

MIL-S-81732(AS)
14 August 1969

MILITARY SPECIFICATION

SEALING COMPOUND, ELECTRICAL, HIGH STRENGTH, ACCELERATOR REQUIRED

This specification has been approved by the Naval
Air Systems Command, Department of the Navy.

1. SCOPE

1.1 Scope - This specification covers the requirements for a high temperature, high strength, reversion resistant, two part silicone sealing compound for various electrical applications within aircraft. The cured silicone rubber is intended for use at temperatures ranging from minus 90° F to plus 400° F.

1.2 Classification - The sealing compound shall be furnished in the following types:

Type I - Room temperature curing (see 4.5.4)

Type II - Heat cure, for manufacture only (see 4.5.4)

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

Federal

J-C-30	Cable and Wire, Electrical (Power, Fixed Installation)
QQ-A-250/13	Aluminum Alloy Alclad 7075, Plate and Sheet
PPP-B-585	Box, Wood, Wirebound
PPP-B-601	Box, Wood, Cleated-Plywood
PPP-B-621	Box, Wood, Nailed and Lock-Corner

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SPECIFICATIONS

Federal (Continued)

PPP-B-636	Box, Fiberboard
PPP-C-96	Can, Metal, 28 Gage and Lighter
PPP-C-300	Chemicals, Liquid, Packaging and Packing of

Military

MIL-E-5272	Environmental Testing, Aeronautical and Associated Equipment, General Specification for
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STANDARDS

Federal

Fed. Test Method Std. No. 406	Plastics, Methods of Testing
Fed. Test Method Std. No. 601	Rubber, Sampling and Testing

Military

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

(Copies of specifications, standards, drawings, and publications required by suppliers 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 form a part of this document to the extent specified herein. Unless otherwise indicated, the issue in effect on date of invitation for bids or request for proposal shall apply.

American Society for Testing and Materials

ASTM D412-68	Tension Testing of Vulcanized Rubber
ASTM D624-54	Tear Strength of Vulcanized Rubber, Test for
ASTM D746-64T	Brittleness Temperature of Plastics and Elastomers by Impact

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

Consolidated Classification Committee

Uniform Freight Classification Rules

(Application for copies should be addressed to the Consolidated Classification Committee, 202 Chicago Union Station, Chicago, Illinois 60606.)

Code of Federal Regulations

49 CFR 171-178

Department of Transportation (DOT) Regulations for the Transportation of Explosives and Other Dangerous Articles by Land and Water

(Application for copies should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D. C. 20402. Orders for the publication should cite "The latest issue and Supplement thereto".)

3. REQUIREMENTS

3.1 Qualification - The sealing compounds furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time set for opening of bids (see 6.3).

3.2 Material - The sealing compound may be supplied as a three or four-component system consisting of the base compound, curing agent, primer and barrier. Components shall be of the highest quality and shall be homogeneous and free of foreign matter.

3.2.1 Primer - A primer specified by the manufacturer shall be used in all tests where required for the material to pass the test requirements.

3.2.2 Suitability - The compound shall protect the electrical components of the equipment to which it is applied by sealing against dirt, fumes, fungus, or other deleterious substances. It shall not cause deterioration or corrosion of materials used in encapsulated parts.

3.3 Characteristics and performance -

3.3.1 Properties before cure -

3.3.1.1 Color - Unless otherwise specified by the procuring activity, the sealing compound shall be furnished in the "as manufactured" color.

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3.3.1.2 Non-volatile content - The non-volatile content of the sealing compound when determined in accordance with 4.6.2.1 shall be not less than 98 percent.

3.3.1.3 Application life - Application life shall be determined as specified in 4.6.2.2. The requirements shall be initial viscosity and application time of the mixed compound as given below.

3.3.1.3.1 Initial viscosity - The initial viscosity of the mixed sealing compound shall be 300 poises maximum.

3.3.1.3.2 Application time - The application time (minimum specified time to reach 900 poises at standard conditions) of the mixed sealing compound shall be two hours.

3.3.1.4 Shelf storage life - After being stored as specified in 4.6.2.19, the mixed compound shall remain within ± 15 percent of the "as received" application life values (3.3.1.3) and cured specimens shall be within ± 5 points of the obtained "as received" hardness (Table I) (see 6.6).

3.3.2 Properties after cure -

3.3.2.1 Physical properties - The physical properties of the cured silicone sealing compound shall be in accordance with Table I.

TABLE I

PHYSICAL PROPERTIES OF CURED COMPOUND

Property	Requirement	Test paragraph
Hardness, initial, points, min	33	4.6.2.3
Tensile strength, psi, min	600	4.6.2.4
Elongation, %, min	300	4.6.2.4
Tear strength, ppi, min	50	4.6.2.5
Specific gravity, max	1.35	4.6.2.6
Flammability	Self-extinguishing within 15 seconds. No more than one inch burned.	4.6.2.7

TABLE I (Continued)

Property	Requirement	Test paragraph
Shrinkage After heat aging, %, max	Type I - 4.0, Type II - 7.0	4.6.2.8
After heat resistance	No cracking, softening, blistering, flowering, distortion or charring	4.6.2.9
Change in hardness, points, max	±5	
Change in weight, %, max	-5	
Change in volume, %, max	-5	
Adhesion		4.6.2.10
As received, lbs, min	Type I - 10, Type II - 20	
After heat aging, lbs, min	Type I - 20, Type II - 20	
Reparability		4.6.2.11
As received, lbs, min	5	
After heat aging, lbs, min	5	
Thick section cure		4.6.2.12
Hardness, initial, min	33	
After heat aging, change in hardness, max	±5	
Thermal shock	Shall not split or rupture	4.6.2.13
Water absorption		4.6.2.14
Change in hardness, points	-5 to +7	
Change in volume, %, max	±3	
Change in weight, %, max	±2	

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TABLE I (Continued)

Property	Requirement	Test paragraph
Brittle point, ° F	-90	4.6.2.15
Hydrolytic stability Hardness, change, points, max (Phase I and Phase II)	-5	4.6.2.16
Corrosion	No greater corrosion than control wire	4.6.2.17
Fungus resistance	Shall not be nutrient	4.6.2.18

TABLE II

ELECTRICAL PROPERTIES OF CURED COMPOUNDS

Property	Requirement Type I and Type II	Test paragraph
Dielectric strength volts/mil, min	500	4.6.3.1
Volume resistivity <u>1</u> / OHM-CM, min At standard conditions At 400 ±5° F (204 ±3° C)	10 ¹⁵ 10 ¹³	4.6.3.2
Dielectric constant <u>2</u> /, max 1 KC 1 MC	3.5 3.8	4.6.3.3
Dissipation factor <u>2</u> / 1 KC 1 MC	0.003 0.002	4.6.3.3
Arc resistance, seconds, min	100	4.6.3.4

1/ Median values should be recorded.2/ Conditioning shall be in accordance with 4.5.

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3.3.2.2 Electrical properties - The electrical properties of the cured sealing compound shall be in accordance with Table II.

3.3.3 Workmanship - Workmanship shall be in accordance with high grade practice for this type of material.

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 as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of 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.

4.2 Classification of tests - The inspection and testing of the sealing compound shall be classified as follows:

(a) Qualification tests (see 4.3).

(b) Quality conformance tests (see 4.4).

4.3 Qualification tests - The qualification tests shall consist of all the tests and examinations of this specification.

4.3.1 Sampling instructions - Qualification test samples shall consist of 12 1-pound units of compound for testing. The compound and curing agent shall be furnished in containers of the type specified in Section 5. Samples shall be forwarded to the Supply Officer, Building 611, Naval Air Engineering Center, Philadelphia, Pennsylvania 19112, marked Attention: Director, Aero Materials Department, plainly and durably marked with the following information:

Sample for Qualification Test
 SEALING COMPOUND, ELECTRICAL,
 HIGH STRENGTH, ACCELERATOR REQUIRED
 Specification MIL-S- (AS)
 Type
 Date of manufacture
 Name and address of manufacturer
 Plant address which produced the compound
 Manufacturer's product identification
 Submitted by (name and date) for qualification in accordance
 with the requirements of MIL-S- (AS) under authorization
 (reference authorizing letter).

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4.3.2 Manufacturer's data - Two copies of the manufacturer's test report, containing complete test data showing that the material submitted for qualification conforms to the requirements of this specification, shall be submitted with qualification samples. In addition two copies of the manufacturer's instructions for use of the compound shall be submitted at this time.

4.4 Quality conformance tests -

4.4.1 Lot formation - Unless otherwise specified, a lot shall consist of all sealing compound of the same type, manufactured at one time from one batch, forming part of one contract or order, and submitted for acceptance at the same time and place.

4.4.2 Sampling -

4.4.2.1 Sampling for quality conformance tests - Two containers, each with enough material to prepare two test specimens for all tests, shall be randomly selected from each lot (see 4.4.1) and shall be tested as specified in 4.4.3.1.

4.4.2.2 Sampling of preparation for delivery - A quantity of shipping containers prepared for delivery, just prior to closure, shall be selected in accordance with Inspection Level I of MIL-STD-105 and examined in accordance with 4.4.3.2. The lot size for purposes of inspection shall be the number of shipping containers.

4.4.3 Inspection and tests -

4.4.3.1 Inspection of sample for quality conformance - Two sets of specimens for each test shall be prepared from each sample selected in accordance with 4.4.2.1. The specimens shall be examined and tested to the requirements of Table III. In addition, the sample may be subjected to any other test specified herein, when considered necessary by the procuring activity, to insure conformance to the requirements of this specification. Nonconformance of either set of specimens to a single requirement (Table III) shall be cause for rejection of the lot represented by the sample.

4.4.3.2 Examination of preparation for delivery - The samples selected in accordance with 4.4.2.2 shall be visually examined to the requirements in Table IV and all other applicable requirements to determine conformance to Section 5 of this specification. The Acceptable Quality Level (AQL) for this examination shall be 2.5 percent defective. In addition to Table IV, shipping containers fully prepared for delivery shall also be examined after closure for closure defects.

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TABLE III
QUALITY CONFORMANCE TESTS

Tests	Applicable paragraph
Specific gravity	4.6.2.6
Application life	4.6.2.2
Hardness	4.6.2.3
Tear strength	4.6.2.5
Dielectric strength	4.6.3.1
Volume resistivity	4.6.3.2

TABLE IV
EXAMINATION OF PREPARATION FOR DELIVERY

Examination	Defect
Fill	Not volume specified in contract or order
Packaging	Wrong size cans or kits Material or construction not as specified Components damaged or missing Unit package components not properly separated Unit package closure incomplete or damaged Not level required by contract or order unit
Packing	Not level required by contract or purchase order Any nonconforming component, incomplete closures Bulged or damaged shipping containers
Count	Less than specified or indicated quantity per shipping container
Markings	Unit package and packing - Omitted, illegible, incorrect, incomplete or not in accordance with contract requirements

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4.5 Tests -

4.5.1 Standard conditions - Unless otherwise specified herein, all mixing, curing, and tests shall be performed at $77 \pm 2^\circ \text{F}$ ($25 \pm 1^\circ \text{C}$) and a relative humidity of 50 ± 5 percent.

4.5.2 Mixing - The base compound and its curing agent, both in the original unopened containers, together with the required spatulas, beakers, and other mixing equipment shall be held at standard conditions (4.5.1) for a minimum of 8 hours. The base compound and curing agent shall then be thoroughly mixed in the proportions recommended by the manufacturer. Proper care should be taken to avoid incorporation of air by excessive stirring or folding action. Deaeration by vacuum or centrifuge should be used. All disk specimens shall be primed, then barrier coated in accordance with manufacturer's instructions. The mixing operation shall be conducted at standard conditions (4.5.1).

4.5.3 Test specimens - Unless otherwise specified, specimens for test shall be cut from cured material cast in ASTM molds 6 by 6 by 0.075 inch or disk molds approximately 4 inches in diameter by 0.075 inch thick. Curing shall be in accordance with 4.5.4.

4.5.4 Curing conditions - All specimens shall be cured in accordance with one of the methods below:

- (a) Type I - 72 hours at $77 \pm 2^\circ \text{F}$ ($25 \pm 1^\circ \text{C}$)
- (b) Type II - 4 hours at $160 \pm 2^\circ \text{F}$ ($71 \pm 1^\circ \text{C}$)

All specimens shall be removed from the molds after completion of the above curing schedule and shall be conditioned in accordance with 4.5.1, 1 to 7 days prior to cutting samples or conducting tests.

4.5.5 Finished specimens - The surfaces of molded and cast specimens shall be clean, smooth, free from holes and bubbles, and all corners and edges shall be well defined.

4.6 Test methods -

4.6.1 Examination of product - The base compound and curing agent shall be examined for conformance to 3.3.1.1 and to requirements for which no test methods are specified herein.

4.6.2 Physical properties -

4.6.2.1 Nonvolatile content - Five to ten grams of the mixed compound shall be transferred to a dish approximately 8 centimeters in diameter. The weight

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shall be determined to the nearest milligram. The compound shall be heated for twenty-four (24 +2, -0) hours at 158 ±2° F (70 ±1° C), transferred to a desiccator, cooled to standard conditions, and weighed to the nearest milligram. The percent nonvolatile content shall be calculated as follows:

$$\text{Percent nonvolatile content} = \frac{\text{Final weight of base compound}}{\text{Initial weight of base compound}} \times 100$$

4.6.2.2 Application life - Initial viscosity and application time shall be determined using a model RVF Brookfield Viscometer equipped with a No. 5 spindle and operated at 4 RPM.

4.6.2.2.1 Procedure - A quantity of base compound and curing agent shall be mixed 5 minutes in a standard 1/2-pint can, approximately 2-3/4 inch diameter, or equivalent. The retaining flange of the can shall be removed. The mixed compound shall be of sufficient volume to allow immersion of the spindle to its depth mark. Initial viscosity shall be determined immediately following the mix period. The initial viscosity shall be in accordance with 3.3.1.3.1. Application time for each type shall be determined at 60 and 110 minutes from the start of mix. Subsequent viscosity readings shall be made at 10 minute intervals until 900 poises is attained. The spindle shall remain immersed in the test compound for the duration of the test. All readings shall be taken after a minimum of 3 revolutions of the spindle.

4.6.2.3 Hardness (curability) - Three molded specimens each 2 by 1 by 0.075 inch cut from slabs prepared and cured in accordance with 4.5.3, shall be placed one upon the other to form a sample 0.225 inch thick. Five measurements of hardness shall be made on this sample using a Shore A scale durometer in accordance with Method 1082 of Fed. Test Method Std. No. 406.

4.6.2.4 Tensile strength and elongation - Specimens of compound prepared as specified in 4.5.3 and 4.5.4 shall be tested in accordance with ASTM Method D-412, Die C.

4.6.2.5 Tear strength - Specimens of compound prepared as specified in 4.5.3 shall be tested in accordance with ASTM Method D-624, Die B.

4.6.2.6 Specific gravity - Three specimens 1 by 2 by 0.075 inch shall be cut from slabs molded and cured in accordance with 4.5.3. Specific gravity shall be determined in accordance with Method 5011 of Fed. Test Method Std. No. 406.

4.6.2.7 Flammability - Three specimens, 6 by 0.5 by 0.5 inch, cut from slabs prepared in accordance with 4.5.3 shall be tested in accordance with Method 2021 of Fed. Test Method Std. No. 406, except that the specimens shall be placed directly on the wire mesh and the flame applied only once.

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4.6.2.8 Shrinkage - A cubical mold, with cover, approximately 1.0 inch on each side shall be constructed. Its volume at $77 \pm 2^\circ \text{F}$ ($25 \pm 1.1^\circ \text{C}$) shall be determined. It shall be utilized for the preparation of a cured compound specimen as specified in 4.5.3. After filling the mold cavity, and then placing the cover on the compound, the specimen shall be subjected to the applicable cure (see 4.5.4), and then placed in a circulating air oven at $400 \pm 5^\circ \text{F}$ ($204 \pm 3^\circ \text{C}$) for 7 days. It shall then be removed, cooled, examined, and its volume at $77 \pm 2^\circ \text{F}$ ($25 \pm 1^\circ \text{C}$) determined by the water displacement method using an analytical balance or jolly balance. The percent shrinkage shall be calculated as follows:

$$\text{Percent shrinkage} = \frac{V_1 - V_2 \times 100}{V_1}$$

Where V_1 = volume of mold
and V_2 = final volume of sealing compound

4.6.2.9 Heat resistance - The specimens used for the "Hardness" test (4.6.2.3) shall be placed in an air circulating oven and conditioned for 168 hours at $392 \pm 5^\circ \text{F}$ ($200 \pm 3^\circ \text{C}$). The specimens shall be removed from the oven and returned to $77 \pm 2^\circ \text{F}$ ($25 \pm 1^\circ \text{C}$), in a desiccator, and examined. Changes in weight and volume shall be determined in accordance with Method 7221 of Fed. Test Method Std. No. 601. Changes in hardness shall be determined in accordance with Method 1082 of Fed. Test Method Std. No. 406.

4.6.2.10 Adhesion -

4.6.2.10.1 Preparation of panels - A coating of compound 0.125 ± 0.030 inch thick shall be applied to the primed side (as recommended by the manufacturer) of a 3 by 6 by 0.0625 inch aluminum alloy panel conforming to QQ-A-250/13 (see Figure 1). One strip 3.750 inch wide of 30 mesh aluminum screen or chemically "etched" polytetrafluoroethylene (primed as specified by the manufacturer) shall be placed primed side down on the surface of the freshly applied compound. The strip shall be placed so that it covers the mold and compound (Figure 1) leaving a 6-inch tail. Three panels shall be prepared for each backing. Each panel shall be cured as specified in 4.5.4. After the applicable cure, one panel of each backing type shall be oven aged for 72 ± 2 hours at $400 \pm 5^\circ \text{F}$ ($204 \pm 3^\circ \text{C}$).

4.6.2.10.2 Testing of panels - The panels shall be individually tested in an autographic testing machine whose capacity shall be such that the tension at failure is not more than 85 percent nor less than 15 percent of the full scale load. If the machine is of the pendulum type, the weight shall swing as free pendulum without engagement of the pawls. The rate of separation of the jaws shall be 2 inches per minute. Two 1-inch wide strips shall be cut lengthwise through the flexible material and compound to the panel surface and extended the full length of the loose end of the material. The edges of the panel shall not be used as an edge of the test strip.

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Specimens shall be mounted in the machine so that the loose end of the 1-inch wide fabric strip shall be folded 180 degrees as it is pulled from the panel. Each strip shall be pulled as follows: A cut through the compound to the panel at the junction of separation shall be made at an angle of 45 degrees in the direction of separation. If the compound separates from the fabric, similar 45-degree cuts shall be made to promote separation of the compound from the panel. A minimum of 5 cuts shall be made. The adhesion in pounds shall be automatically recorded on a chart as a continuous curve. The adhesion value shall be calculated by averaging the maximum force required to separate the compound from the panel.

4.6.2.11 Reparability - A coating of compound approximately 0.125 ± 0.030 inch thick shall be applied to the primed side (as specified by the manufacturer) of two 3 by 6 by 0.0625 inch aluminum alloy panels conforming to QQ-A-250/13 (see Figure 1). Three panels of Type I compound and three panels of Type II compound shall be prepared and cured as specified in 4.5.4. After the applicable cure period, one panel of each type shall be oven aged for 72 ± 2 hours at $400 \pm 5^\circ$ F ($204 \pm 3^\circ$ C). The surface of each specimen shall be scuffed with fine sandpaper. All panels shall then be recoated with newly mixed compound approximately 0.125 ± 0.030 inch thick. One strip 3.750 inches wide of a thin flexible material, such as 30 mesh aluminum screen (primed as specified by the manufacturer) shall be placed primed side down on the surface of the freshly applied compound. The strip shall be placed so that it covers the mold and compound (Figure 1) leaving a 6-inch long tail. The recoated panels shall be cured as specified in 4.5.4, and tested in accordance with 4.6.2.10.2.

4.6.2.12 Thick section cure and thermal reversion resistance -

4.6.2.12.1 Preparation of test specimens - The container for the confinement of the catalyzed compound shall be a metal tube 4.250 ± 0.005 inches long, threaded at both ends, having an inner diameter of 2.5 inches and a wall thickness suitable for threading. Metal screw caps and aluminum foil gaskets which provide an air-tight seal shall be used for end closures and designed so that the total inside height of the capped tube does not exceed 4.250 ± 0.005 inches. Seal one end of the tube and pour the mixed and deaerated catalyzed sealing compound to a depth of 3.250 ± 0.032 inches. Allow the material to cure as specified in 4.5.4 with the container top uncapped. Remove the bottom cap and obtain the hardness in the center area of the bottom surface in accordance with Method 1082 of Fed. Test Method Std. No. 406 (see Table I).

4.6.2.12.2 Reversion resistance - Immediately following the hardness determination, seal both ends of the tube and condition the test fixture at $392 \pm 5^\circ$ F ($200 \pm 3^\circ$ C) for 7 days. At the expiration of the heat aging period, allow the test fixture to cool at standard conditions for 24 ± 1 hour. Obtain a hardness reading in the same area of the bottom area where the original hardness was determined in accordance with Method 1082 of Fed. Test Method Std. No. 406.

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Tests shall be made in duplicate. If the compound fails in only one specimen, repeat the test. A second failure shall be cause for rejection.

4.6.2.13 Thermal shock -

4.6.2.13.1 Apparatus - The apparatus shall be as follows:

- (a) An analytical type, electrically heated oven so designed that specimens can be introduced and removed with a minimum drop in temperature. The oven shall be held at $311 \pm 5^\circ \text{ F}$ ($155 \pm 2^\circ \text{ C}$).
- (b) An isopropyl alcohol dry ice bath maintained at $-67 \pm 2^\circ \text{ F}$ ($-55 \pm 2^\circ \text{ C}$).

4.6.2.13.2 Specimens - Two specimens shall be cast in molds similar to the molds shown in Figure 2. In preparing the mold, the glass tube shall be coated with a release agent and the one inch long, 0.750 inch cold drawn low carbon steel hex bar shall be polished with number "0" emery cloth, washed with a 50:50 xylol-isopropyl alcohol mixture, coated with barrier material and primed as specified by the manufacturer. The casting and cure procedure shall be as specified in 4.5.3 and 4.5.4.

4.6.2.13.3 Procedure - Specimens shall be placed in the oven for 30, minus 0 plus 1 minutes at the specified temperature, removed, then immediately plunged into the dry ice alcohol bath and left for 10, minus 0 plus 1 minutes. After each cycle, the alcohol on the specimens shall be quickly wiped off and the next cycle started. Cycling shall continue until the specimen fails or 10 cycles have been completed. Specimens shall be observed after each phase of the cycling to determine the number of cycles which are required to produce cracks or other indications of failure in the casting. If four of the five specimens complete the 10 cycles, the compound shall be considered as having met the requirement of Table I.

4.6.2.14 Water absorption - Three specimens 1 by 2 by 0.075 inch shall be cut from slabs prepared as specified in 4.5.3. Each shall be immersed in distilled water for 72 hours at $140 \pm 2^\circ \text{ F}$ ($60 \pm 1^\circ \text{ C}$). The specimens shall be tested for changes in hardness in accordance with Method 1082 of Fed. Test Method Std. No. 406. Change in weight shall be determined in accordance with Method 6251 of Fed. Test Method Std. No. 601, and change in volume in accordance with Method 6211 of Fed. Test Method Std. No. 601.

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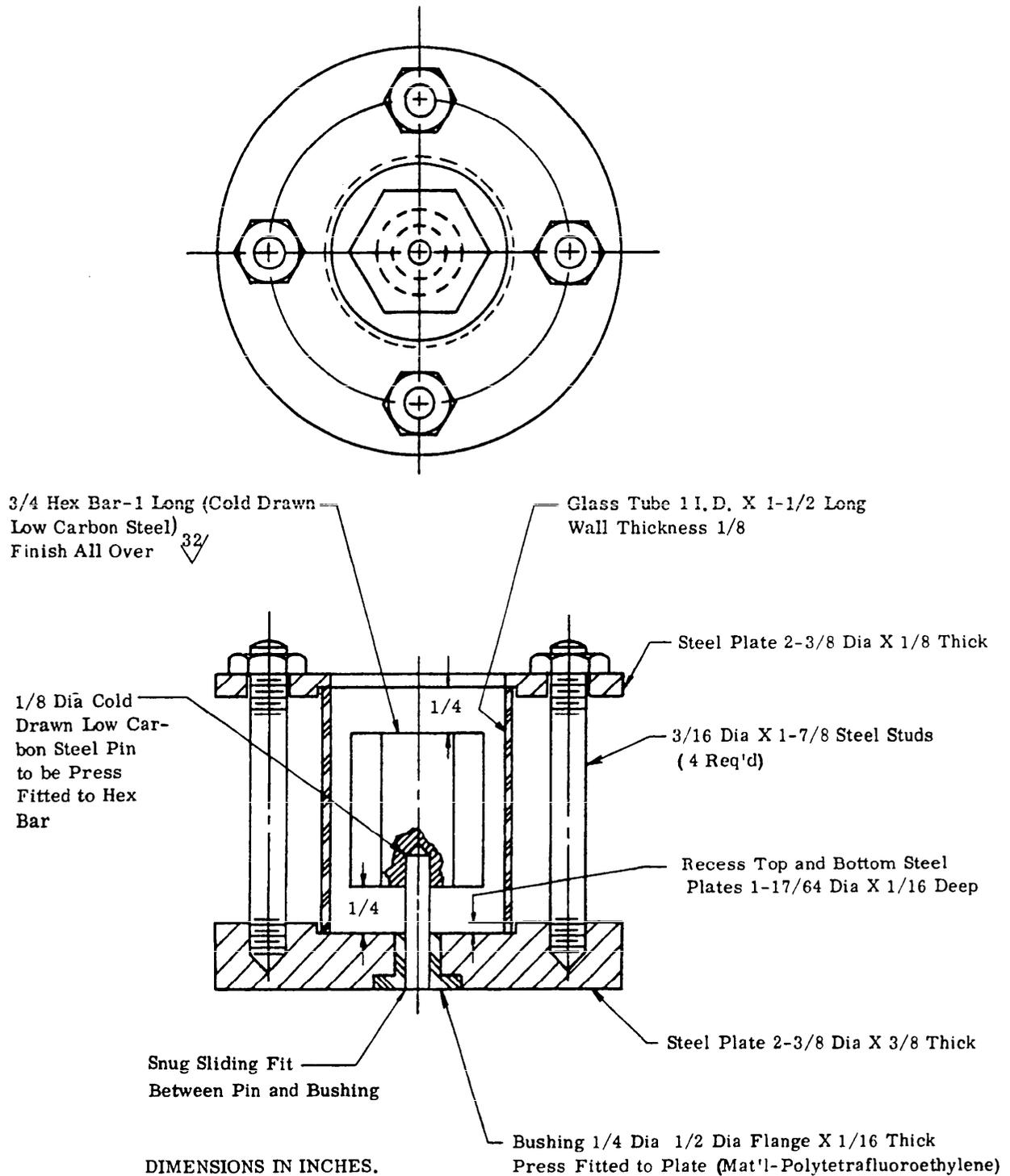


Figure 2. Mold for Thermal Shock Specimen

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4.6.2.15 Brittle point - The brittle point of the cured silicone compound shall be determined in accordance with ASTM Method D746-64T and shall conform to the requirement of Table I.

4.6.2.16 Hydrolytic stability, physical -

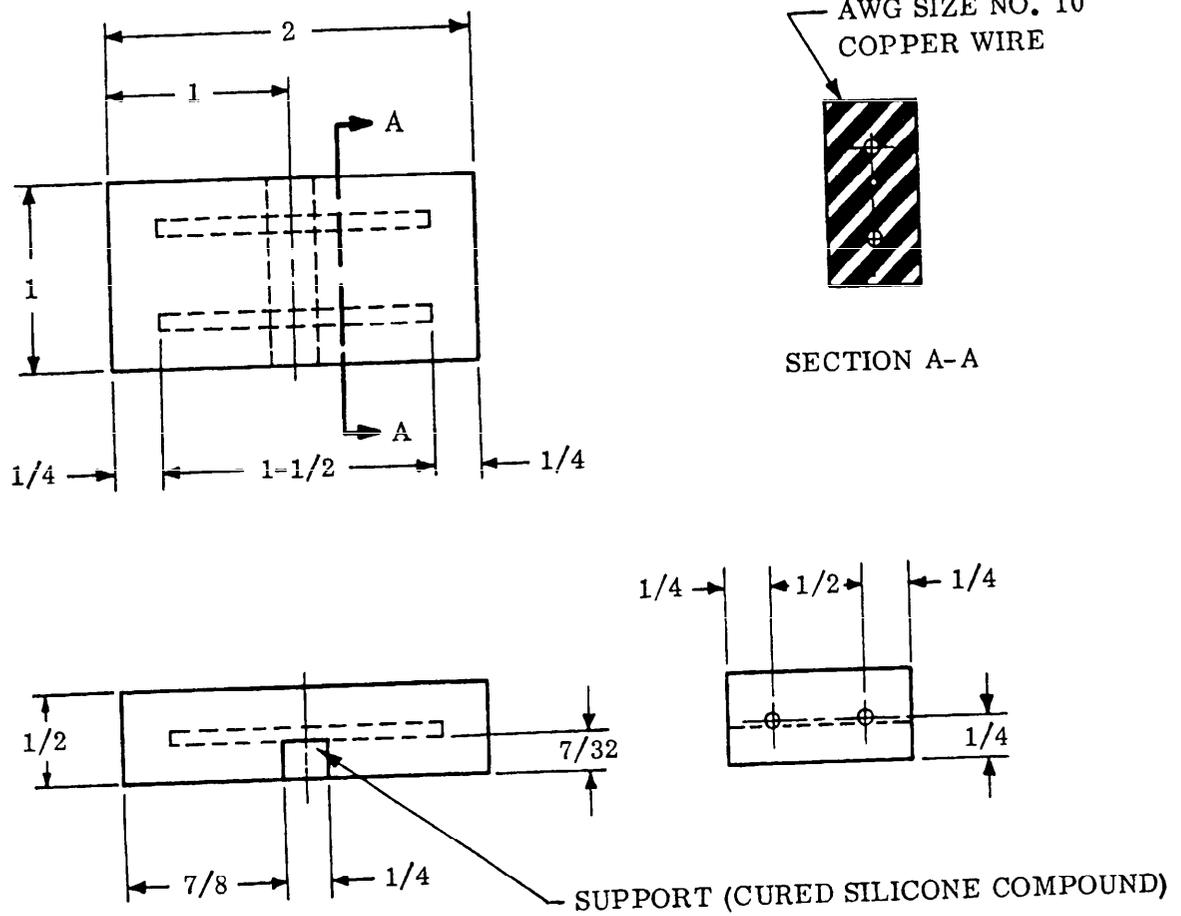
4.6.2.16.1 Specimen preparation - Sufficient base compound and curing agent shall be mixed (4.5.2) to prepare 6 test specimens, 2-1/2 inches in diameter by 1/2 inch thick. Each specimen shall be subjected to the applicable cure of 4.5.4. Hardness shall be determined using a Shore A Durometer in accordance with Test Method 1082 of Fed. Test Method Std. No. 406 after 3-second application time. Hardness shall be determined at the same locations, before and after exposure.

4.6.2.16.2 Procedure - After determining hardness before exposure, three specimens shall be placed, vertically, on a suitable tray in each of two glass desiccators. Each desiccator shall contain a glycerine (22 percent by volume) in water solution, in the bottom, which will produce a relative humidity (RH) of 95 percent at the test temperature. One desiccator shall be placed in an oven maintained at $200 \pm 2^\circ \text{ F}$ ($93.4 \pm 1^\circ \text{ C}$) for 28 days ± 4 hours (Phase I) (see 6.6). The other desiccator shall be placed in an air circulating oven maintained at $160 \pm 2^\circ \text{ F}$ ($71 \pm 1^\circ \text{ C}$) for a period of 120 days ± 4 hours (Phase II). At the end of the respective exposure period, the desiccator shall be removed from the oven and cooled to standard conditions (4.5.1) for 16 to 24 hours. Hardness shall be determined as specified in 4.6.2.16.1. The obtained values for each specimen shall be in accordance with the requirement in Table I.

4.6.2.17 Corrosion - Prepare three 1.5 inch lengths of copper wire AWG Size 10 conforming to J-C-30, by removing all insulation, cleaning with a degreasing agent and buffing to a bright finish. Encapsulate two wire specimens centrally into a suitable mold 1 by 2 by 0.5 inch thick. A previously cured section of the same silicone compound undergoing test shall be placed in the mold as a support for the wires (see Figure 3). The mixed compound, prepared in accordance with 4.5.2 shall be subjected to applicable cure of 4.5.4. The third wire (control) shall also be subjected to the Cure condition. The curing agent used for this test shall be the same used in sample preparation for all the other physical and electrical tests. Place the specimen along with the control wire into an environment of 95 to 98 percent relative humidity and $49 \pm 1^\circ \text{ C}$ ($120 \pm 2^\circ \text{ F}$) for 28 days. At the end of this period the mold shall be slit open and the encapsulated wire compared with the control for compliance with the requirement in Table I.

4.6.2.18 Fungus resistance - Three specimens, 4 by 4 by 0.125 inch, shall be cut from panels prepared and cured as specified in 4.5.3 and 4.5.4. Tests shall be conducted in accordance with MIL-E-5272.

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UNLESS OTHERWISE SPECIFIED, DIMENSIONS IN INCHES.

Figure 3. Location of the Wire Specimens in the Silicone Casting

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4.6.2.19 Shelf storage life - One pint of the base compound together with its curing agent shall be stored separately in their "as received" containers for 4 months (time shall be counted from date of manufacture). The storage temperature shall be as specified by the manufacturer, but shall not be below conditions of 4.5.1. At the conclusion of the storage test, the silicone compound shall conform to 3.3.1.4.

4.6.3 Electrical tests -

4.6.3.1 Dielectric strength - Three disk specimens, 4 inches in diameter and approximately 0.075 inch thick shall be cut from specimens molded and cured in accordance with 4.5.3. Dielectric strength determinations shall be made in accordance with Method 4031 of Fed. Test Method Std. No. 406. Electrodes 0.250 inch in diameter shall be used and the test shall be made under oil at a frequency not exceeding 100 cycles per second. The voltage shall be increased uniformly at the rate of 500 volts per second (see Table II).

4.6.3.2 Volume resistivity - Three disk specimens, 4 inches in diameter and approximately 0.075 inch thick, shall be cut from panels prepared and cured as specified in 4.5.3. Resistivity tests shall be conducted in accordance with Method 4041 of Fed. Test Method Std. No. 406, using a General Radio Type 544B bridge or equivalent instrument with a test voltage of 500 volts. Readings shall be made 1 minute after application of current. Lead foil electrodes shall be disks, 2 inches in diameter, centrally located on one face of the specimen. The guard electrode shall be a concentric ring of 2.281 inches inside diameter and with an outside diameter equal to that of the specimen. The unguarded electrode shall be a foil disk 4 inches in diameter applied to the opposite side of the specimen. The test current shall be introduced to the guarded electrode, the guard electrode, and the unguarded electrode by means of a brass disk 2 inches in diameter by 1 inch in thickness, a brass ring 2.313 inches inside diameter by 4 inches outside diameter by 0.125 inch thick, and a brass disk 4 inches in diameter, respectively. Calculations necessary for volume resistivity shall be made using Method 4041 of Fed. Test Method Std. No. 406 (see Table II).

4.6.3.3 Dielectric constant and dissipation factor.- Three disk specimens, 4 inches in diameter and approximately 0.075 inch thick shall be cut from slabs prepared and cured as specified in 4.5.3. Tests shall be conducted in accordance with Method 4021 of Fed. Test Method Std. No. 406. Lead foil electrodes shall be used and applied to the specimen. The electrodes shall consist of two lead foil disks, one of the same diameter as the specimen and the other 2 inches in diameter, centrally located on the opposite face of the specimen. The test current shall be introduced to the foil through two brass disks. The upper disk shall be 2 inches in diameter and 1 inch in thickness, and the lower disk shall be 4 inches in diameter. The specimens shall be tested at frequencies of 1 kilocycle, 1 megacycle, and 10 megacycles. Calculation shall include corrections for edge and ground capacitance effects (see Table II).

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4.6.3.4 Arc resistance - Three disk specimens four inches in diameter shall be cut from material prepared as specified in 4.5.3. Tests shall be conducted in accordance with Method 4011 of Fed. Test Method Std. No. 406. The surface of the test specimens shall be smooth, and free from dust or other contamination (see Table II).

5. PREPARATION FOR DELIVERY

5.1 Packaging - Packaging shall be Level A or C as specified (see 6.2).

5.1.1 Level A -

5.1.1.1 Unit protection - The base compound, curing agent, primer, and barrier, shall each be packaged in their own containers. Each curing agent container shall be packaged with one base compound container with a suitable separator between the two containers, in a manner which will prevent accidental separation but which will permit easy separation for mixing purposes. The ratio of the quantity contained in the base compound container to the quantity contained in the attached curing agent container shall be the same as the recommended mixing ratio of the base compound and curing agent.

5.1.1.2 Unit package - The base compound shall be furnished in 1 pint multiple friction top cans, conforming to Type V, Class 2 of PPP-C-96. The amount of base compound contained in each can shall fill the container to approximately three-fourths of its capacity. The proper amount of curing agent and 4 oz. of primer shall be furnished in glass or plastic jars conforming to Type I, Class 1, or Type III, Class 1 of PPP-C-300, having vertical smooth inside walls, with projections or lips not exceeding 1/16 inch. The inside bottom shall be approximately horizontal. The jars shall have one rolled thread such that the cap will turn a minimum of 1/4 revolution to fully secure. The jars shall be provided with enameled metal or plastic screw type caps.

5.1.2 Level C - The base compound, curing agent, primer, and barrier, shall be packaged in accordance with the manufacturer's commercial practice.

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

5.2.1 Level A - Base compound, curing agent, primer, and barrier, packaged in accordance with 5.1.1 shall be packed in an overseas exterior type container conforming to PPP-B-585, PPP-B-601, PPP-B-621, or PPP-B-636, as specified (see 6.2). Weight of the contents shall conform to the weight limitations of the applicable box specification and shall not exceed a total weight of 200 pounds. PPP-B-601 boxes shall be surface treated in accordance with requirements of the

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specification. Containers shall be closed and sealed in accordance with the appendix of the applicable specification.

5.2.2 Level B - The base compound, curing agent, primer, and barrier, packaged as specified in 5.1 shall be packed in exterior domestic type containers conforming to PPP-B-585, PPP-B-601, PPP-B-621, or PPP-B-636. Weight of contents shall conform to the limitations of the applicable box specification.

5.2.3 Level C - Base compound, curing agent, primer, and barrier, packaged in accordance with 5.1, shall be packed to afford protection against damage during direct shipment from the source of supply to the first receiving activity for immediate use. Containers shall comply to the Uniform Freight Classification Rules or other regulations applicable to the mode of transportation.

5.3 Marking -

5.3.1 Packages -

5.3.1.1 All component packages - All component packages shall be marked in accordance with the Code of Federal Regulations, Title 49 (171-178).

5.3.1.2 Base compound container - Each base compound container shall be durably and legibly marked as specified in MIL-STD-129 and include the following information:

SEALING COMPOUND, ELECTRICAL, HIGH STRENGTH,
ACCELERATOR REQUIRED

Specification number

Type

Curing agent for (insert product designation for base compound)

Primer Identification

Barrier Identification

Date of Manufacture

Manufacturer's name and address

Manufacturer's product designation

Manufacturer's batch identification

Contract number

Expiration date

Manufacturer's recommended storage temperature

Quantity contained

Stock number

5.3.1.3 Exterior shipping containers - Each exterior shipping container shall be marked as specified in 5.3.1.2, and in accordance with MIL-STD-129.

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5.4 Instructions for use - The supplier of the silicone compound shall furnish with each shipment, 2 copies of complete instructions which shall contain:

- (a) Storage stability, uncatalyzed, indicating the optimum storage temperature and conditions of storage to obtain maximum stability.
- (b) The types of curing agents and the proportions and time required to give maximum cure at room temperatures. The proportions of compounds and curing agents shall be on a weight basis and the methods for mixing them shall be clearly stated.

6. NOTES

6.1 Intended use - The cured silicone sealing compound is intended for use as a protecting encapsulant for electric connectors, components, and other electronic equipment within aircraft.

6.1.1 Type I sealing compound will cure at room temperature and is recommended as a field repair product.

6.1.2 Type II sealing compound will cure by application of heat and is recommended for manufacture only.

6.2 Ordering data - Procurement documents should specify the following:

- (a) Title and date of this specification.
- (b) Type required (see 1.2).
- (c) Quantity desired (see 5.1.1).
- (d) Level of packaging and packing required (see 5.1 and 5.2).
- (e) Any special marking required.
- (f) Applicable Level A shipping container.

6.3 Qualification - With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is

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called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is the Naval Air Systems Command, Washington, D. C. 20360, however, information pertaining to qualification of products may be obtained from the Naval Air Development Center, Johnsville, Warminster, Pennsylvania 18974, Attention: Director, Aero Materials Department.

6.4 Toxicity - The sealing compound 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 procuring activity to the appropriate department medical service who will act as an advisor to the preparing activity.

6.5 Processing information -

6.5.1 This high volume expansion of RTV silicones precludes their use for the total filling of confined units. Pressures developed upon heating are of a high order. The high volume expansion suggests the use of "built in void areas" and the use of silicone cellular rubber or sponge in the unit.

6.5.2 Adhesion - Type I and II compounds will not adhere to electronic parts. To obtain adhesion, a primer recommended by the manufacturer must be applied to surfaces to which a bond is required.

6.5.3 Literature pertaining to the manufacturer's product should be thoroughly understood prior to consideration of RTV silicones. All applications involving the use of RTV silicones should be thoroughly evaluated prior to release.

6.6 Sealing compounds conforming to the other requirements of this specification may, at the option of the Qualifying Activity, be placed on the Qualified Products List of products qualified under MIL-S- (AS) (see 6.3) pending completion of the Phase II hydrolytic stability test (4.6.2.16) and the shelf storage life tests (4.6.2.19). Removal of the compound from the Qualified Products List will be necessary, if subsequently, the compound does not meet either of the above requirements.

Preparing activity:
Navy - AS
Project No. 8030-N020

SPECIFICATION ANALYSIS SHEET		Form Approved Budget Bureau No. 119-R004
<p align="center">INSTRUCTIONS</p> <p>This sheet is to be filled out by personnel either Government or contractor, involved in the use of the specification in procurement of products for ultimate use by the Department of Defense. This sheet is provided for obtaining information on the use of this specification which will insure that suitable products can be procured with a minimum amount of delay and at the least cost. Comments and the return of this form will be appreciated. Fold on lines on reverse side, staple in corner, and send to preparing activity (as indicated on reverse hereof).</p>		
SPECIFICATION MIL-S-81732 (AS)		SEALING COMPOUND, ELECTRICAL, HIGH STRENGTH, ACCELERATOR REQUIRED
ORGANIZATION (Of submitter)		CITY AND STATE
CONTRACT NO.	QUANTITY OF ITEMS PROCURED	DOLLAR AMOUNT
MATERIAL PROCURED UNDER A <input type="checkbox"/> DIRECT GOVERNMENT CONTRACT <input type="checkbox"/> SUBCONTRACT		
1. HAS ANY PART OF THE SPECIFICATION CREATED PROBLEMS OR REQUIRED INTERPRETATION IN PROCUREMENT USE? A. GIVE PARAGRAPH NUMBER AND WORDING.		
B. RECOMMENDATIONS FOR CORRECTING THE DEFICIENCIES.		
2. COMMENTS ON ANY SPECIFICATION REQUIREMENT CONSIDERED TOO RIGID		
3. IS THE SPECIFICATION RESTRICTIVE? <input type="checkbox"/> YES <input type="checkbox"/> NO IF "YES", IN WHAT WAY?		
4. REMARKS (Attach any pertinent data which may be of use in improving this specification. If there are additional papers, attach to form and place both in an envelope addressed to preparing activity)		
SUBMITTED (Printed or typed name and activity)		DATE

FOLD

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Naval Air Engineering Center
Philadelphia, Pennsylvania 19112

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