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FEDERAL SPECIFICATION

SEALANTS, JOINT, TWO-COMPONENT, JET-BLAST-RESISTANT, COLD-APPLIED, FOR PORTLAND CEMENT CONCRETE PAVEMENT

This specification was approved by the Assistant Administrator, Office of Federal Supply and Services, General Services Administration, for the use of all Federal agencies.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers two types of two-component, elastomeric, cold-applied, jet-fuel- and jet-blast-resistant sealing compounds for use in sealing joints and cracks in portland cement concrete pavement. Certain sealants require a primer to produce satisfactory adhesion (see 3.2.3). Machine application will require specialized equipment designated for the specific formulation, for satisfactory application (see 3.3.1).

1.2 Classification. The sealants shall be of the following types (see 6.2):

Type M - Machine application, fast curing
Type H - Hand mixed, retarded cure

2. APPLICABLE DOCUMENTS

2.1 The following documents, of the issues in affect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein.

Federal Specifications

PPP-B-601 - Boxes, Wood, Cleated-Plywood
PPP-C-96 - Cans, Metal, 28 Gauge and Lighter
PPP-P-704 - Pails, Metal: (Shipping, Steel, 1 Through 12 Gallons)

Federal Standards

FED-STD-123 - Marking for Shipment (Civil Agencies)
FED-STD-313 - Material Safety Data Sheets Preparation and the Submission of

(Activities outside the Federal Government may obtain copies of Federal specifications, standards, and commercial item descriptions as outlined under General Information in the Index of Federal Specifications, Standards, and Commercial Item Descriptions. The Index, which includes cumulative bimonthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

(Single copies of this specification and other Federal specifications and commercial item descriptions required by activities outside the Federal Government for bidding purposes are available without charge from General Services Administration Business Service Centers in Boston, MA; New York, NY; Philadelphia, PA; Washington, DC; Atlanta, GA; Chicago, IL; Kansas City, MO; Fort Worth, TX; Houston, TX; Denver, CO; San Francisco, CA; Los Angeles, CA; and Seattle, WA.

(Federal Government activities may obtain copies of Federal Specification documents, and the Index of Federal Specifications, Standards, and Commercial Item Descriptions from established distribution points in their agencies.)

Military Standards

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes
MIL-STD-129 - Marking for Shipment and Storage
MIL-STD-147 - Palletized Unit Loads

(Copies of military specifications and standards required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

Federal Regulations

29 CFR 1900-1999 - Occupational Safety and Health Administration (OSHA), Department of Labor

(The Code of Federal Regulations (CFR) and the Federal Register (FR) are for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402. When indicated, reprints of certain regulations may be obtained from the Federal agency responsible for issuance thereof.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless a specific issue is identified, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials (ASTM)

C33 - Concrete Aggregates
C150 - Portland Cement
Cl92 - Making and Curing Concrete Test Specimens in the Laboratory, Method of

C220 - Flat Asbestos-Cement Sheets
D140 - Sampling Bituminous Materials, Methods of
D217 - Cone Penetration of Lubricating Grease, Test Methods for
D471 - Rubber Property - Effect of Liquids, Test Method for
D714 - Evaluating Degree of Blistering of Paints, Method of
D1475 - Density of Paint, Varnish, Lacquer, and Related Products, Test Method for
D2393B.- Viscosity of Epoxy Resins and Related Components, Test Method for
G23 - Operating Light-Exposure Apparatus (Carbon-Arc Type) With and Without Water for Exposure of Nonmetallic Materials, Practice for

(Application for copies should be addressed to the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.)

Technical Association of the Pulp and Paper Industry

T431 om - Ink Absorbency of Blotting Paper

(Application for copies should be addressed to the Technical Association of the Pulp and Paper Industry, Technology Park/Atlanta, P.O. Box 105113, Atlanta, GA 30348.)

(Industry association specifications and standards are generally available for reference from libraries. They are also distributed among technical groups and using Federal agencies.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence.

3. REQUIREMENTS

3.1 Description. The sealant shall be a combination of two component materials, a base and a curing agent. Unless otherwise specified (see 6.2), the mixture of the materials shall be black. The mixture shall cure to form a resilient and adhesive elastomeric compound which is resistant to the solvent action of jet fuel and lubricating oils, and to the direct heat and blast of aircraft engines. The sealant shall effectively seal joints and cracks in pavements against the infiltration of moisture and jet fuel throughout repeated cycles of expansion and contraction, and shall not flow from the joints or be picked up by pneumatic tires at in-place joint seal temperatures of 60 degrees Celsius (°C) (140 degrees Fahrenheit (°F)) or below. The mixed material shall have a uniform application or pouring consistency suitable for completely filling the joint without inclusion of blisters, bubbles, or discontinuities. Material shall be applicable at ambient temperatures of 4°C (40°F) and above. When material is applied at ambient temperatures of 16°C (60°F) and above, it shall cure to permit traffic on the pavement within 3 hours after application of type M, or 12 hours after application of type H, without wheel pickup.

3.2 Material.

3.2.1 Component A (curing agent). Component A shall activate the polymer system to end point when mixed with component B at the ratio, conditions, and curing time as specified herein for the applicable type. Component A shall be a homogeneous mixture of curing agent(s) with accelerators, plasticizers, gelling agents (thixotropes), and fillers, as required.

3.2.2 Component B (base resin). Component B shall be a homogeneous mixture of polymer and filler, with activators, plasticizers, gelling agents (thixotropes), pigments, and extenders, as required.

3.2.3 Primer. When a primer is recommended by the manufacturer for a specific surface, al.1 tests and applications concerning adhesion shall include the primer, applied in accordance with instructions provided by the manufacturer. Primers shall be formulated to cure in not more than 1 hour, and shall remain active for not less than 4 hours after application. Primers shall function effectively at the material application temperatures specified in 3.1.

3.3 Types.

3.3.1 Type M sealant (fast curing). Type M sealant shall conform to the following requirements:

a. Sealant shall be formulated for application with pressurized mixing and extruding equipment specified by make and model number (see 5.3.3.2 and 6.2). The equipment shall deliver the components in the required ratio plus or minus 5 percent variation.
b. Mixing ratio: Component A and component B shall be supplied in preproportioned containers, in a volume ratio of 1:1.
c. The viscosity of component A and component B each shall not exceed 200 Pascal seconds (Pa-s) (200,000 centipoise (cP)), when tested as specified 4.4.3.1.
d. Working life of the homogeneous mixture of sealant shall be formulated for time duration allowing use of the specified equipment (see 3.3.1a) to mix and extrude the material and to seal a prepared concrete joint, with performance properties as specified herein (see 4.4.3.2.1).
e. The tack-free time shall not exceed 3 hours after application, when the sealant is tested as specified in 4.4.4.

3.3.2 Type H sealant (retarded cure). Type H sealant shall conform to the following requirements:

a. The sealant shall be formulated for manual slow-speed electric or air-driven mixing, and pouring or extruding application.
b. Mixing ratio: Component A and component B shall be supplied in preproportioned containers.
c. The viscosity of component A and component B each shall not exceed 150 Pa.s (150,000 cP), when tested as specified in 4.4.3.1.

d. The working life of the homogeneous mixture of sealant shall be not less than 3 hours after mixing, as evidenced by viscosity not exceeding 200 Pa-s (200,000 cP), when tested as specified in 4.4.3.2.2.
e. The tack-free time shall not exceed 12 hours after application, when tested as specified in 4.4.4.

3.4 Performance.

3.4.1 Accelerated aging. Component A, component B, and primer as applicable, shall undergo no visual or physical change during accelerated aging in sealed containers, when tested as specified in 4.4.5.

3.4.2 Self-leveling. The sealant, extruded or poured into a joint on a level plane, shall flow to a variation of the surface not greater than 3.2 millimeters (mm) (0.125 inch), and when extruded into a joint on a 1.5 percent incline, shall limit flow to a depth variation not greater than 1.6 mm (0.063 inch), when tested as specified in 4.4.6.

3.4.3 Change in mass by fuel immersion. The change in dry mass of the sealant after fuel immersion for 24 hours at 49°C (120°F) shall not exceed 2.0 percent, and there shall be no apparent defects that will affect the material as a sealant, when the sealant is tested as specified in 4.4.7.

3.4.4 Change in volume on exposure to elevated temperature. The change in volume of the sealant when exposed to 70°C (158°F) for 168 hours shall not exceed 5.0 percent, when the sealant is tested as specified in 4.4.8.

3.4.5 Resilience. Recovery shall be a minimum of 75.0 percent, when the sealant is tested as specified in 4.4.9. The initial penetration shall not exceed 2.0 mm (0.079 inch) and shall not be less than 0.5 mm (0.020 inch).

3.4.6 Artificial weathering. Sealant exposed to 160 hours of artificial weathering shall not show surface softening, presence of an oil-like film, reversion to a mastic-like substance, formation of surface blisters exceeding the specified size and density, or an average change in volume exceeding 5.0 percent, when tested and examined as specified in 4.4.10.

3.4.7 Bond to concrete. None of the specimens shall develop any surface checking or crazing, crack, separation, or other opening in the sealant, or between the sealant and the concrete blocks, and there shall be no surface hardening or loss of resilient, rubber-like characteristics in the sealant, when the sealant is tested as specified in 4.4.11.

3.4.8 Flame resistance. The sealant shall not show any evidence of ignition, support of combustion, hardening or loss of flexibility, flow, or separation during heat exposure, or upon examination after cooling, or any separation or loss of adhesive strength between sealant and concrete blocks, when exposed to 260°C (500°F) for 120 seconds, when tested as specified in 4.4.12.

3.4.9 Flow. The sealant shall show no evidence of cracking, sag, or dimensional change, after 5 hours of exposure to 93°C (200°F), when tested as specified in 4.4.13.

3.4.10 Storage stability. When specified (see 6.2), the Government will retain samples for verification of these requirements: The sealant materials, when stored in full, tightly closed containers for 6 months from the date of delivery, at temperatures from 16 to 38°C (60 to 100°F), away from direct sunlight and weather exposure, and tested in accordance with this specification, shall meet all of the requirements herein.

3.5 Toxicity. The material shall have no adverse effect on the health of personnel when used for its intended purpose. Questions pertinent to this effect shall be referred by the acquiring activity to the appropriate medical service who will act as advisor to the acquiring activity. The manufacturer's instructions shall provide personnel protection to meet OSHA requirements, including 29 CFR 1910.1000, 1910.1001, and 1910.1002, as applicable (see 4.5).

3.6 Material Safety Data Sheets (MSDS). MSDS shall be prepared in accordance with FED-STD-313 and submitted as directed in the contract or order at the time of acquisition award (see 6.2, 6.3, and 6.5).

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 Material inspection. The contractor is responsible for insuring that supplies and materials are inspected for compliance with all the requirements specified herein and in applicable referenced documents.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. Quality conformance inspection (see 4.2.1).
b. Inspection for preparation for delivery (see 4.6).

4.2.1 Quality conformance inspection. The quality conformance inspection shall be as specified in 4.4. Sampling shall be in accordance with 4.3.

4.3 Sampling. Unless otherwise specified (see 6.2), samples for testing shall be taken at the point of manufacture in accordance with ASTM D140. It shall be the responsibility of the contractor to determine that the samples taken are representative of the batches proposed for shipment. Samples shall not be composited, either within batch or between batches, and each batch shall be tested. Representative samples of the sealant shall consist of not

leas than 11.4 cubic decimeters (dm^3) (3 gallons) of each component, and 0.95 dm^3(1 quart) primer as applicable, from each batch. Sample identification shall include the name of the testing agency, contract or purchase order number, and special marking as specified in 5.3.3.

4.4 Testing. Testing shall be conducted at a Government-approved facility (see 6.2). Samples taken as specified in 4.3 shall be tested as specified in 4.4.1 through 4.4.13. Individual test values, and results of failure analyses of individual specimens, shall be recorded. Failure of the sealant to pass any test shall be cause for rejection of the lot.

4.4.1 Standard conditions. Laboratory atmospheric conditions, hereinafter referred to as standard conditions, shall be 23 ± 2°C (73 ±+ 4°F) temperature and 50 ± 5 percent relative humidity. Specimens shall be stored and tested *at* standard conditions unless otherwise specified.

4.4.2 Specimen preparation.

4.4.2.1 Mixing.

4.4.2.1.1 Type M sealant. For test purposes, mix type M sealant in the proportioned ratio under conditions typical of conditions encountered in pressurized extruding equipment as specified (see 3.3.1).

4.4.2.1.2 Type H sealant. Mix type H sealant in the proportioned ratio, at standard atmospheric conditions, in accordance with manufacturer's instructions (see 3.3.2).

4.4.2.2 Pouring. Pour or extrude the test material as applicable into cylindrical specimen containers of the sizes and configurations listed below see 6.6.1). Make and record tare weights of the containers when weighed specimens are required. Measure and record volumes displaced by container walls when specimen volumes are required.

a. 44-cubic-centimeter (cc) (1.5-ounce) specimens: 38 mm (1.5 inches) minimum in diameter with 36 mm (1.4 inches) depth, or to a maximum of 44 mm (1.7 inches) in diameter with 28 mm (1.1 inches) depth. (Five specimens required, for change in volume and artificial weathering, as specified in 4.4.8 and 4.4.10, respectively.)
b. 89-cc (3-ounce) specimens, 54 mm (2.1 inches) in diameter and 35 mm (1.4 inches) in depth. (Two specimens required for change in mass, as specified in 4.4.7.)
c. 177-CC (6-ounce) specimens, 70 mm (2.8 inches) in diameter and 48 mm (1.9 inches) in depth. (Two specimens required for resilience, as specified in 4.4.9.)

Clean containers for test specimens with residue-free solvent (isopropyl or denatured alcohol) and dry with a clean cloth. Pour or extrude the test material into containers from the bottom up, overfilling, and immediately striking off the excess with a spatula, leaving containers level full. Wipe container exteriors for change in volume and change in mass specimens free of contaminating material after curing. In addition, prepare specimens for tack-free time, self-leveling, artificial weathering, and flow tests as

specified in 4.4.4, 4.4.6, 4.4.10, and 4.4.13, respectively. Prepare nine specimens for concrete bond and flame resistance as specified in 4.4.11 and 4.4.12.

4.4.2.3 Curing. Unless otherwise specified herein, cure specimens at standard conditions: For type M, 24 hours, and for type H, 48 hours; except that, at the discretion of the testing agency, to allow for coordination of tests within the normal work-span, up to an additional 24 hours may be allowed before initiation of tests for either type, except as specified in 4.4.9.1. Initiate test procedures within the above time references for curing, and carry through directly within the time specified for each test method.

4.4.3 Viscosity and work life.

4.4.3.1 Viscosity. Test the viscosities of liquid components A and B in accordance with ASTM D2393, at a test temperature of 23.0 ± 0.1°C (73.4 ± 0.2°F), to determine conformance to 3.3.1c and 3.3.2c.

4.4.3.2 Work life.

4.4.3.2.1 Type M sealant. Type M sealant work life shall be formulated in accordance with the requirements of the specified application equipment (see 3.3.1d).

4.4.3.2.2 Type H sealant. Determine type H sealant work life by extending the viscosity test (see 4.4.3.1) for a specimen of newly mixed sealant (see 4.4.2.1.2) placed on a nonconducting surface. Three hours after mixing, run the viscosity test at the temperature of the mix, for not less than 2 minutes before reading, to determine conformance to 3.3.2d.

4.4.4 Tack-free time. Prepare a specimen 100 by 38 by 6 mm (4 by 1.5 by 0.25 inches), using a metal or polyethylene mold, and a base plate approximately 75 by 150 mm (3 by 6 inches), 16 to 24 gage (see 3.2.3). Fill the mold with sealant prepared as specified in 4.4.2, and immediately strike off with a spatula. After curing at standard conditions for 3 hours for type M, or 12 hours for type H, as applicable, load a 150- by 25- by 0.1 ± 0.025-mm (6- by l- by 0.004 + 0.001-inches) polyethylene film for 30 seconds on the top surface of the sealant, using a metal plate approximately 41 by 29 mm (1.6-by 1.1 inches), with not less than 30 or more than 31 grams (g) mass. Remove the plate, and withdraw the film, uniformly and progressively, at right angles to the surface of the sealant. Sealant adhering to the polyethylene film shall constitute failure to conform to the requirements specified in 3.3.1e and 3.3.2e.

4.4.5 Accelerated aging. Expose sealed containers of component A, component B, and primer as applicable, to a temperature of 49 ± 1°C (120 ± 2°F) for 21 days ± 4 hours, and then allow the material to reach thermal equilibrium at standard conditions. Visual evidence of settling, separating, or hardening, that will not return to a homogeneous liquid by simple stirring, or skinning greater than 1.6 mm (0.063 inch) thick shall constitute failure to conform to the requirements of 3.4.1.

4.4.6 Self-leveling.

4.4.6.1 Specimens. Use two types of specimen molds:

a. Mold A, a channel having both ends closed and inside dimensions of 12.7 mm (0.5 inch) wide, 25 mm (1.0 inch) deep, and 305 mm (12 inches) long. The channel may be made of not less than 3.2 mm (0.125 inch) thick aluminum stock, steel, or plastic.
b. Mold B, a channel as described for mold A above, but so constructed as to enable positioning the longitudinal base on a 1.5 percent slope with a level plane.

4.4.6.2 Procedure. Clean the specimen molds with a detergent, followed with a nonresidue solvent.

a. For type M sealant, fill mold A with material extruded into the mold at an acute angle with the bottom plane to within 6 mm (0.25 inch) of the top. Fill in a single pass of the nozzle, while the mold is on a horizontal plane, at a speed which will not envelop the nozzle in the mold with sealant. For type H sealant, pour material into mold A at its center point, and allow material to flow freely to within 6 mm of the top. After curing the prepared specimen for 24 hours at standard conditions, determine the difference in height of the sealant on a transverse plane at the quarter points on the longitudinal axis. An average difference in height on any transverse plane greater than 3.2 mm (0.125 inch) shall constitute failure to conform to the requirements of 3.4.2.
b. Overfill mold B with sealant, type as applicable, and immediately strike off level full with a knife edge. Within 60 seconds after filling, and with a minimum of vibration, position the mold to provide the 1.5 percent slope on the 305-mm dimension. Cure 24 hours at standard conditions, then examine the specimen for flow. A change in depth of the sealant at either end of the channel cross-section greater than 1.6 mm (0.063 inch) shall constitute failure to conform to the requirements of 3.4.2.

4.4.7 Change in mass by fuel immersion. Prepare specimens as specified in 4.4.2. in tared containers. and determine the mass to the nearest 0.01 g. Immerse specimens for 24 ± 0.25 hours in 500 cc (16.9 ounces) each of clean test fuel maintained at 49 + 1°C (120 + 2°F). The container for the test fuel and specimens shall have a 3.2-mm (0.125-inch) round hole cut in the lid to eliminate pressure buildup. More than one specimen of the same manufacturer's material may be immersed in the same container, provided the volume of test fuel per specimen is maintained at 500 cc. The container shall be deep enough to provide a minimum of 12.7 mm (0.5 inch) of test fuel covering the surface of the specimens. Use a covered constant-temperature water bath to maintain the container, test fuel, and specimens at the required temperature. The test fuel shall be a 70 percent isooctane/30 percent toluene composition, by volume, Conforming to the requirements of ASTM Reference Fuel B of ASTM D471 (see 6.6.2). Immediately after the 24-hour immersion period, dry the specimens for 1 hour under a 300-mm (12-inch) diameter electric fan, placed to provide an air speed of 0.76 to 2.54 meters per second (m/s) (150 to 500 feet

per minute (fpm)) over the surface of the specimens. Redetermine specimen masses. Report percent, plus or minus, change in net mass, and result of visual examination, to determine conformance of each specimen to the requirements of 3.4.3.

4.4.8 Change in volume on exposure to elevated temperature. Prepare three specimens as specified in 4.4.2. Before filling the containers, determine the volume displaced by the walls of each container and record. Make volume measurements, with a weight-per-gallon cup, as specified in ASTM D1475 (see 6.6.3), except as specified herein. Maintain the contant-temperature bath, for conditioning the cup, specimen, and distilled water prior to measurements of mass, at 25 + 0.1°C (77 + 0.2-F). Condition specimens for 1 hour just prior to measurement of mass. Make volume and mass measurements as required to determine the volume of each specimen, calculated as follows:

Volume of specimen = A - (C - B) - D

where :

A = volume of weight-per-gallon cup
B = mass of cup with specimen
C = mass of cup with specimen, filled with distilled water
D = volume of walls of specimen container,

assuming 1 cc of distilled water at standard conditions has a mass of 1 g. Expose the measured specimens at 70 + 1°C (158 ± 2°F) in a forced draft oven for 168 ± 2 hours. Cool specimens in air 1 hour at standard conditions, followed-by 1 hour in the constant-temperature bath, just prior to remeasurement. Report the average of the percent change in volume of the specimens, and whether plus or minus, to determine conformance to the requirement of 3.4.4.

4.4.9 Resilience.

4.4.9.1 Specimen preparation. Prepare duplicate specimens as specified in 4.4.2, except cure the specimens for 24 hours for type M, or 48 hours for type H, at standard conditions prior to testing. Oven-age one specimen in a forced-draft oven at 70 ± 1°C (158 + 2°F) for 168 ± 2 hours, cool under standard conditions for 1 hour, and-then condition for 1 hour in a water bath maintained at 25 ± 0.3°C (77 ± 0.5°F) prior to testing. Condition the unaged specimen for 1 hour in a water bath maintained at 25 ± 0.3°C prior to testing.

4.4.9.2 Procedure. Use a penetrometer as specified in ASTM D217, substituting the ball penetration tool of figure 1 for the needle. Lightly dust the surface of the specimen with talc and immediately remove the excess by blowing. Place the ball in contact with the surface of the specimen and set- the indicating dial to zero. Position a light so that initial contact of the ball with the surface of the specimen can be observed readily. Release the ball penetration tool, allow it to penetrate the specimen for 5 seconds, and record the reading as penetration (P) in tenth-millimeter units. Without returning the dial pointer to zero, press the ball penetration tool down an additional 100 units (i.e., to a reading of P + 100) at a uniform rate in 10 seconds. Re-engage the clutch to hold the tool down for an additional

5 seconds and during this time return the dial to zero. Release the clutch, allow the specimen to recover for 20 seconds, and record the final dial reading (F). Make determinations at three points equally spaced from each other and not less than 13 mm (0.5 inch) from the container rim. Calculate the recovery, a measure of resilience, as follows:

Recovery, percent = P + 100 - F

Report averages of three determinations of recovery, and three determinations of initial penetration, for each specimen. Determine conformance to the requirements of 3.4.5.

4.4.10 Artificial weathering.

4.4.10.1 Equipment, Use a weatherometer conforming to ASTM G23, Type D.

4.4.10.2 Specimens. Prepare two types of specimens, in duplicate:

a. Panel specimens of the dimensions described in 4.4.4, but with 4.8-ass (0.19-inch) asbestos-cement composition base plates conforming, to ASTM C220, Type U (see 3.2.3).
b. The 44-&c containerized specimens prepared for this test in 4.4.2. Measure these specimens for volume change by the volume measurement procedure of 4.4.8.

4.4.10.3 Procedure. Expose both sets of specimens to artificial weathering in accordance with ASTM G23, except that the black-panel temperature shall be 140 ± 5°F. the 44-cc containerized specimens shall not be inverted at the end of each day's test cycle, and the daily test cycle shall be as follows:

Test condition	Exposure
Exposure, light only	51 minutes
Exposure, light with water spray	9 minutes
Total period	60 minutes
Periods per day	20 hours, minimum
Total exposure	160 hours

4.4.10.4 Results. On completion of each 20 hours exposure in the weatherometer. examine all test specimens immediately, while specimens are at approximately weatherometer exposure temperature, and make appropriate notes regarding any changes observed. In addition to visual examination, only light finger touch may be used for the 20-hour periodic examination. On completion of the 160-hour exposure, while the specimens are still at approximately the weatherometer chamber temperature, examine the panel test specimens in a detailed manner for indication or presence of breakdown of cure, lack of cure, or any blistering. Make the volume remeasurement on the exposed containerized specimens for volume change determination (see 4.4.8).

4.4.10.5 Failure criteria. Evidence of any of the following shall constitute failure to conform to the requirements of 3.4.6:

a. Breakdown of cure or lack of cure as evidenced by softening at the surface, presence of an oil-like film, or reversion to a mastic-like substance.

b. Any blistering such as formation of surface bubbles or deformities, either intact or broken, which are or may have been greater than "Blister Size No. 2" and classed as 'Medium Dense" in accordance with ASTM D714.

c. Inability to meet the change in volume requirement.

4.4.11 Bond to concrete.

4.4.11.1 Extension machine. The extension machine used in the bond test shall be so designed that the specimen can be maintained at the test temperature while being extended at a uniform rate as specified. It shall consist essentially of one or more screws rotated by an electric motor through suitable gear reductions. Self-alining plates or grips, one of each pair fixed and the other carried by the rotating screw or screws, shall be provided for holding the test specimen in position during the test.

4.4.11.2 Concrete block preparation. Prepared blocks are available (see 6.6.4).

4.4.11.2.1 Materials. Use aggregate conforming to ASTM C33 except as specified herein. Use aggregate grading specified in table I, with coarse aggregate consisting of crushed limestone (+ 95 percent $CaC0_3$) having a water absorption of not more than 1.5 percent, with fine aggregate of crushed limestone manufactured from the same parent rock as the coarse aggregate, and with fine aggregate approximately 40 percent of the total aggregate solid volume. Use portland cement conforming to ASTM C150, Type II. Make a concrete mix with a water-cement ratio of 5.5 gallons of water per bag of cement, a cement factor of 6.0 ± 0.5 bags of cement per cubic yard of concrete, a slump of 64 ± 13 mm (2.5 ± 0.5 inches), and an air content of 5 ± 0.5 percent by addition of an air-entraining agent such as a neutralized thermoplastic resin (see 6.6.5), or equivalent. Use a 250 by 450- by 75-mm (lo- by 17.5- by 3-inch) metal mold, secured to a metal base plate to form a watertight assembly, and oiled with mineral oil before use.

TABLE f. Aggregate grading.

Type	Sieve size	Percent passing
Coarse aggregate	(19.0 mm) 3/4 inch	97 - 100
	(12.5 mm) 1/2 inch	63 - 69
	(9.5 mm) 3/8 inch	30 - 36
	(4.75 mm) No. 4	0 - 3
Fine aggregate	(4.75 mm) No. 4	100
	(2.36 mm) No. 8	82 - 88
	(1.18 mm No. 16	60 - 70
	(600 µm) No. 30	40 - 50
	(300 µm No. 50	16 - 26
	(150 µm) No. 100	5 - 9

4.4.11.2.2 Block preparation. Prepare and cure the blocks in accordance with ASTM Cl92 except as specified herein. Fill the mold to overflowing, vibrate externally 30 seconds, screed (level) to a smooth surface with a wooden float, and level off with a metal straightedge drawn across the top

with a sawing motion. Cure for not less than 14 days, then cut the block into 25- by 50- by 75-mm (l- by 2- by 3-inch) test blocks, using a 40 to 60 grit diamond saw blade at a peripheral speed of 50.8 ± 1.3 m/s (10,000 ± 250 fpm), cutting the face to be bonded in a vertical plane, and allowing vertical selvages of 1 inch or more for discard. While the blocks are still wet from the sawing operation, scrub the surfaces lightly with a stiff-bristle brush, under running water. Store the blocks under lime-saturated water maintained at standard-condition temperature. Stocks of prepared blocks may be stored under standard conditions indefinitely, but blocks shall be immersed in lime-saturated water for not less than 7 days prior to use.

4.4.11.3 Specimen preparation. Prepare nine bond test specimens (18 blocks) as follows: Remove blocks from the storage water individually, scrub the 50- by 70-mm (2- by 3-inch) faces lightly with a stiff-bristle brush, under running water, and resubmerge in fresh tap water until all blocks have been scrubbed. Remove all blocks from the water and lightly blot with an oil-free, soft, absorbent cloth or paper to remove all free surface water. Place the blocks, three each, with 50- by 75-mm faces down, centered and uniformly spaced 25 mm (1 inch) apart on sheets of blotting paper placed on a plane, solid, nonabsorbent surface. The sheets shall be approximately 100- by 240-mm (4- by 9.5-inch) rise, cut from material having a maximum absorption time of 28 seconds as measured by TAPPI T431 (see 6.6.6). Three blocks shall be placed on each sheet. At the end of 1 hour, prime the blocks as recommended by the manufacturer, when applicable (see 3.2.3). When a primer is used, allow the blocks to dry for an additional hour before assembling. At the end of the applicable drying period, assemble pairs of concrete blocks to provide test specimens. Complete setup and pour within 1 hour. Spacers and base plate shall be metal, with nonadherent, nonreactive surfaces. The metal surface shall be coated with a release agent, such as a thin, cured film of heat-stable silicone (see 6.6.7). or equivalent. Place spacer strips not less than 6.35 mm (0.25 inch) thick on a base plate to form an open space 12.7 mm (0.5 inch) wide and 50 mm long. Place pairs of the concrete blocks on the spacers so that the 25- by 75-mm faces are on the spacers, and the 50- by 75-mm faces which were against the blotting paper form the space to be filled with sealant. Space the blocks 12.7 ± 0.1 mm (0.500 ± 0.005 inch) apart with 12.7 ± 0.1 mm square by 75 mm long spacers. Corners may be slightly rounded, but discard spacers having a diagonal dimension of less than 16.51 mm (0.650 inch). Place these spacers at a distance from the ends of the blocks so that an opening 12.7 ± 0.1 by 50 mm by 50 mm (0.500 ± 0.005 by 2.0 by 2.0 inches) is formed. Clamps or other suitable means may be used to hold the blocks in position. Place a 63- by 75-mm (2.5- by 3-inch) metal template, 0.8 mm (0.03 inch) thick, with a 38- by 50-mm (1.5- by 2-inch) central opening, on top of the block forms so that a 12.7- by 50-mm portion of each block adjacent to the sealant cavity is exposed. Holding the template firmly, fill the forms with sealant from the bottom up, in a manner to exclude air pockets. Using the template as a guiding surface, strike off the overfill of sealant with the leading edge of a spatula, leaving the forms level full. Excess sealant, templates, and base plates shall not be removed prior to curing. Allow the specimens to cure as specified in 4.4.2.3, after which remove spacers, templates, and base plates, trim off excess sealant, and initiate testing.

4.4.11.4 Nonimmersed bond. Condition three bond test specimens, with spacers maintaining the 12.7-mm (0.500-inch) dimensions, at the test temperature, -29 ± 1°C (-20 + 2°F), with forced air circulation, for not less than 4 hours. Then extend the specimens 6.35 mm (0.25 inch) at a uniform rate of 3.18 mm (0.125 inch) per hour, while maintaining the specimens at the test temperature. Remove the specimens from the extension machine, reinsert the 12.7-mm spacers, and examine the specimens as described in 4.4.6.7. Then permit the specimens to return to the original dimensions at standard conditions, resting each specimen on one concrete block so that the weight of the top block recompresses the joint sealant. Three cycles of conditioning, extension, and recovery shall be completed within 5 days after the start of the first cycle, and shall constitute one complete test for nonimmersed bond (see 4.4.11.7). When initiation of the second or third cycle is delayed, store the specimens at the test temperature.

4.4.11.5 Fuel-immersed bond. Insert thinner, metal spacers between the concrete blocks of another three bond specimens, so that an opening of not less than 6.35 by 12.7 by 50 mm (0.25 by 0.5 by 2 inches) will be produced and maintained between the spacers and the sealant. Using the type containers and procedures described in 4.4.7 and the test fuel specified therein, immerse each specimen for 24 ± 0.25 hours in 500 cc (16.9 ounces) of the test fuel maintained at 49 ± 1°C (120 ± 2°F) by means of a covered constant-temperature water bath. Place the specimens with the concrete blocks in a horizontal position. Three specimens may be placed in one container, provided the fuel-to-specimen ratio is maintained. Clean fuel shall be used for each test. At the end of the 24-hour immersion period, condition the entire assembly of test specimens, fuel, and containers in an atmosphere at -29 ± 1°C C-20 ± 2°F) for 4 hours. Remove the test specimens from the fuel, remove the spacers, and conduct the extension test as specified in 4.4.11.4. Three cycles of immersion, conditioning, extension, and recovery shall constitute one complete test for fuel-immersed bond (see 4.4.11.7).

4.4.11.6 Water-immersed bond. Insert thinner spacers between the concrete blocks of the other three bond specimens, so that an opening of not less than 6.35 by 12.7 by 50 mm (0.25 by 0.5 by 2 inches) will be produced and maintained between the spacers and the sealant. Using covered containers deep enough to provide a minimum of 12.7 mm of water cover, immerse the specimens for 96 ± 1 hours in 500 cc (16.9 ounces) of distilled or deionized water per. specimen, and maintain at standard conditions. Place the specimens with the concrete blocks in a horizontal position. Three specimens may be placed in one container provided the water-to-specimen ratio is maintained. At the end of the 96-hour immersion period, remove the specimens from the water, remove the spacers, and remove the excess surface water from the specimens with a soft, dry, absorbent material. Subject the specimens to conditioning and extension test as specified in 4.4111.4. Three cycles of immersion, conditioning, extension, and recovery shall constitute one complete test for water-immersed bond (see 4.4.11.7).

4.4.11.7 Bond-test results. Remove the bond-test specimens from the extension machine within 30 minutes after the completion of the extension of each of the first two test cycles, and examine the specimens for obvious separations within the sealant and between the sealant and the blocks, without distorting or manually causing extensions of the specimens. Imediately upon

completion of the final extension, insert both sets of spacers, or otherwise maintain 50 percent extension during examination, and examine the specimens thoroughly, while still frozen, for separations between the sealant and the blocks, and within the sealant, including surface checking or crazing, crack, separation, or other opening in the sealant. This shall be accomplished without distorting the specimens, but after recovery as specified in 4.4.6.4, the specimens may be extended uniformly up to 6.35 mm (0.25 inch) to permit further detailed examination. Determine conformance to the full requirements of 3.4.7.

4.4.12 Flame resistance. Use a test specimen prepared as specified in 4.4.11 for the flame resistance test. One of the specimens passing the nonimmersed bond test may be used for this test.

4.4.12.1 Apparatus. Supply heat from a high temperature laboratory burner rated to supply 10,000 British thermal units per hour (see 6.6.8). Use an open-end cylinder of light gage metal, with a diameter of 127 mm (5 inches) and a height of 305 mm (12 inches), as a draft shield. Use a specimen support made as follows: Weld two 150-mm (6-inch) rods and two 51-mm (a-inch) rods from 3.2-mm (0.125-inch) steel stock to form a support across the draft cylinder with a rectangular center opening of 51 by 64 mm (2 by 2.5 inches). A secondary draft shield may be required to maintain the required temperature range at the top of the primary draft shield.

4.4.12.2 Procedure. Assemble the apparatus, using a tripod or similar support for the primary shield to place the top of the centered burner in the same plane as the bottom of the primary shield. With the specimen support centered on top of this shield, support a laboratory thermometer in a horizontal position, laid on the support with the bulb in the center. Regulate the burner to produce a thermometer reading of 260 ± 11°C (500 ± 20°F) for a 2 minute period. Substitute the specimen-for the thermometer, with the 25- by 75-mm (1- by)-inch) dimensions of the specimen blocks centered and parallel with, and resting on the long support rods. Apply the stabilized burner heat to the specimen for 120 ± 1 seconds. Observe the specimen for evidence of ignition, hardening, flow, or separation. Remove the burner at the end of the 120-second exposure, allowing the specimen to remain on the support to cool to room temperature. Examine the specimen, and determine conformance to the requirements of 3.4.8.

4.4.13 Flow.

4.4.13.1 Specimen preparation. Prepare duplicate specimens in molds 40 by 60 by 3.2 mm (1.56 by 2.34 by 0.125 inches) deep, placed on a bright tin panel (see 3.2.3). The release molds shall have nonadherent, nonreactive surfaces (see 4.4.11.3). Fill the molds with excess material and trim flush with the face of the molds prior to cure.

4.4.13.2 Test. Remove the molds and mark reference lines across the panels coincident with the transverse edges of the specimens. Mount the specimens, with the long axis at an angle of 75 + 1° with the horizontal, and the transverse axis horizontal, in a forced-draft oven maintained at 93.3 ± 2.8°C (200 ± 5°F). After 5 hours, remove the specimens and mark another reference line on each specimen, coincident with the lowest point of

sag or flow, and parallel to the line directly above it. Examine for indicated change in length of the specimen, and other evidence of flow, to determine conformance to the requirements of 3.4.9.

4.5 Toxicological data and formulations. The manufacturer shall provide a listing of the components in the sealant that could be hazardous (see 5.3.3). Where precautions need to be taken relative to the inhaling of vapors, or skin and eve contact with materials, these precautions shall be included in the manufacturer's instructions (see 3.5 and 5.3.3.2).

4.6 Inspection for preparation for delivery.

4.6.1 Sampling. Sampling for inspection of filled containers shall be in accordance with MIL-STD-105, inspection level II. The unit of product shall be one unit prepared for shipment.

4.6.2 Examination. Each filled container selected shall be inspected for conformance to the requirements of section 5. Inspection shall be based on an Acceptable Quality Level of 2.5 percent defective.

5. Preparation for delivery.

5.1 Preservation and packaging. Preservation and packaging shall- be level A or C as specified (see 6.2).

5.1.1 Level A. Component A and component B shall be packaged separately in l- through 5-gallon metal pails conforming to PPP-P-704, type II, class 1, or, as required, smaller metal cans conforming to PPP-C-96, type V, class 2. The primer, when required, shall be packaged in metal cans conforming to PPP-C-96, type V, class 2, size as required. Cans and pails shall be color coded as follows: Component A containers shall be black; component B containers shall be gray or silver; cans of primer, when required, shall be red.

5.1.1.1 Two-gallon kits, type H. When specified (see 6.2), materials shall be packaged and color coded as specified in 5.1.1, with the quantities of component A and component B totaling 2 gallons, except that the larger quantity component shall be packaged in a 2-l/2-gallon pail.

5.1.2 Level C. Unless otherwise specified (see 6.2), the materials, in a 5-gallon quantities or less, shall be packaged and color coded as specified in 5.1.1. When specified (see 6.2), for larger quantity requirements for a specific project, materials may be packaged and color coded in larger size, single trip containers. Packaging shall comply with the rules and regulations applicable to the mode of transportation.

5.2 Packing. Packing shall be level A, B, or C as specified (see 6.2).

52.1 Level A.

5.2.1.1 Separate packing. The 5-gallon or smaller containers of type M materials, packaged as specified in 5.1.1, shall be packed in close-fitting boxes conforming to PPP-B-601, overseas type. Only like components shall be packed together. The contents shall be blocked and braced to prevent movement and damage to the contents.

5.2.1.2 Kits.

5.2.1.2.1 Ten-gallon kits, type M. Materials for a single kit of quantities of component A and component B totaling 10 gallons, and primer, when required, packaged as specified in 5.1.1, shall be packed as specified in 5.2.1.1.

5.2.1.2.2 Kits, type H.

5.2.1.2.2.1 Two-gallon kits. Materials for a single kit packaged as specified in 5.1.1.1, shall be packed as specified in 5.2.1.1.

5.2.1.2.2.2 Ten-gallon kits. Materials for a single kit of quantities of component A and component B totaling 10 gallons shall be packaged as specified in 5.1.1, placed within a 12-gallon pail conforming to PPP-P-704, type II class 7, but without a cover (it is possible that the top containers of material may extend above the rim of the pail), then packed as specified in 5.2.1.2.1.

5.2.2 Level B.

5.2.2-l Separate packing. Unless otherwise specified (see 6.2), the l- through 5-gallon containers of materials of like formulation, packaged as specified in 5.1, shall be palletized in accordance with MIL-STD-147, load type IV. Smaller containers, and primer when required, shall be packed as specified in 5.2.1.1 except that domestic type boxes shall be used. When specified (see 6.2), larger containers of material shall be palletized in accordance with the applicable load type of MIL-STD-147.

5.2.2.2 Kits, type M and type H. The materials shall be packed as specified in 5.2.1.2, except that domestic type boxes shall be used.

5.2.3 Level C. Materials shall be packed to insure carrier acceptance and safe delivery at destination in containers complying with the rules and regulations applicable to the mode of transportation.

5.3 Marking.

5.3.1 Civil agencies. Shipments to civil agencies shall be marked in accordance with FED-STD-123.

5.3.2 Military agencies. Shipments to military agencies shall be marked in accordance with MIL-STD-129.

5.3.3 Special marking. In addition to the marking of 5.3.1 or 5.3.2, and any special marking of the contract or order, the following information shall be shown on each can or pail:

a. Name of sealant
b. Identification of component, or primer
c. Specification number and type
d. Manufacturer's name
e. Manufacturer's lot and batch number

f. Date of manufacturer (month and year)
g. Shelf life retest date (month and year)
h. List of hazardous components (see 4.5)
i. Quantity of material in container (volume)
j. Storage instructions
k. Instructions for use

5.3.3.1 Storage instructions. Each container shall be clearly marked with the following instructions:

"Store and transport this material out of the weather, away from direct sunlight, and at temperatures not less than 16°C (60°F) nor more than 38°C (100°F)."

5.3.3.2 Instructions for use. Each container shall be clearly marked with the following instructions:

"Warning: When sealant is mixed, the entire quantities of components A and B in preproportioned containers shall be prepared as one batch. Partial containers of components A and B shall not be used. Any overmix shall be discarded."

In addition, the instructions for use shall include, but not be limited to: Ambient temperature and humidity ranges, and moisture conditions of joints, for successful installation; essential requirements for preparation of joints; equipment make and model number if machine applied (see 6.2); mixing, application, and disposal instructions; and any restrictions to be adhered to in order to reduce hazards to personnel or to the environment. If it is not feasible to include all instructions on the container without sacrificing legibility, the most important information shall be shown on the container and the full instructions referenced and furnished separately.

6. NOTES

6.1 Intended use. This sealant is intended for sealing joints and cracks in portland cement concrete pavements subject to spillage of jet fuels, and lubricating oils, and to the direct heat and blast of aircraft engines. Type M sealant shall have certification for application with equipment specified by make and model, in new or refinished airfields, utilizing a primer when specified by the manufacturer. Type M sealant should be purchased and stored for the specific project identified in the purchase order. Type H sealant is intended for use in manual application for general maintenance and repair, in cleaned joint surfaces, primed when specified by the manufacturer.

6.2 Ordering data. Purchasers shall select the preferred options and include the following information in the procurement documents:

a. Title, number, and date of this specification.
b. Type of sealant required (see 1.2).
c. Color of sealant when other than black is acceptable (see 3.1).
d. Equipment to be used for application of type M (see 3.3.1).
e. When stability samples are required, quantity to be retained, and by what activity (see 3.4.10 and 6.4).

f. Addressees for submission of MSDS (see 3.6 and 6.5).
g. Sampling, if other than specified (see 4.3).
h. Designation of Government-approved test facility (see 4.4).
i. Level of preservation and packaging and level of packing required (see 5.1 and 5.2).
j. When 2-gallon, type H kits shall be packaged as specified (see 5.1.1.1).
k. When level C packing is other than specified (see 5.1.2).
l. When palletization of 1- through 5-gallon containers is not required (see 5.2.2.1).
m. When palletization of large containers is required (see 5.2.2.1).

6.3 Data requirements. When this specification is used in an acquisition which incorporates a DD Form 1423, Contract Data Requirements List (CDRL) and invokes the provisions of paragraph 52.227-7031 of the Federal Acquisition Regulations (FAR), the data requirements will be developed as specified by an approved Data Item Description (DD Form 1664) and delivered in accordance with the approved CDRL (DD Form 1423) incorporated into the contract. When the provisions of FAR 52.227-7031 are not invoked, the data shall be delivered in accordance with the contract requirements (see 3.6).

6.4 Stability sampler. The date of delivery will be marked on samples submitted for stability testing (see 3.4.10).

6.5 MSDS submission and forwarding. MSDS copies will be forwarded to the designated Industrial Hygienist and the focal point of the activity that purchased the item, and the focal point of the using activity if different. After review and acceptance of MSDS by designated recipients, approved copies will be forwarded to arrive at destinations prior to material delivery (see 3.6).

6.6 Availability of testing materials and apparatus. Known suppliers of specified testing materials and apparatus are as follows:

6.6.1 Specimen containers. Cylindrical specimen containers, described as seamless ointment cans, as specified in 4.4.2.2: Ellisco Seamless Metal Cans, Style No. 22, Ellisco Inc., American & Luzerne Streets, Philadelphia, PA 19140-2690.

6.6.2 Reference fuel. Reference fuel as specified in 4.4.7: ASTM Reference Fuel B of ASTM D471, Phillips Petroleum Company, Customer Service Center, Drawer "O", Borger, TX 79007.

6.6.3 Weight-per-gallon cup Weight-per-gallon cups as specified in 4.4.8, including "featherweight" type: Paul N. Gardner Company, Inc., 218-D Commercial Blvd., Suite 205, Lauderdale-by-the-Sea, FL 33308-4491.

6.6.4 Concrete blocks. Blocks as specified in 4.4.11.2: U.S. Army Corps of Engineers, Missouri River Division Laboratory, 420 South 18th Street, Omaha, NE 68102.

6.6.5 Thermoplastic resin. A resin as specified in 4.4.11.2.1: Vinsol NVX resin, Hercules, Inc., Hercules Plaza, Wilmington, DE 19894.

6.6.6 Blotting paper. Paper as specified in 4.4.11.3: White Reliance Blotting Paper, Product Code 13-01-12, James River Paper Company, Inc., 145 James Way, Southampton, PA 18966.

6.6.7 Release agent. An agent as specified in 4.4.11.3: Dow Corning 20 release coating, Dow Corning Corporation, Midland, MI 48640.

6.6.8 Laboratory burner. A burner as specified in 4.4.12.1: Catalog No. 03-902, Fisher Scientific Company, 711 Forbes Avenue, Pittsburgh, PA 15219.

MILITARY INTERESTS :

Custodians

Army - ME
Navy - YD
Air Force - 99

Review Activities

Army - CE, MD, MR
Navy - MS

User Activity

Navy - MC

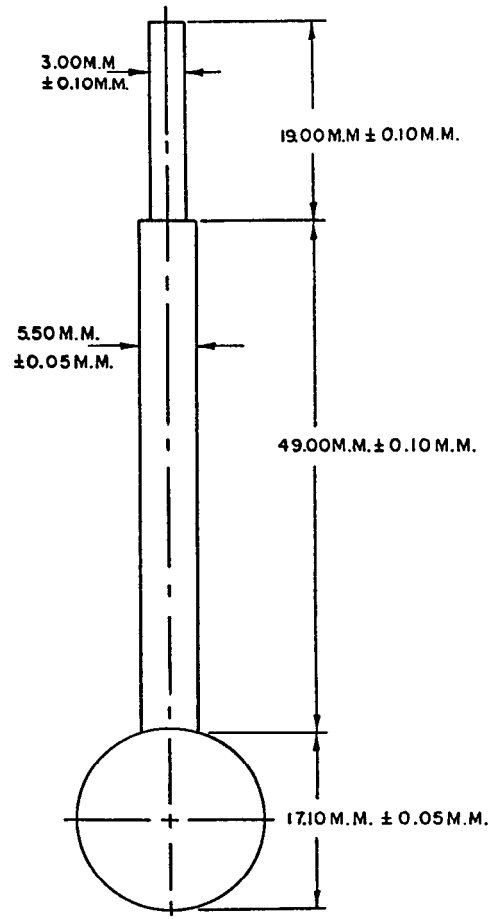
CIVIL AGENCY COORDINATING ACTIVITIES:

GSA - FSS
DOT - APM, NHT

PREPARING ACTIVITY:

Navv - YD

DOD project 8030-0422



NOTES:
MATERIAL: STEEL
TOOL WEIGHT: 27.50 GRAMS PLUS OR MINUS 0.10 GRAMS.
TOTAL WEIGHT ON SPECIMEN: 75.00 GRAMS PLUS OR MINUS 0.01 GRAM.

Figure 1 BALL PENETRATION TOOL

BX1590A

* US. GOVERNMENT PRINTING OFFICE: 1994-705-040/A4094

SS-S-2OOE
AMENDMENT-1
August 23, 1988

FEDERAL SPECIFICATION

SEALANTS, JOINT, TWO-COMPONENT, JET-BLAST-RESISTANT, COLD-APPLIED, FOR PORTLAND CEMENT CONCRETE PAVEMENT

This amendment, which forms a part of SS-S-200E, dated August 15, 1984, is approved by the Commissioner, Federal Supply Service. General Services Administration, for the use of all Federal agencies.

Page 3

Paragraph 2.2

DELETE: C220-Flat Asbestos-Cement Sheets

Page 11

Paragraph 4.4.10.2a

DELETE: Panel specimens of the dimensions described In 4.4.4, but with 4.8 millimeter (0.19-Inch) asbestos-cement composition base plates conforming to ASTM C220, Type U (see 3.2.3).

ADO: Panel specimens as described in 4.4.4. and primed when required (see 3.2.3).

PREPARING ACTIVITY:
Navy - YD

(000 project 8030-0609)

FSC 8030