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Fed. Spec. TT-S-227B,
October 12, 1964

INTERIM FEDERAL SPECIFICATION

SEALING COMPOUND: ELASTOMERIC TYPE, MULTI-COMPONENT (FOR CALKING, SEALING, AND GLAZING IN BUILDINGS AND OTHER STRUCTURES)

This Interim Federal Specification was developed by the National Bureau of Standards, Washington, D. C. 20234, based upon currently available technical information. It is recommended that Federal agencies use it in procurement and forward recommendations for changes to the preparing activity at the address shown above.

The General Services Administration has authorized the use of this Interim Federal Specification as a valid exception to Federal Specification TT-S-227B, dated October 12, 1964.

1. SCOPE AND CLASSIFICATION

1.1 Scope. This specification covers the properties of a multi-component cold-applied elastomeric type joint sealing compound (joint sealant), including curing agents, for sealing, calking, and glazing operations in buildings, building area (plazas, decks, pavements, etc.), and other types of construction.

1.2 Classification. The sealing compound shall be furnished in the following types and classes, as specified (see 6.2).

Type I - Flow, self-leveling.
Type II - Non-sag.

Class A - Compounds resistant to 50 percent total joint movement (includes Type I and Type II).[1]

Class B - Compounds resistant to 25 percent total movement (includes Type I and Type II).[1]

2. APPLICABLE DOCUMENTS

2.1 Specification and standards. The following specifications and standards, of the issues in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

Federal Specifications:

SS-R-406 - Road and Paving Materials: Methods of Sampling an Testing.
PPP-B-636 - Box, Fiberboard.
PPP-C-96 - Cans, Metal, 28 Gage and Lighter.
PPP-P-704 - Pails, Shipping, Steel (1 through 12 gallon).

[1] To clarify the meaning of 50 percent total joint movement, the following hypothetical examples are given:

If a building joint is filled on the hottest day of the year the maximum seasonal movement of 50 percent will occur in extension only and none in compression, beyond the original nominal joint width. Likewise if a joint is filled on the coldest day of the year, the maximum seasonal movement of 50 percent will occur in compression only and none in extension, i.e., beyond the original nominal with. At all other times of sealant installation there will be combination of extension and compression beyond the nominal width of the joint. The combinations might be extension, 25 percent - compression, 25 percent; extension, 35 percent - compression, 15 percent and so forth.

For Class B sealants the same explanation as given above applies, except that the anticipated total movement is 25 percent.

Federal Standards:

Fed. Std. No. 123 - Marking for Domestic Shipment (Civilian Agencies).
Fed. Test Method Std. No. 141 - Paint, Varnish, Lacquer and Related Materials: Methods of Inspection, Sampling, and Testing.
Fed. Test Method Std. No. 601 - Rubber: Sampling and Testing.

(Activities outside the Federal Government may obtain copies of Federal Specifications, Standards, and Handbooks as outlined under General Information in the Index of Federal Specifications and Standards, and at the prices indicated in the Index. The Index, which includes cumulative monthly supplements as issued, is for sale on a subscription basis by the Superintendent of Documents, U. S. Government Printing Office, Washington, D.C. 20402.)

(Single copies of this specification and other Federal specifications required by activities outside the Federal Government for bidding purposes are available without charge from Business Service Centers at the General Services Administration Regional Offices in Boston, New York, Washington, D.C., Atlanta, Chicago, Kansas City, Mo., Fort Worth, Denver, San Francisco, Los Angeles and Seattle, Washington.)

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from the 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.

(Copies of Military Specification 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.)

2.2 Other publications. The following documents from a part of this specification to the extent specified herein. Unless otherwise specified, the issues in effect on date of invitation for bids or request for proposal shall apply:

American Society for Testing and Materials (ASTM) Standards:

C-33 - Specifications for Concrete Aggregates.
C-150 - Specifications for Portland Cement.
C-510 - Method of Test for Staining and Color Change of One-or Two Part Joint Sealants.
D-1191 - Methods of Testing Concrete Joint Sealers.
D-2240 - Test for Indentation Hardness of Rubber and Plastics by Means of a Durometer.

(Copies of the above publications may be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.)

Uniform Classification Committee:

Uniform Freight Classification.

(Application for copies should be addressed to the Uniform Classification Committee, 202 Union Station, 516 West Jackson Boulevard, Chicago, Ill. 60606.)

National Classification Board:

National Motor Freight Classification.

(Application for copies should be addressed to the National Classification Board, 1616 P Street, N. W., Washington, D. C. 20036.)

3. REQUIREMENTS

3.1 Material. The sealing compound shall be furnished in two or more components, a base component with suitable reinforcing agents, liquid or paste curing agents and suitable extenders for on-the-job mixing. The resulting mixture shall be homogeneous and of proper consistency suitable for immediate application by hand or pressure calking gun, or by hand tool. The compound when completely cured shall form an elastomeric type solid capable of maintaining a seal against water, wind, and dirt.

3.2 Types and classes. The sealant shall be available in two types and two classes as follows:

Type I. (Self-leveling or flow) shall be a compound which has sufficient flow to give a smooth level surface when applied in a horizontal joint at 40 deg. F. (4 deg. C.).

Type II. (Non-sag) shall be a compound which permits application in joints on vertical surfaces without sagging (slumping) at temperatures between 40 deg. and 122 deg. F. (4 deg. and 50 deg. C.).

Class A. Compounds capable of resisting compression-extension cycling of plus and minus 25 percent of the nominal half joint width, as specified in the durability requirement (see 4.3.9.4.1).

Class B. Compounds capable of resisting compression-extension cycling of plus and minus 12-1/2 percent of the nominal half inch joint width, as specified in the durability requirement (see 4.3.9.4.2).

3.3 Stability. The base compound and curing agent shall be stable for at least 12 months from the time of delivery, when stored at a temperature not exceeding 80 deg. F. (26.7 deg. C.).

3.4 Toxicity. Under normal application conditions and adequate ventilation, the compound shall not be considered toxic.

3.5 Detail requirements.

3.5.1 Color. The color of the sealant, after curing 14 days at standard conditions of temperature and relative humidity (see 4.3.1) shall be any specific color agreed upon by the purchaser and supplier (see 6.2).

3.5.2 Rheological properties.

3.5.2.1 Type I (flow, self-leveling) compound. The flow of a properly prepared Type I compound shall be such that when tested as prescribed in 4.3.2.1 it shall exhibit a smooth level surface.

3.5.2.2 Type II (non-sag) compound. The flow of a properly prepared Type II compound shall be such that when tested as prescribed in 4.3.2.2 it shall not sag or flow more than 3/16 inch in vertical displacement. The compound shall show no deformation when tested as prescribed in 4.3.2.3.

3.5.3 Application life. A compound, when mixed as specified in 4.3.3.1 shall have an application life of not less than 3 hours when tested as prescribed in 4.3.3.1 or 4.3.3.2.

3.5.4 Hardness properties.

3.5.4.1 Hardness at standard conditions. A compound mixed as specified in

4.3.3.1 after 14 days cure shall show a hardness reading of not less than 15 nor more than 50 when tested with a Durometer, Type A2, instantaneous method, as prescribed in 4.3.4.1. For sealants specified for joints in horizontal walkways, pavements, decks, etc., the minimum hardness reading shall not be less than 35 nor more than 50.

3.5.4.2 Hardness after heat aging. A compound mixed as specified in 4.3.3.1 after 7 days cure at standard conditions followed by 21 days cure at 158 deg. +/- 3.6 deg. F. (70 deg. +/- 2 deg. C.), shall show a hardness reading of not more than 60 for Type I compounds and not more than 50 for Type II compounds when tested for indentation hardness as prescribed in 4.3.4.2.

3.5.5 Weight loss, cracking, and chalking after heat aging. A properly mixed compound shall not lose more than 10 percent of its original weight, nor shall it show any cracks or chalking after heat treatment at 158 deg. +/- 3.6 deg. F. (70 deg. +/- 2 deg. C.) when tested as prescribed in 4.3.5.

3.5.6 Tack-free time. A compound mixed as specified in 4.3.3.1 shall cure to a tack-free condition in not more than 72 hours from the time of mixing, when tested as prescribed in 4.3.6.

3.5.7 Stain and color change. A properly mixed compound shall not cause any visible stain on the top surface of a white cement mortar base when tested as prescribed in 4.3.7. The compound itself shall not show a degree of color change that is unacceptable to the purchaser when tested as prescribed in 4.3.7. Back-up material to be used with the sealant shall not cause any discoloration or staining of the sealant when tested as prescribed in 4.3.8.

3.5.8 Durability. When tested as prescribed in 4.3.9 with standard mortar, glass and aluminum, or any other specified substrate, the total loss in bond area and cohesion area and/or equivalent amount of sealant deformation among the 3 specimens tested (for each substrate), shall be no more than 1-1/2 square inches. The maximum loss for any single specimen shall be less than 1 square inch.

3.5.9 Adhesion-in-peel. When tested as prescribed in 4.3.10 with standard mortar, glass and aluminum or any other specified substrate, the peel strength for each individual test shall be not less than 5 pounds. In addition, the compound shall show no more than 25 percent adhesion loss for each individual test.

3.6 Adhesion in peel after ultraviolet radiation through glass. When tested as prescribed in 4.4 the requirements shall be the same as specified in 3.5.9.

3.7 Instructions. The proper mixing proportions, mixing equipment, as well as procedures for application, including the use of primers for specific substrates shall be included in the manufacturer's instructions.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements specified herein. Except as otherwise specified in the suppliers may utilize his own facilities or any commercial laboratory acceptable to 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 that supplies and services conform to the prescribed requirements.

4.2 Sampling and inspection should be in accordance with methods 1011, 1021, and/or 1031 of Fed. Test Method Std. No. 141, as applicable.

4.3 Laboratory tests.

4.3.1 Standard conditions for laboratory tests. The standard conditions of temperature and relative humidity referred to in the following sections are defined as 73.4 deg. +/- 3.6 deg. F. (23 deg. +/- 2 deg. C.) and 50 +/- 5 percent, respectively. The sealant sample shall be held in the unopened container for at least 24 hours at standard conditions before the laboratory tests are started.

4.3.2 Rheological properties.

4.3.2.1 Type I (flow, self-leveling compound). Apparatus and accessory materials required are: (1) Controlled temperature box 40 deg. +/- 3 deg. F. (4 deg. +/- 1.7 deg. C.) (2) Stainless steel channel (type 304, No. 2-B finish, approximately No. 16 gage) with inside dimensions 3/4 inch wide, 1/2 inch deep, 6 inches long and closed at both ends (fig. 1a). Clean the channel with methyl ethyl ketone or similar solvent followed by a thorough cleaning with a detergent solution, a final rinse with distilled or deionized water and air dried.[1] Before preparing the test assembly expose the compound under test in the unopened container (base and curing agent) for at least 24 hours at standard conditions. Using at least 100 grams of base compound and appropriate amount of curing agent (unmixed), condition for 16 to 24 hours and the channel for at least 2 hours in the cold box. Remove the compound and hand mix for 5 minutes. Return the mixed compound to the cold box for an additional 30 minutes. After the 30 minute period pour the

compound into the channel held horizontally in the cold box and maintain the specimen at this temperature for 4 hours. At the end of this period examine for flow properties.

4.3.2.2 Type II (non-sag) compound, Vertical slump. Apparatus and accessory materials required for this test for: (1) Oven, convention type, controlled at 122 deg. +/- 3 deg. F. (50 deg. +/- 2 deg. C.); (2) Cold box, controlled at 40 deg. +/- 3 deg. F. (4 deg. +/- 1.7 deg. C.); (3) Two stainless steel channels (type 304, 2-B finish, approximately No. 16 gage) with inside dimensions 3/4 inch wide, 1/2 inch deep, and 6 inches long with the top and open and the back surface extended 2 inches (fig. 1b). Before preparing the test assemblies clean channels as described in 4.3.2.1. Condition base compound at standard conditions as described in 4.3.2.1. Expose the channels with open ends for 2 hours, one in the cold box and oven. Immediately before removing the conditioned channels from the cold box and oven, hand mix at least 200 grams of base compound and appropriate amount of curing agent for 5 minutes. Remove channels from the respective chambers and fill them compound within 10 minutes. The channels shall be filled with a spatula and trimmed so that the sealant is flush with the face and ends of the channels. Return the filled channels to their respective chambers and set in a vertical position for 4 hours with the 2 inch extension at the base position. At the end of this period remove channels from the chambers and measure the sag at the lower ends to the nearest 1/16 inch. This is the distance that the bottom edge of the compound moves downward along the 2 inch extended back surface.

[1] Methyl ethyl ketone and similar solvents are both toxic and flammable and should be handled with caution in a well-ventilated hood.

4.3.2.3 Type II (non-sag) compound, horizontal slump. Repeat the procedure described in 4.3.2.2 with the following change: after filling the 2 channels return them to their respective chambers and set them in a horizontal position with the channels lying on the 1/2 inch side. At the end of the exposure period remove channels from the chambers and record any change in the configuration of compound in the channels.

4.3.3 Application life.

4.3.3.1 Type I (flow, self-leveling) compound. Accessory materials required are: (1) 6-ounce capacity air powered calking gun; (2) standard 6-ounce polyethylene cartridge with standard front opening (0.54 +/- .002 inch inside diameter); 50 psi air supply; (4) pint container; (5) timer with second hand. Place the unopened sample at standard conditions for at least 24 hours. At the end of the conditioning period mix about 400 grams of base compound and appropriate amount of curing agent for about 5 minutes. After mixing completely fill the 6 ounce cartridge with plunger in place. Set aside the filled cartridge in a vertical position at standard conditions for 3 hours. At the end of 3 hours with no nozzle added to the cartridge, gun out the compound at 50 psi into an empty pint container (fig. 2). Determine the time in seconds it takes to empty the cartridge. The compound meets the requirement for application life if the time required to empty the cartridge does not exceed 20 seconds.

4.3.3.2 Type II (non-sag compound). The test procedure is the same as that described in 4.3.3.1. The compound meets the requirement for 3 hours application life if the time required to empty the cartridge does not exceed 45 seconds.

4.3.4 Hardness property:

4.3.4.1 Hardness at standard conditions. Apparatus and materials required are: (1) Durometer, Model A2: (2) brass frame with inside dimensions 5 by 1-1/2 by 1/4 inch thick; (3) 2 aluminum plates 3 by 6 inch (16 to 24 gage); (4) thin knife blade; (5) metal straight edge. The instrument used to measure hardness is a Durometer model A2 described in Federal Test Method Standard No. 601, method 302 or ASTM D2240. All readings shall be taken by the instantaneous method, using a force of about 1300 grams (2.8 lbs). (To obtain precise readings, the use of a stand fitted with a Durometer to which a 822 gram weight is attached, is recommended. This results in an approximate total force of 1300 grams or 2.8 lbs on the indentor, see Fig. 3a). Procedure shall be carried out at standard conditions. After conditioning at least 250 grams of base compound and appropriate amount of curing agent for at least 24 hours at standard conditions, mix the components thoroughly for 5 minutes. Fill the frame, after centering it on the aluminum plate, with a portion of the sample and strike off flat with a metal straight-edge. Lift the frame from the sealant after running a thin blade along the inside of the frame (fig. 3a-A,B). Prepare two such specimens and cure them for 14 days at standard conditions. At the end of the 14 days take 3 hardness readings on each specimen at standard conditions. The average of 6 readings is the accepted value.

4.3.4.2 Hardness after heat aging. Apparatus and materials required: (1) forced draft oven controlled at 158 deg. +/- 3.6 deg. F. (70 deg. +/- 2 deg. C.); (2) Durometer, Model A2; (3) brass frame with inside dimensions, 5 by 1-1.2 by 3.8 inch thick; (4) 2 aluminum plates 3 by 6 inch (16 to 24 gage); (5) thin knife blade; (6) metal straightedge. Prepare 2 specimens as described in 4.3.4.1 except to make the thickness of the sealant layer 3/8 inch instead of 1/4 inch. Cure the specimens for 7 days at standard conditions followed by 21 days in the oven. At the end of the oven curing period allow the

specimens to cool at standard conditions for at least 1 hour. Cut 1/8 inch layer of sealant from half of the top surface of the specimen (fig. 3B-C). Take 3 hardness readings on the newly exposed surface of each specimen. The average of 6 readings is the accepted value.

4.3.5 Weight loss, cracking, and chalking after heat aging. Apparatus and materials required are: (1) forced draft oven controlled at 158 deg. +/- 3.6 deg. F (70 deg. + 2 deg. C.); (2) balance sensitive to 0.01 g.; (3) materials listed in 4.3.4.1. After weighing the aluminum plates to the nearest 0.01 gram, prepare 2 specimens as described in 4.3.4.1 and weigh specimens again. Expose specimens for 7 days at standard conditions. Following this exposure period, place specimens in the oven for an additional 21 days. At the end of the heat treatment allow the specimens to cool for 1 hour and weigh to the nearest 0.01 gram. Calculate the percentage weight loss of the compound based on the original net weight of the compound. The average weight loss, in percent, of the specimens in the accepted value. Examine the specimens for chalking and cracking.

4.3.6 Tack-free time. Accessory materials required are: (1) brass weight, 30 grams, approximately 1-5/8 by 1 by 1/8 inch; (2) 2 polyethylene strips (clear), approximately 4 by 0.004 +/- 0.002 inch; (3) materials listed in 4.3.4.1. Prepare 2 specimens as described in 4.3.4.1. After exposing the specimens at standard conditions for 72 hours, press the polyethylene film on the top surface with the brass weight (30 grams) for 30 seconds. Withdraw the film progressively at right angles to the compound (fig. 4). The sample meets the requirement if the film pulls off from each of the two specimens without any sealant adhering to it.

4.3.7 Stain and color change. Perform the test in accordance with ASTM Standard C-510. Figure 5 illustrates the steps in the preparation of the stain test specimens.

4.3.8 Stain and discoloration effects of back-up material on sealing compound. Apparatus and materials required are: (1) accelerated weathering machine as specified in ASTM Standard C-510; (2) three specimens prepared on aluminum plates (no mortar) as described in 4.3.4.1. Immediately after preparing the specimens press a 5-inch strip of the back-up material lengthwise into the center of the sealant of one of the specimens. Using a small spatula, cover completely any exposed back-up material with a thin layer of additional sealant. Allow the 3 specimens to cure for 7 days at standard conditions. At the end of the curing period place the specimen with the back-up material and one specimen without back-up material in the weathering machine for 100 hours (ASTM Standard C-510). Leave the third specimen at standard conditions. Remove specimens from weathering machine after the specified time and examine them for stain and discoloration and record results.

4.3.9 Durability (bond-cohesion).

4.3.9.1 Apparatus required. (1) Extension-compression machine, (b) cold box or chamber maintained at -15 deg. +/- 3 deg. F. (-26.1 deg. +/- 1.7 deg. C.); (c) forced draft over controlled at 158 deg. +/- 3.6 deg. F. (70 +/- 2 deg. C.). The machine used in this test shall be so designed that the test specimen can be automatically compressed or extended at a continuous rate of 1/8 inch per hour. For Class A sealants the compression shall be 25 percent of the nominal 1/2 inch joint width to 3/8 inch, and extension shall be 25 percent of the nominal 1/2 inch width to 5/8 inch. For Class B sealants the compression shall be 12-1/2 percent, to 7/16 inch and the extension to 9/16 inch. The machine may be similar to the one shown in fig. 6a, b, or the one described in SS-R-406 method 223.11, or in ASTM Standard D-1191, as shown in Fig. 6c. The machine should be equipped with grips of sufficient thickness to resist elastomeric sealants with high tensile strength.

4.3.9.2 Accessory materials. The standard accessory blocks and plates (substrates) used in the test are: (1) Portland cement mortar; (2) plate glass; (3) aluminum alloy.[1]

4.3.9.2.1 Mortar blocks. Cement mortar blocks, 1-by 1-by 3 inches shall be prepared as described in ASTM D-1191. The cement shall conform to Type III of the Specifications for Portland Cement (ASTM C-150). The sand (file aggregate) shall conform to the requirements of Specifications for Concrete Aggregate (ASTM C-33, Fine Aggregate). The exceptions to the requirements in ASTM D-119 are: (1) the blocks shall be 1-by 1-by 3 inches; (2) the blocks shall be surfaced by wet grinding on an iron lap with No. 60 silicon carbide or aluminum oxide grain.

4.3.9.2.2 Plate glass. Glass accessory plates shall be 1/4 by 1 by 3 inch water-white polished plate glass. Prior to use, the glass shall be cleaned as specified in 4.3.2.1 for steel channel.[2]

4.3.9.2.3 Aluminum. The aluminum plates shall be 1/4 by 1 by 3 inch aluminum alloy, 6063-T5 or 6061-T6 clear anodized a minimum of 20 minutes over a scale free finish. Prior to use the aluminum shall be cleaned as specified for the steel channel in 4.3.2.1.[3]

4.3.9.3 Preparation of test specimens. Prepare three test specimens for each accessory material that is used with the sample under test. After conditioning the unopened sample for at least 24 hours at standard conditions, mix for 5 minutes 250 grams of base compound with appropriate

amount of curing agent. Apply a bead of sealant 1/2 by 1/2 by 2 inches, between 7b, and 7c. Wood or metal spacer bars are used to form the proper size of bead. Polyethylene tape, paraffin, or any other suitable mold release agent is applied to the inside surfaces of the spacers to prevent adhesion of the spacers to the sealant, after cure. Adhesive tape, rubber bands, or clamps are used to hold the test assembly together before and after filling with the compound. In the case of a flow type compound, masking or any other suitable tape shall be used to retain the compound.

[1] Other substrates such as brick, cast stone, marble, stainless steel, etc. may be specified either in place of the standard materials, or in addition to them at the request of the purchaser.

[2] At the request of the sealant manufacturer the detergent cleaning step shall be omitted from the specified cleaning procedure.

[3] All non-porous substrate materials shall be cleaned as specified for the steel channel in 4.3.2.1, except as indicated in [2]. Porous accessory blocks, other than standard mortar, shall be dried and cleaned as specified for mortar in 4.3.9.2.1.

4.3.9.3.1 Primers. Substrate materials shall be primed with the manufacturer's recommended primer only when such primer is specified by the seller and agreed upon by the purchaser. Use of such primers including manufacturer's designation shall be included in the test report. When a primer shows staining or discoloration of the substrate beyond the primed area, such effects shall also be noted in the report.

4.3.9.4 Cycling procedure.

4.3.9.4.1 Class A sealants. Cure the test assemblies at standard conditions for 14 days. Following this curing period remove the spacers from the specimens and proceed as follows:

1. Immerse the specimens in distilled or deionized water for 7 days.[1]

2. Following the immersion period, remove specimens from water and hand-flex twice about 60 deg. to check bond and cohesion. If no failure occurs, compress the specimens 25 percent of the nominal half inch (to 3/8 inch) using a "C" clamp and 3/8 inch blocks to hold specimens in place. Place compressed specimens in the draft oven.

3. After the oven treatment, allow the specimens to cool to standard temperature and place them in a machine which automatically compresses the joints from the nominal 1/2 inch width to 3/8 inch and extends to joints to 5/8 inch in a continuous movement at the rate of 1/8 inch per hour (fig. 6a). A total number of 10 cycles shall be completed. One cycle is defined as follows: Compression from the nominal 1/2 inch width to 3/8 inch, followed by extension to 5/8 inch and then compression to 1/2 inch. At the completion of the 10 cycles extend the specimens (by hand crank) to 5/8 inch, insert blocks, remove specimens, and examine for bond and cohesion breaks (fig. 7e). If the specimens are rated as failure at this stage the Durability test is stopped.

4. The final portion of the Durability test consists of compressing the specimens to 3/8 inch (with "C" clamp) and while in compression are held in the oven for 16 to 20 hours. They are then removed from the oven, cooled to standard temperature, clamps and spacers removed, and placed in the extension machine located in the cold box or chamber. The specimens shall be extended to 5/8 inch while they are being cooled down to -15 deg. F.[2]. The rate of extension is 1/8 inch per hour. On completion of the extension the specimens are blocked at 5/8 inch, removed from freezer, and allowed to warm up to standard temperature. They are examined for bond and cohesion breaks as well as permanent deformation. The daily compression-extension cycles described in part 4 above are performed a minimum of 10 times or stopped at any time of failure as defined in 3.5.

4.3.9.4.2 Class B sealants. The test procedure is the same as that described in 4.3.9.4.1 with the following exceptions:

(a) All compression movements consist of 12 1/2 percent of the nominal half inch width, i.e., to 7/16 inch instead of 3/8 inch.

(b) All extension movements consist of 12 1/2 percent of the nominal half inch width, i.e., to 9/16 inch instead of 5/8 inch.

(c) Footnote 1 also applies to Class B sealants except that the joints shall be blocked at 9.16 inch during the water immersion period.

4.3.10 Adhesion in peel. This test is made on plate glass, anodized aluminum, and portland cement mortar[3] after the test specimens have been

cured for 21 days as specified herein. It is performed in a testing machine in which the sealant (sealed to cloth) is peeled back at an angle of 180 deg. at a separation rate of 2 inches per minute.

[1] If the sealant under test is specified for horizontal joints in a pavement, walkway, deck, mall, and so forth, the specimens shall be extended with 5/8 inch blocks and kept immersed for 7 days while in extension.

[2] Regardless of the amount of recovery of the sealant after the "C" clamps are removed, the jaws of the extension machine are set at 3/8 inch before extension is stared in the freezer. For Class B sealants the jaws shall be set at 7/16 inch.

[3] Other substrates such as precast stone, brick, marble, steel, etc. shall be used in the test in place of or in addition to the standard materials when requested by the purchaser.

4.3.10.1 Apparatus and accessory materials required are: (1) testing machine with tension grips capable of pulling at a rate of separation of 2 inches per minute with a dial or chart indicator calibrated in 1-pound units; (2) two 6 by 3 inch pieces of anodized aluminum (same type as described in section 4.3.9.2.3); (3) two pieces of 1/4 inch plate glass, about 6 by 3; (4) two 6 by 3 by 3/8 inch mortar slabs prepared as described in 4.3.9.2.1 except for size; (5) desized grade A airplane fabric, 4.38 ounces per yard, 80/84 count, or any suitable cloth that will adhere to the sealant (six 6 by 3 inch pieces); (6) paper masking tape, 1 inch wide. Before constructing the test assemblies, clean the aluminum and glass substrate as specified for the steel channel in 4.3.2.1[3]. Clean mortar substrates as specified in 4.3.9.2.1[4]. Place a strip of 1 inch paper masking tape across the width of the plate so that the lower edge of the tape is parallel to the lower edge of the plate and 2 inches above it (fig. 8A). After conditioning not less than 250 g. of compound and curing agent for at least 24 hours at standard conditions, spread a properly mixed portion on the surface of the plate to a thickness of 1/8 inch over an area from the top edge of the tape to the bottom of the plate and the entire width of the plate (fig. 8B). The cloth, approximately 6 by 3 inches is smeared with the compound at one end over an area of 3 by 3 inches and forced into the cloth using a spatula. The impregnated cloth is laid over the 1/8 inch layer of compound without entrapping air. Then the assembly is placed between 1/16 inch spacer bars and the surfaces of the cloth rolled with a glass rod so that the thickness of the compound between the cloth and the surface is 1/16 inch (fig. 8C). Prepare two aluminum, glass and mortar specimens as described above for each sample of sealant. Apply primer to the dry surfaces only when specified and supplied by the manufacturer and agreed upon by the purchaser. After preparation, allow the test specimen to cure in air for 14 days at standard conditions followed by an additional 7 days curing while completely immersed in distilled or deionized water at standard temperature. After the specimen has cured about 7 days, coat the cloth with a thin layer (1/32 inch or less) of the mixed sample to protect the cloth from moisture and to minimize cloth adhesion failure after water immersion (fig. 8D). After 14 days curing in air and immediately before immersing the specimen in water for 7 days, cut the surface of the fabric through to the base surface with a sharp razor blade leaving two strips of sealant and fabric 1 inch wide, separated by a space approximately 3.8 inch wide (fig. 8E). Immediately following the 21 days cure, prepare the specimen for testing by wiping it dry, and releasing 1 inch of the cloth and masking tape from the base. Then place the specimen in the testing machine and peel the cloth back at an angle of 180 deg. (fig. 9). The rate of separation of the jaws of the machine shall be 2 inches per minute. Pull the sealant for 1 minute, and note the average value in pounds indicated by a dial or recording chart on the machine. If the cloth peels from the sealant during testing, disregard the values. In such instance cut the compound across with a sharp razor blade in order to get separation at the interface to the test surface. Test four strips for each base material (aluminum, glass, etc.) and record the peel value in pounds for each strip as well as the average peel value for each substrate.

4.4 Adhesion in peel after ultra-violet radiation exposure through glass[4]. Prepare and cure two plate glass peel strength specimens as specified in 4.3.10.1. At the end of the 14th day cure period, place the test specimens with the sealant surface facing away from the light source on the drum of an accelerated weathering machine as specified in 4.3.7. Expose the specimens to the UV radiation for 200 hours without water spray. Following the exposure, immerse the specimens in distilled or deionized water for 7 days and obtain peel strength and record data as prescribed in 4.3.10.1.

4.5 Inspection of preparation for delivery. An inspection shall be made to determine that the preservation, packaging, packing, and marking comply

with the requirements in section 5 of this specification. Defects shall be scored in accordance with table I. For examination of interior packaging the sample unit shall be one shipping container fully prepared for delivery, selected at random just prior to the closing operations. Sampling shall be in accordance with MIL-STD-105. Defects of closure listed shall be examined on shipping containers fully prepared for delivery. The lot size shall be the number of shipping containers in the end item inspection lot. The inspection level shall be S-2 with an AQL of 4.0 defect per hundred units.

[3] Other substrates such as precast stone, brick, marble, steel, etc. shall be used in the test in place of or in addition to the standard materials when requested by the purchaser.

[4] The test shall be performed when the sealant bonding area to glass may be adversely affected by the sun's rays passing through the glass and should be requested by the purchaser.

TABLE I. Classification of preparation for delivery defects

Examine	Defects
Markings (exterior and interior)	Omitted; incorrect; illegible; improper size, location, sequence, or method of application.
Materials	Any component missing or damaged.
Workmanship	Inadequate application of component such as incomplete closure of container flaps, loose strapping, inadequate stapling, or distortion of container.
Contents (exterior container)	Number per container is more or less than required. Net weight exceeds requirements.

5. PREPARATION FOR DELIVERY.

5.1 Packaging. Packaging shall be level A, B, or C, as specified, (see 6.2.).

5.1.1 Level A. The compound shall be furnished in quantities as follows: 3/4 pint in a 1 pint can; 3/4 quart in a 1 quart can; 3/4 gallon in a 1 gallon can; 1 gallon in an imperial gallon can or 4 gallon in a 5 gallon pail. The activator portion of the compound shall be segregated from the base material by a tray type compartment at the top of the container, a glass or plastic jar within the container, or a polyethylene bag within the container. The cans shall conform to PPP-C-96 and the pails shall conform to PPP-P-704.

5.1.2 Level B. The level B packaging shall comply with paragraph 5.1.1, except commercial exterior coatings are acceptable.

5.1.3 Level C. The compound shall be furnished in quantities specified in paragraph 5.1.1 in containers of the type normally furnished for commercial practice.

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

5.2.1 Level A. The filled 1 pint and 1 quart cans shall be packed in quantities of 12 in a close-fitting box conforming to PPP-B-636, class weather-resistant. The filled 1 gallon and imperial gallon cans shall be packed in quantities of 4 to a close-fitting box conforming to PPP-B-636, class weather-resistant. The filled 5 gallon pails require no overpacking.

5.2.2 Level B. The level B packing shall comply with paragraph 5.2.1, except that the fiberboard boxes shall conform to PPP-B-636, class Domestic.

5.2.3 Level C. The compound shall be packed in a manner which will insure arrival at destination in satisfactory condition and which will be acceptable to the carrier at the lowest rates. Containers and packing shall comply with the Uniform Freight classification or National Motor Freight Classification.

5.3 Marking.

5.3.1 Civil agencies. In addition to any special markings required by the contract or order, the interior and shipping containers shall be marked in accordance with Fed. Std. 123 and shall include date of manufacture by month and year.

5.3.2 Military agencies. In addition to any special markings required by the contract or order, the interior and shipping containers shall be marked in accordance with MIL-STD-129.

6. NOTES.

6.1 Intended uses.

6.1.1 The joint sealing compound covered by this specification is intended to seal joints in all types of structures including plazas, decks, and pavements where some movement is expected and where tightness against dust, dirt, wind, and water is required. Some of the uses of the compound include channel glazing, bedding and sealing around panels and lights of curtain wall structures, sealing window and door perimeters, sealing the joints between precase concrete panels, sealing flashings and expansion joints, and pointing brick and natural stone masonry. Producers of two-part elastomeric joint sealants list many other and varied uses for this type of sealing compound.

6.1.2 The compound is supplied in two or more components, usually referred to as base and curing agents or accelerators. Small quantities may be mixed on a board or plate instead of using the base container. On large jobs the compound may be mixed in specially designed power mixers.

6.1.3 The mixed compound should be installed with either a calking gun (hand or power), putty knife, or trowel in strict accordance with the producer's instructions.

6.1.4 The compound shall not be applied to surfaces coated with lacquer or paint. Such coatings shall be removed before sealant is applied. Before applying the compound to masonry joints previously treated with water repellent solutions, a laboratory test for bond shall be made with the specified type of masonry and repellent solution. It is recommended that the sealant producer be consulted before applying a compound to concrete previously treated with retardant, surface curing, or mold release agents.

6.1.5 Unless specifically agreed upon by supplier and purchaser, the compound shall not be applied in contact with joint fillers such as asphaltic materials, oil base calkings, or any other sealants in which the bonding properties and adverse effects resulting from the combination are not known.

6.16 Producers often recommend the use of a specific primer or surface conditioner for specific surface. The primer or conditioner is designed to assure adhesion of the compound to a specific surface. Substitute primers or conditioners other than those recommended by the producer shall not be used. In all cases where primers or conditioners are recommended with a compound, it is advisable to have the durability and peel strength test made with the primer in question.

6.1.7 Whenever possible the compound shall not be applied to a joint at temperatures under 40 deg. F. At such temperatures a film of moisture is likely to form on the surfaces of the joint as a result of condensation. This moisture film which can be entirely invisible under certain atmospheric conditions may prevent the formation of a strong bond between the compound and the substrate.

6.1.8 Whenever possible a back-up material should be used with sealant in a moving joint to insure good bond to sides of the joint as well as to control the depth of the sealant. The back-up material should be completely inert, non-rigid, and also shall not form a strong bond to the sealant itself. The sealant producer should recommend the proper back-up material for his product for a particular substrate and joint design.

6.1.9 Although the compounds are generally available in several colors, a freshly cured compound may be painted any desired color provided the producer approves such procedure.

6.1.10 Modification of a compound by the addition of liquids or powders to alter the flow properties shall not be permitted. Other suitable flow characteristics than those specified herein may be agreed upon by the supplier and purchaser. Special non-sag properties may be required in unusually large joints and lesser flow characteristics may be required in sloping joints where perfect leveling is not desired.

6.1.11 A compound shall not be used on any job if the date of manufacture indicates that the compound is more than 12 months old.

6.1.12 This specification covers joint sealants which are capable of resisting joint movements not exceeding a total of 50 percent of the nominal

joint width for Class A sealants, and a total of 25 percent for Class B sealants (see 1.2, footnote[1]).

6.1.13 A sealing compound meeting the requirements of this specification may have a life expectancy of 20 years provided there are proper application and joint design.

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

(a) Title, number, and date of this specification.

(b) Type of produce required (see 1.2).

(c) Color required (see 3.5.1).

(d) Selection of applicable levels of packaging and packing required. (see 5.1 and 5.2).

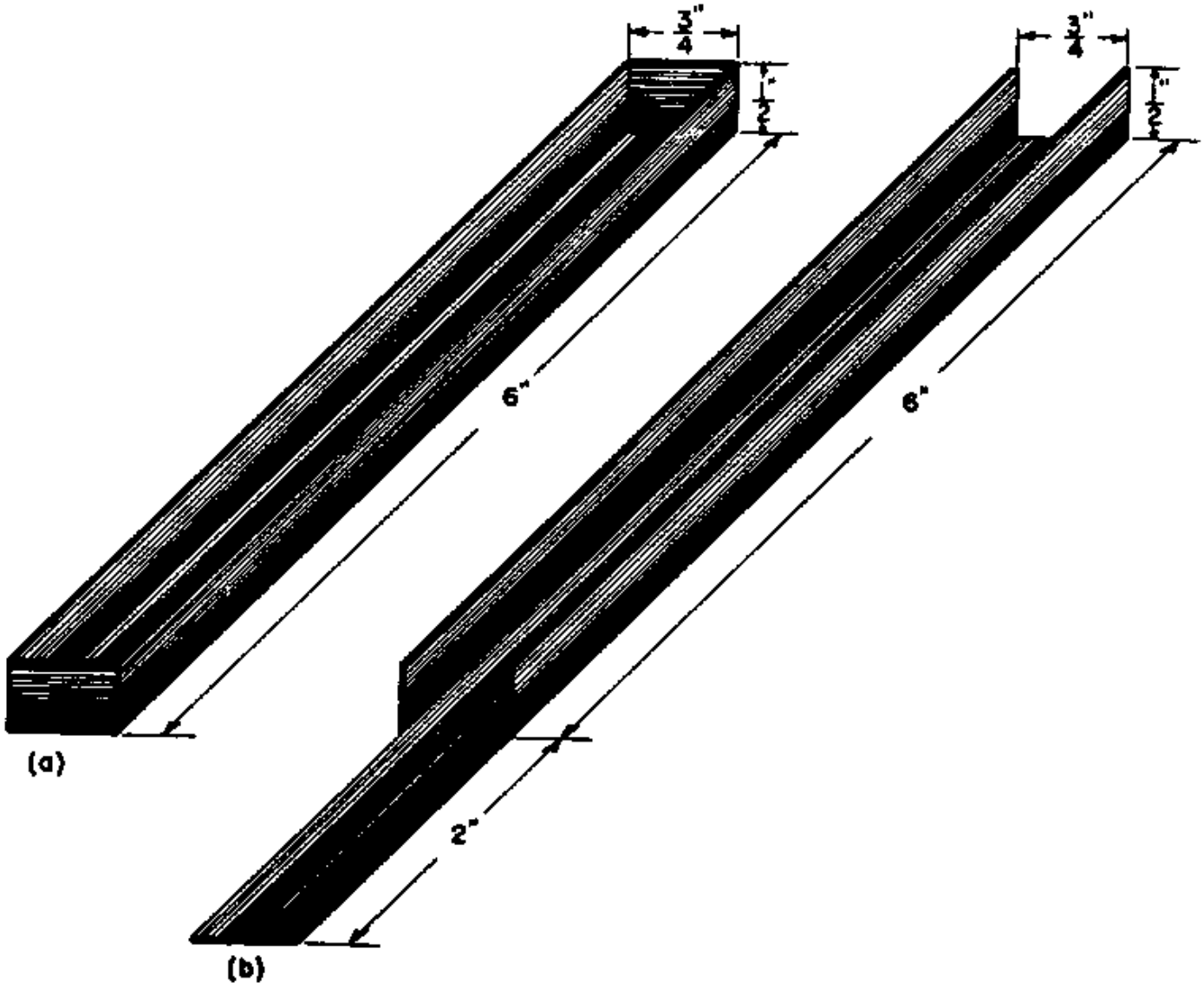

FIGURE 1. Channels used for determining rheological properties, (a) for self leveling or flow type compound (Type I), (b) for non-sag type compound (Type II)

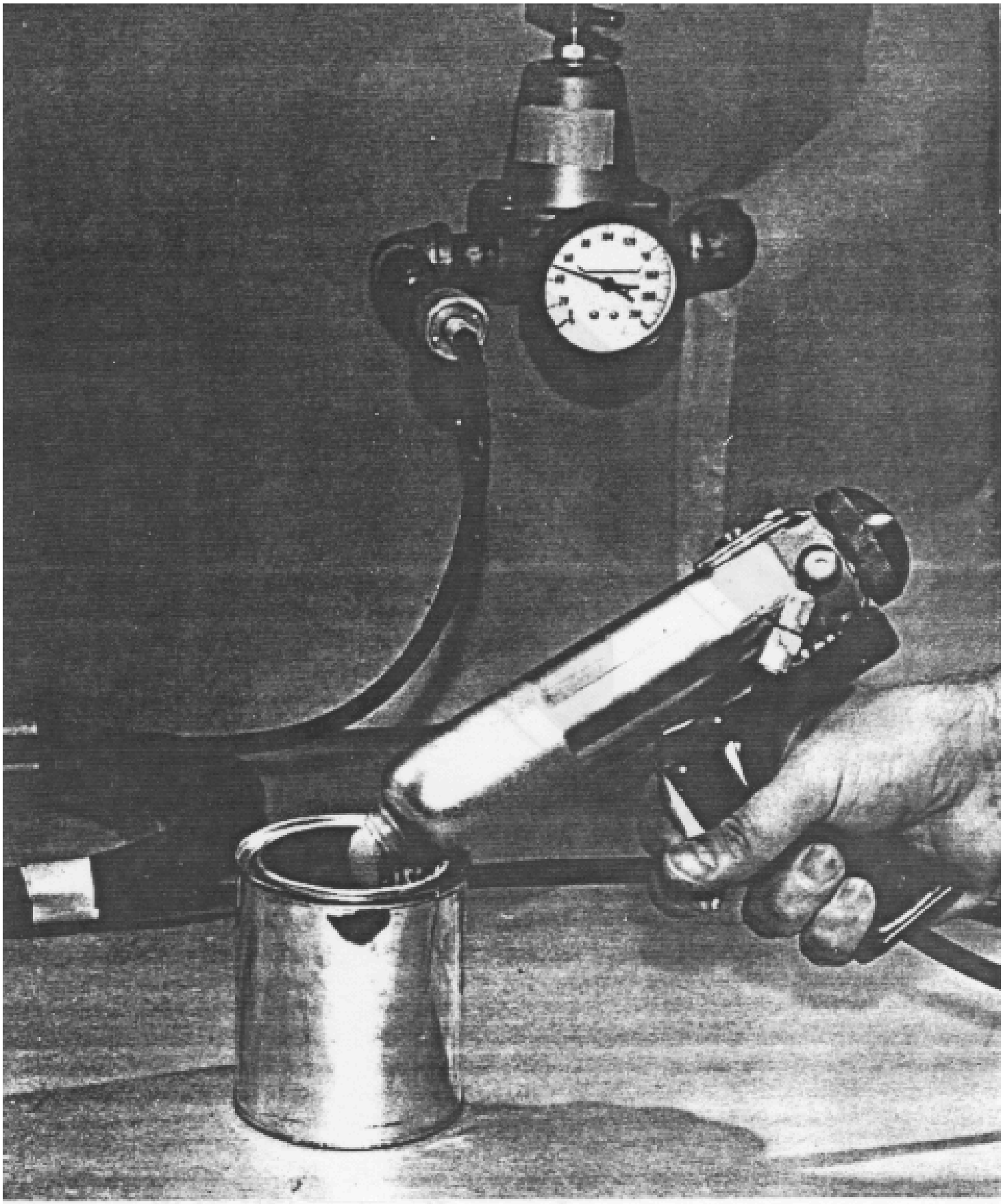

FIGURE 2. Application life test using a 6 oz. power gun containing a 6 oz. cartridge without added nozzle, and operated at 50 p.s.i.

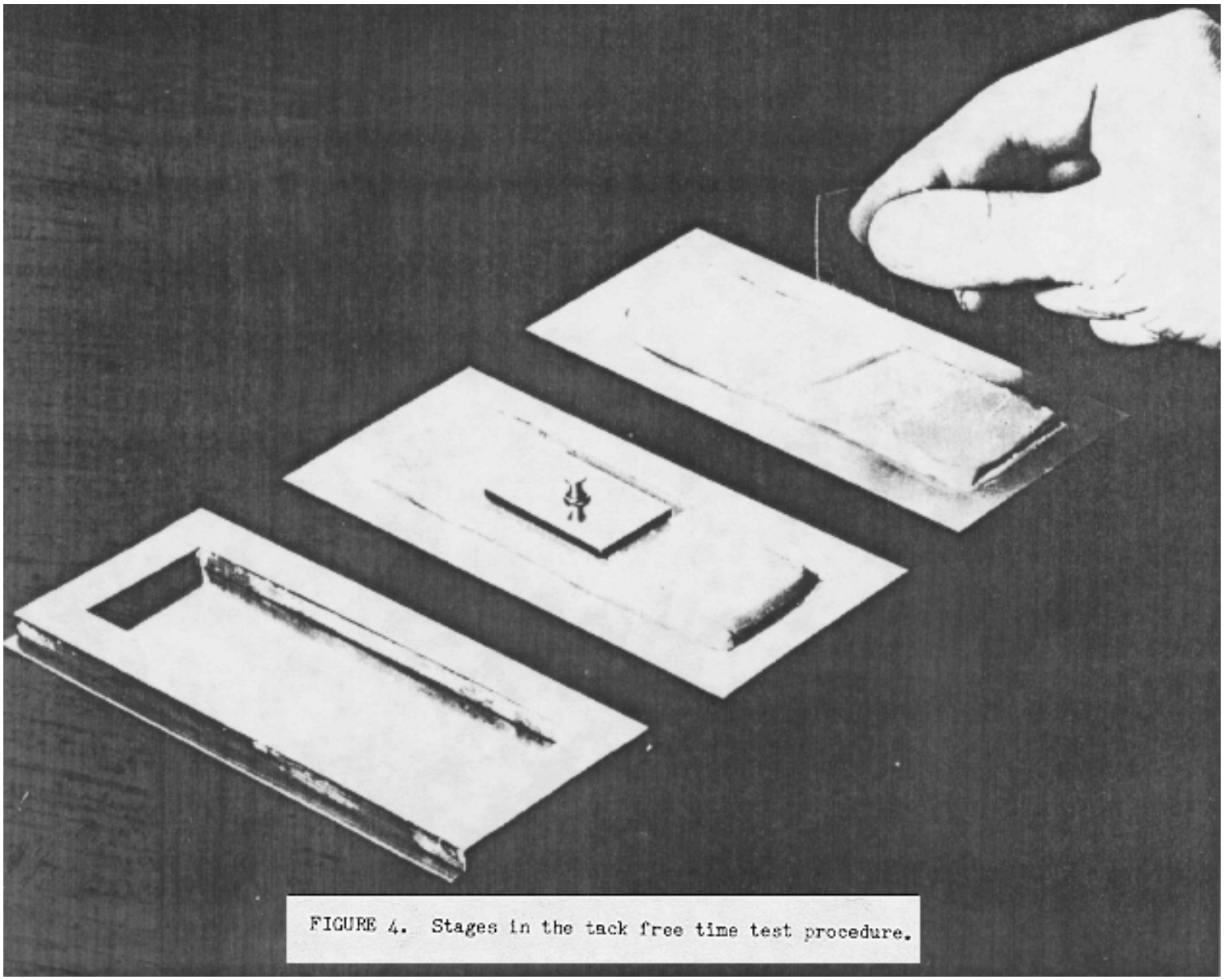

FIGURE 4. Stages in the tack free time test procedure.

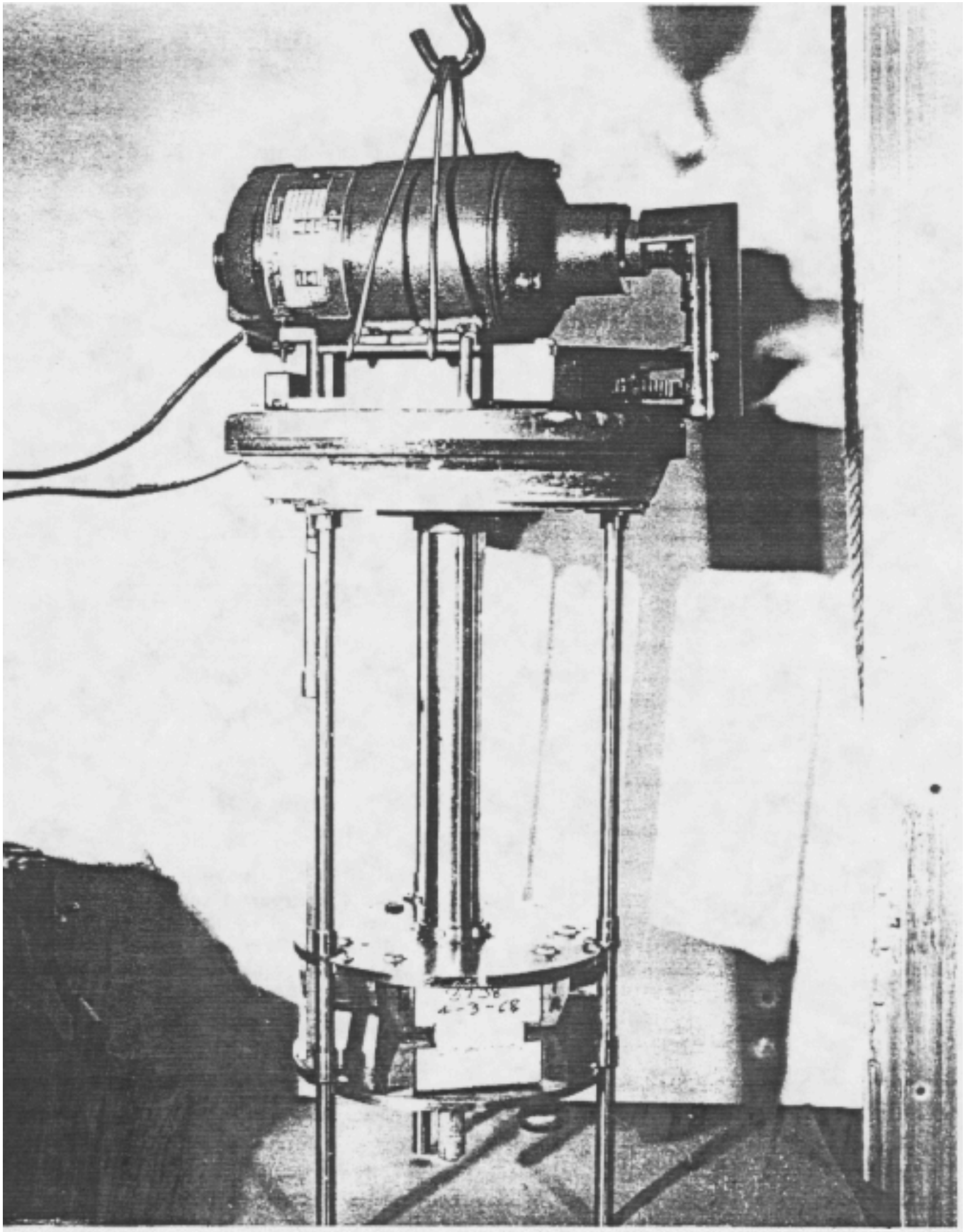

FIGURE 6c. A motor driven machine used for extension of specimens at -45°F. in the Durability test.

Durability Specimens For Class A and B Sealants

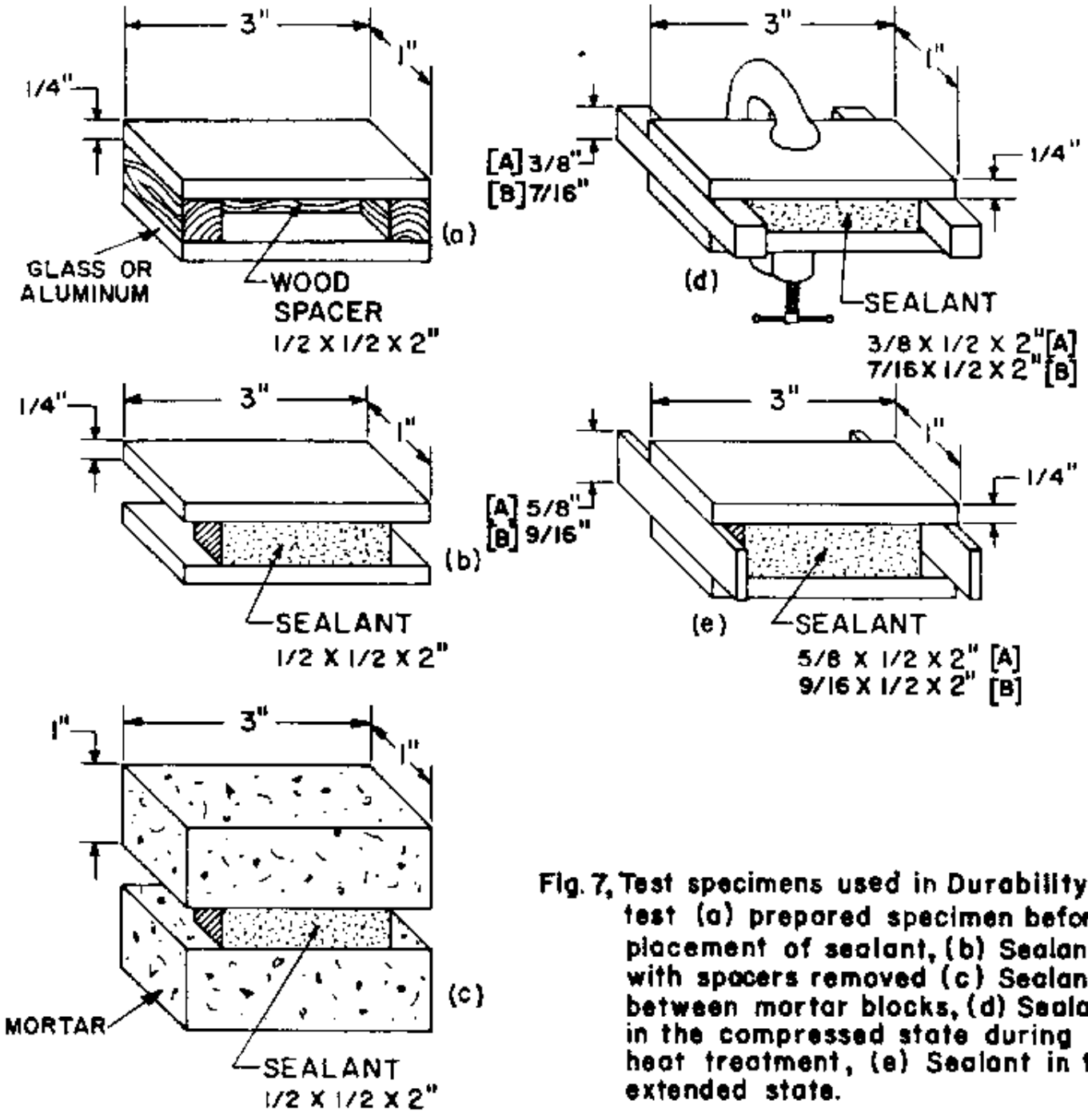

Fig. 7, Test specimens used in Durability test (a) prepared specimen before placement of sealant, (b) Sealant with spacers removed (c) Sealant between mortar blocks, (d) Sealant in the compressed state during heat treatment, (e) Sealant in the extended state.