaces to be bonded, and proper separation of noncompatible materials from the joint sealant cannot be overemphasized. The same applies to storage, preparation, proportioning, mixing and placement of sealants. The neglect of any facet of these operations can result, and has resulted, in poor performance of the joint sealant.

Provide details of the existing joints and the required depth of removal of old sealant on the drawings.

****

Unless otherwise indicated, remove existing material, saw, clean and reseal joints. Do not proceed with final cleaning operations by more than one working day in advance of sealant. Clean joints by removing existing joint sealing compound, bond-breakers, dirt, laitance, curing compound, filler, and protrusions of hardened concrete from the sides and upper edges of the joint space to be sealed and other foreign material with the equipment. Do not permit cleaning procedures that damage joints or previously repaired patches by chipping or spalling. Remove existing sealant to the required depth. Precise shape and size of existing joints vary, and conditions of joint walls and edges vary and include but are not limited to rounding, square edges, sloping, chips, voids, depressions, and projections.

3.3.1 Existing Sealant Removal

****

NOTE: Delete this paragraph if the joints have never been sealed and renumber the subsequent paragraphs. Specify and show on the plans the depth to remove the old sealant from the joints. Show typical existing joint dimensions. Waterblasters have been used successfully to remove sealants that still have some resilience. A nozzle that puts out a thin stream of water is required to cut the sealant loose from the joint walls. Do not use the concrete saw if it widens the joint to a width greater than 25 mm 1 in.

****

Cut loose the in-place sealant from both joint faces and to the required depth, using the [tractor-mounted routing equipment] [concrete saw] [waterblaster] as specified in paragraph EQUIPMENT. Provide a depth sufficient to accommodate blocking media and bond breakers that are required to maintain the depth of new sealant to be installed. For expansion joints, remove existing sealant to a depth of not less than [the indicated depth.][25 mm 1 in.] When existing preformed expansion-joint material is more than 25 mm 1 in below the surface of the pavement, remove existing sealant to the top of the preformed joint filler. Prior to further cleaning operations, remove loose old sealant remaining in the joint opening by blowing with compressed air. Permit use of hand tools to

remove sealant from random cracks. Do not permit chipping, spalling, or other damage to the concrete. Clean pavement surface with vacuum sweeper. Protect previously cleaned joints from being contaminated by subsequent cleaning operations.

3.3.2 Sawing

****

NOTE: Joints often need to be refaced or widened to provide vertical faces and remove damaged concrete. Care should be used when refacing or widening joints so that the joint's width does not exceed 25 mm 1 in. If the joint width exceeds 25 mm 1 in, rebuilding of the joint should be considered. Joint walls should be vertical. The edges should not be rounded or beveled unless required by design.

****

3.3.2.1 Refacing of Joints

****

NOTE: Specify refacing of joints by sawing for the following reasons:

1. To widen the joint space or change the shape factor.

2. To straighten the vertical walls inside the joints and remove old sealant.

If the joints have never been sealed, change the title of this paragraph to Facing of Joints and the appropriate words and sentences used. If "dry" sawing is used to face or reface the joints, remove the debris using compressed air.

****

Accomplish [refacing] [facing] of joints using a concrete saw as specified in paragraph EQUIPMENT [to remove residual old sealant and a minimum of concrete from the joint face to provide exposure of newly cleaned concrete, and, if required, to enlarge the joint opening to the width and depth shown on the drawings.] [to saw through sawed and filler-type joints to loosen and remove material until the joint is clean and open to the full specified width and depth.] Provide exposure of newly clean concrete through removal. Remove burrs and irregularities from sides of joint faces. Stiffen the blade with a sufficient number of dummy (used) blades or washers. Clean, immediately following the sawing operation, the joint opening using a water jet to remove saw cuttings and debris and adjacent concrete surface. Protect adjacent previously cleaned joint spaces from receiving water and debris during the cleaning operation.

a. Joint Widening (Except Expansion Joints): Saw joints having grooves less than 10 mm 3/8 in wide and less than 25 mm 1 in deep to a minimum width of [10] [13] [_____] mm [3/8] [1/2] [_____] in and to the minimum depth, [of] [25 mm] [38 mm] [1 in] [1-1/2 in] [as indicated].

3.3.2.2 Refacing of Random Cracks

****

NOTE: Use a vertical spindle routing device to clean random cracks. Sandblast clean random cracks that are approximately 25 mm 1 in wide to prevent additional widening of the crack instead of sawing or routing.

****

Accomplish sawing of the cracks using a power-driven concrete saw as specified in paragraph EQUIPMENT. Use a saw blade 150 mm 6 in or less in diameter to enable the saw to follow the trace of the crack. Stiffen the blade with dummy (or used) blades or washers. Immediately following the sawing operation, clean the crack opening using a water jet to remove saw cuttings and debris.

3.3.3 Final Cleaning of Joints

3.3.3.1 Sandblasting

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NOTE: Specify sandblasting of joint walls following sawing of joints. Sandblasting may cause some minor deterioration around the joint area. Secure station permission before sandblasting. If necessary, insert a cross-reference to Section 01 57 19 TEMPORARY ENVIRONMENTAL CONTROLS.

Do not permit sandblasting of joints under certain conditions. Blowing sand and dust may either violate atmospheric pollution statutes or may drift into areas where it is objectionable. When sandblasting is prohibited, substitute cleaning the joints with a waterblaster or wire brushes. Wire brushes do not clean as well as the sandblaster or waterblaster; use only for small areas. When wire brushes are used, provide attention to ensure worn brushes are not used and that the joints are being adequately cleaned. When waterblasting is required instead of sandblasting, replace the word sandblasting with waterblasting.

****

Following removal of existing sealant, and sawing, and immediately before resealing, clean newly exposed concrete joint faces and pavement surface extending to a mimimum of 13 mm 1/2 in up to 50 mm 2 in from each joint edge by sandblasting until concrete surfaces in the joint space are free of sealants, dust, dirt, water and other foreign materials that prevent bonding of new sealants to the concrete. Use sand particles of the proper size and quality for the work. Perform sandblasting with specified nozzles, air compressor, and other appurtenant equipment. Position nozzles to clean the joint faces. Make at least two passes; one for each joint face. Make as many passes as required for proper cleaning. Immediately prior to sealing the joint, blow out the joint spaces with compressed air until completely free of sand, water, and dust. Install joint sealants to dry joints. Replace expansion joint filler material damaged in performing the work with new materials of the same type and dimensions as the existing material, or with appropriate blocking media.

3.3.4 Bond Breaker

At the time the joints receive the final cleaning and are dry, install bond breaker material as indicated with a steel wheel or other approved device.

3.3.4.1 Blocking Media (Backer Rod) (Except for Expansion Joints)

When the joint opening is of a greater depth than indicated for the sealant depth, plug or seal off the lower portion of the joint opening using a blocking media/back-up material to prevent the entrance of the sealant below the specified depth. Take care to ensure that the blocking media/backup material is placed at the specified depth and is not stretched or twisted during installation.

3.3.4.2 Bond Breaking Tape

Where inserts or filler materials contain bitumen, or the depth of the joint opening does not allow for the use of a backup material, insert a bond breaker separating tape to prevent incompatibility with the filler materials and three-sided adhesion of the sealant. Bond the tape to the bottom of the joint opening to prevent it from floating up into the new sealant.

3.3.5 Rate of Progress of Joint Preparation

Limit the stages of joint preparation, including sandblasting, air pressure cleaning and placing of the back-up material to only that lineal footage that can be sealed during the same day.

3.3.6 Disposal of Debris

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NOTE: Specify location of disposal of debris.
****

Sweep pavement surface to remove excess joint material, dirt, water, sand, and other debris by vacuum sweepers or hand brooms. Remove the debris immediately [to a point off station.] [to a designated area.] [in accordance with Section 02 41 00 [DEMOLITION] [AND] [DECONSTRUCTION]].

3.4 PREPARATION OF SEALANT

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NOTE: Delete the inappropriate paragraphs.
****

3.4.1 Hot-Poured Sealants

Heat hot-poured sealing materials in accordance with ASTM D6690 and with safe heating temperature ranges recommended by the manufacturer. Withdraw and waste sealant that has been overheated or subjected to heating for over 3 hours or that remain in the applicator at the end of the day's operation. Heat sealant in specified equipment.

3.4.2 Single-Component, Cold-Applied Sealants

Inspect the ASTM D5893/D5893M sealant and containers prior to use. Reject materials that contain water, hard caking of any separated constituents,

nonreversible jell, or materials that are otherwise unsatisfactory. Do not reject sealants that exhibit settlement of constituents in a soft mass that can be readily and uniformly remixed in the field with simple tools.

3.5 INSTALLATION OF SEALANT

3.5.1 Time of Application

After approval of the test section, seal joints immediately following final cleaning and placing of bond breakers. Commence sealing joints when walls are dust free and dry, and when weather conditions meet sealant manufacturer's instructions. If the above conditions cannot be met, or when rain interrupts sealing operations, reclean and permit the joints to dry prior to installing the sealant.

3.5.2 Sealing Joints

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NOTE: Joints should be slightly underfilled to preclude extrusion of the material above the surface of the pavement at summertime temperatures. For airfield pavements, the sealant should be recessed 3 mm 1/8 in below the pavement surface; for roads, streets and parking lots, the sealant should be recessed 6 mm 1/4 in. For pavements that receive tracked vehicle traffic, the sealant should be recessed a minimum of 6 mm 1/4 in below the pavement surface after it has cured or cooled to ambient temperature.

****

Do not install joint sealant until joints to be sealed have been inspected and approved. Install bond breaker just prior to pouring sealant. Fill the joints with sealant from bottom up until joints are uniformly filled solid from bottom to top using the specified equipment for the type of sealant required. Fill joints to [3][6] mm [1/8][1/4] in plus or minus 1.5 mm 1/16 in below top of pavement, and without formation of voids or entrapped air. Do not permit gravity methods or pouring pots to be used to install the sealant material. Except as otherwise permitted, tool the sealant immediately after application to provide firm contact with the joint walls and to form the indicated sealant profile below the pavement surface. Remove excess sealant that has been inadvertently spilled on the pavement surface. Do not permit traffic over newly sealed pavement until authorized. When a primer is recommended by the manufacturer, apply it evenly to the joint faces in accordance with the manufacturer's recommendations. Check sealed joints frequently to ensure that newly installed sealant is cured to a tack-free condition within the specified time. Protect new sealant from rain during curing period.

3.6 INSPECTION/FIELD QUALITY CONTROL

3.6.1 Joint Cleaning

Inspect joints during the cleaning process to correct improper equipment and cleaning techniques that damage the concrete pavement in any manner. Approve cleaned joints prior to installation of the separating or back-up material and joint sealant.

3.6.2 Sampling Sealant

Obtain a 4-L one gal sample of each type of sealant on the project from material used for each 3000 m 10,000 linear ft or less of joints sealed. Store samples according to sealant manufacturer's instructions. Retain samples until final acceptance of the work.

3.6.3 Sealant Application Equipment

Inspect the application equipment to ensure conformance to temperature requirements, proper proportioning and mixing (if two-component sealant) and proper installation. Suspend operations if there is evidences of bubbling, improper installation, or failure to cure or set until causes of the deficiencies are determined and corrected.

3.6.4 Joint Sealant

Inspect the joint sealant for proper rate of cure and set, bonding to the joint walls, cohesive separation within the sealant, reversion to liquid, entrapped air and voids. Remove sealants exhibiting these deficiencies prior to the final acceptance of the project from the joint, wasted, and replace at no additional cost to the Government. Obtain approval for each joint seal installation.

3.7 ACCEPTANCE

Reject sealer that fails to cure properly, or fails to bond to joint walls, or reverts to the uncured state, or fails in cohesion, or shows excessive air voids, blisters, surface defects, swelling, or other deficiencies, or is not properly recessed within indicated tolerances. Remove rejected sealer and reclean and reseal joints. Perform removal and reseal work promptly by and at the expense of the Contractor.

3.8 CLEAN-UP

Upon completion of the project, remove unused materials from the site and leave the pavement in a clean condition.

-- End of Section --