MILITARY SPECIFICATION

SEALING COMPOUND
BUTYL RUBBER SEALANT
(FOR USE IN AMMUNITION)

1. SCOPE

1.1 This specification covers a type of Butyl Rubber Sealant (Caulk). The material is a single component, solvent release type, butyl rubber based sealing compound for sealing and caulking operations for use in ammunition items (see 6.3).

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

PPP-P-704 - Pails, Metal (Shipping, Steel, 1 Through 12 Gallon)
PPP-D-729 - Drums, Metal, 55-Gallon (For Shipment of Noncorrosive Material)

STANDARDS

FEDERAL

Test Method Standard No. 141 - Paint Varnish, Lacquer and Related Material; Method of Inspection Sampling and Testing

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes (ABC-STD-105)
MIL-STD-109 - Quality Assurance Terms and Definitions
MIL-STD-129 - Marking for Shipment and Storage
MIL-STD-650 - Explosive: Sampling, Inspection and Testing
MIL-STD-1167- Ammunition Data Cards
MIL-STD-1235- Single and Multilevel Continuous Sampling Procedures and Tables for Inspection by Attributes

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activities or as directed by the Contracting Officer).

2.2 Other publications.-The following documents form a part of this specification 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-D-2202	-	Method of Test for Slump of Oil and Resin-Base Caulking Compounds
ASTM-D-2452	-	Method of Test for Extrudability of Oil and Resin-Base Caulking Compounds

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

UNIFORM FREIGHT CLASSIFICATION COMMITTEE

UNIFORM FREIGHT CLASSIFICATION 6 - Ratings, Rules and Regulations

(Application for copies of these freight classification rules should be addressed to the Uniform Freight Classification Committee, 202 Union Station, Chicago, Illinois 60606).

3. REQUIREMENTS

3.1 The sealing compound shall be a homogeneous mixture of a proper consistency suitable for immediate application by pressure gun or hand tool. The compound, when set, shall form a semi-elastic type solid capable of maintaining a seal against water and dirt.

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

3.3 Detailed Requirements

3.3.1 Tenacity.-The sealant compound when bent as prescribed in 4.4.1 shall not show any cracking, separation, delamination, or adhesion loss.

3.3.2 Shrinkage.-The compound when tested on glass as prescribed in 4.4.2 shall not shrink more than 25.0 percent.

3.3.3 Slump.-The compound shall not slump more than 0.15 inch when tested as prescribed in 4.4.3.

3.3.4 Extrudability .-The compound shall have an extrudability value of not more than 9 seconds per ml. when tested as prescribed in 4.4.4.

3.3.5 Tack-free time.-When tested as prescribed in 4.4.5, no sealant material shall adhere to the polyethylene strip when the latter is pulled from the layer of compound.

3.3.6 Reactivity.-When applicable, suitability of the material for use with a particular explosive shall be as specified by the procuring activity, or the contract or the purchase order. The test shall be performed for First Article Inspection only (see 6.1). When subjected to a stability reactivity vacuum test as specified in 4.4.6, the reactivity of the compound with the specified explosive shall not exceed 3.0 ml. of gas over and above that generated by the controls. (see 6.5).

3.3.7 Stability (storage shelf life).-The compound shall be stable for at least 6 months, from the time of delivery, when stored at a temperature not exceeding 90°F. Tests shall be performed in accordance with 4.4.7. This test shall be performed for the First Article Inspection only.

3.4 First Article Testing.-This specification makes provisions for first article testing. Submission of first article quantity by the contractor shall be as specified in the contract.

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 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. Reference shall be made to Standard MIL-STD-109 in order to define the terms used herein.

4.1.1 Submission of product.-At the time the completed lot of product is submitted to the Government for acceptance, the contractor shall supply the following information accompanied by a certificate which attests that the information provided is correct and applicable to the product being submitted:

a. A statement that the lot complies with all requirements and quality assurance provisions specified in this specification.

b. Specification number and date, together with an identification and date of changes.

c. Certificates of analysis on all materials used directly by the contractor when such material is controlled by Government specifications shall be made available upon request by the Contracting Officer.

d. Quantity of product in the lot.

e. Date submitted.

The certificate shall be signed by a responsible agent of the certifying organization. The initial certificate submitted shall be substantiated by evidence of the agent's authority to bind his principal. Substantiation of the agent's authority will not be required with subsequent certificates unless, during the course of the contract, this authority is vested in another agent of the certifying organization.

4.2 First Article Inspection

4.2.1 Submission.-The contractor shall submit a first article sample consisting of 5 lbs. of the butyl rubber sealant in accordance with instructions issued by the Contracting Officer for evaluation in accordance with paragraph 4.2.2. All samples submitted shall have been produced by the contractor using the same production processes, procedures, and equipment as will be used in fulfilling the contract. All materials shall be obtained from the same sources of supply as will be used in regular production. The sample shall be accompanied by certificates of analysis. A first article quantity, or portion thereof, as directed by the Contracting Officer, shall also be submitted whenever there is a lapse in production for a period in excess of 90 days, or whenever a change occurs in manufacturing process, material used, drawing, specification or source of supply as to significantly affect product uniformity as determined by the Government. Prior to submission, the contractor shall inspect the sample to the degree necessary to assure that it conforms to the requirements of the contract and submit a record of this inspection with the sample. A sample containing known defects will not be submitted unless specifically authorized by the Contracting Officer.

4.2.2 Inspections to be performed.-The sample will be subjected by the Government to any or all of the examinations or tests specified in 4.3 and 4.4 of this specification and any or all requirements of the applicable drawings.

4.2.3 Rejection.-If the sample fails to comply with any of the applicable requirements, the first article quantity shall be rejected. The Government reserves the right to terminate its inspection upon any failure of the sample to comply with any of the stated requirements. In the event of rejection, the Government reserves the right to require the contractor to take corrective action and submit a new first article quantity or portion thereof. Until a first article quantity is accepted, the contractor is in no way authorized by the Government to resume regular production unless otherwise directed by the Contracting Officer.

4.3 Inspection provisions

4.3.1 Lot formation.-A lot shall consist of one batch of the sealant material. A batch is that quantity of sealant material produced by one manufacturer in accordance with the same specification, or same specification revision under one continuous set of operating conditions. Each batch shall consist of that quantity of material that has been subjected to the same unit chemical or physical mixing process intended to make the final product homogeneous. The product shall be submitted for inspection in accordance with Standard MIL-STD-105 (or Standard MIL-STD-1235 when applicable).

4.3.2 Examination.-Sampling plans and procedures for the following classifications of defects shall be in accordance with MIL-STD-105 (ABC-STD-105), except that inspection for Critical defects shall be 100 percent. Contractor's sampling plans, if used, shall be approved by the Government and shall provide, as a minimum, the protection afforded the Government by the sampling plans in MIL-STD-105. Continuous sampling plans in accordance with MIL-STD-1235 may be used if approved by the procuring activity. Also, at the option of the procuring activity, AQL's and sampling plans may be applied to the individual characteristics listed, using an AQL of 0.40 percent for each Major defect and an AQL of 0.65 percent for each Minor defect except where 100 percent inspection is specified.

4.3.2.1 Butyl Rubber Sealant Material

Categories	Defects	Method of Inspection	Code No. (see 6.2)
Critical:	None defined.		
Major:	AQL 0.65 percent		
101.	Not uniform in consistency	Visual	01001
102.	Not free of foreign particles	Visual	01002
Minor:	None defined.		

4.3.2.2 Unit drum and/or container, as applicable (see 5.1.1 and 5.2).

Categories	Defects	Method of Inspection	Code No.
Critical:	None defined.		
Major:	AQL 1.00 percent		
101.	Marking missing or improper	Visual	02001
102.	Improper sizes	Visual	02002
103.	Improper fill*	Scale	02003
104.	Leakage	Visual	02004
105.	Improper closure	Visual	02005
106.	Dents	Visual	02006
107.	Foreign material present	Visual	02007
Minor:	None defined.		

* The actual weight of a container filled with the minimum required quantities of sealant material shall be the basis for determining the acceptable weight of subsequent containers.

4.3.3 Testing and Sampling

4.3.3.1 Testing.-The tests depicted in 4.4 except for 4.4.6 and 4.4.7 shall be performed on each batch of material. If the batch fails to comply with any of the requirements specified in 3.1 thru 3.3 the batch shall be rejected. The tests depicted in 4.4.6 and 4.4.7 shall be performed for First Article Inspection only.

4.3.3.2 Sampling.-Prepare a one quart sample of the material by removing quantities of the sealant from the processing equipment by use of a suitable thief. The sample shall be taken prior to pouring into the shipping containers provided that the material has been completely processed and mixed. The sample should be stored in a container which protects the sample from moisture, etc.

4.3.4 Inspection equipment.-For the performance of all tests and examinations specified in 4.3 and 4.4, commercial inspection equipment should be employed (see 6.4). The contractor shall have available, and utilize correctly, this equipment and is charged with the responsibility of insuring that proper calibration procedures are followed. Government approval of all inspection equipment is required prior to its use for acceptance purposes.

4.4 Test Methods and Procedures

The standard conditions of temperature and relative humidity referred to in this specification are defined as 73.4° ± 3.6°F (23° ± 2°C), and 50 ± 5 percent R.H.

The sealant sample shall be held in the unopened container for at least 24 hours at standard conditions before starting the following tests.

4.4.1 Tenacity - Major Defect, Code No. 03001.-Apparatus and materials required are: (1) Thin aluminum panels, 3 inches (7.6 cm) wide by 5 inches (12.7 cm.) long by approximately 0.01 inch (0.3 mm.) thick; (2) template, steel or brass, 1/8 inch (0.3 cm.) high, 3 3/4 inches (9.5 cm) by 1 inch (2.5 cm.) inside and approximately 4 3/4 inches (12 cm.) by 2 inches (5.1 cm.) outside; (3) Spatula, steel with knife edge; (4) Oven, forced draft type having a temperature controlled at 158° ± 4°F, (70° ± 2°C); (5) Freezer chest or cold box having a temperature controlled at -10° ± 5°F, (-23° ± 3°C); (6) Mandrel or rod with a diameter of 1/4 inch (0.64 cm.) and with a suitable holder or rack to support the rod.

Procedure.- Clean the template and aluminum panels with methyl ethyl ketone or similar solvent. Prepare three (3) test specimens. Center the template on an aluminum panel and carefully fill it with test compound, avoiding air pockets. Strike off the surface of the compound flat to a uniform 1/8 inch (0.32 cm.) thickness. With the thin knife edge of the spatula, cut all around the outside edge of the compound and lift the template straight up and off.

Cure the specimens for at least 24 hours at standard conditions. Then expose the specimen to the following cycle three (3) times:

16 hours at 158° ± 4°F. (70° ± 2°C)

8 hours at -10° ± 5°F. (-23° ± 3°C)

At the end of the third cycle, while in the freezer at -10°F. (-23°C), sharply bend the plate in half across its width over the 1/4 inch (0.64 cm.) diameter mandrel. Take no more than one second to make the bend.

Examine the sealant and report any cracking and loss of adhesion. Very minor crazing of the thin surface skin may be disregarded. If two (2) specimens pass and one (1) fails of the three specimens tested, the test shall be repeated. If two (2) or more specimens fail, the compound is rated as having failed. Methyl ethyl ketone and similar solvents are both toxic and flammable and should be handled with caution in a well-ventilated hood.

4.4.2 Shrinkage - Major Defect, Code No. 04001.-Apparatus and accessory materials required are: (1) titrating buret marked in 0.1 ml., (2) brass ring approximately 2 5/8 inches (6.7 cm.) in inside diameter and 1/2 inch (1.27 cm.) wide, with ends ground flat, (3) 2 ground glass cover plates, 3 to 31/2 inches (8 cm.) in diameter, (4) leveling tool for spreading compound, designed to lay down a 1/8 inch layer of sealant, as shown in Figure 1, (5) distilled water.

Procedure.-Adhere the brass ring to one of the ground glass plates. Determine the volume of the ring by filling it with distilled water at standard temperature from a titrating buret. The water from the buret shall be slowly added so that there are no air bubbles when the glass cover plate is centered on the ring. Record the amount of water required to fill the ring, to the nearest 0.03 ml. as V_r.

Spread a 1/8 inch (0.32 cm.) layer of compound in the ring using the leveling tool to form good contract with ring and glass. Pour distilled water from the buret into the ring until it is exactly filled (without air bubbles), as determined by covering with the other glass plate. Record how much water is required to fill the ring using the buret (reading the buret to an accuracy of 0.03 ml.) and designate the amount as V_1.

Pour the water from the ring and let the specimen set at standard conditions for a period of 14 days. At the end of this exposure period, repeat the filling of the ring using the buret and distilled water and record the volume of water as V_f. Calculate the shrinkage of the sample as follows:

$$\text{Percent Shrinkage} = \frac{V_f - V_i \times 100}{V_r - V_i}$$

Where:

V_r = Volume of ring
V_f = Volume of water required to fill the ring after 14 days exposure
V_i = Volume of water required to fill the ring before 14 days exposure

4.4.3 Slump - Major Defect, Code No. 05001.-Perform the test in accordance with ASTM Standard D 2202. Figure 2 illustrates the flow test jig used in this procedure.

4.4.4 Extrudability - Major Defect, Code No. 06001.-Equipment and accessories required are: (1) Press Flow Extrusion Rheometer as described in ASTM Standard D2452, (Fig. 3); (2) air supply and pressure guage accurate to 1 psi; (3) stand and clamps to hold Rheometer; (4) weight per gallon cup; (5) triple beam balance accurate to one gram; (6) chemical balance; (7) stop watch.

Procedure.-After conditioning Rheometer at standard conditions for at least 4 hours, remove both ends from Rheometer and stand the Rheometer tube on a horizontal surface, bottom up, Insert follower plate and fill with sealant, avoiding air pockets. Strike off filled tube, flat, with spatula. Replace top and orifice caps and connect to air supply.

Adjustment of Air Pressure: Adjust air pressure to 60 psi and open air valve. If pressure drops, readjust to 60 psi while extrusion is in progress. Close air valve and discard extruded sealant. The equipment is now ready for testing.

Place assembly in a stand so that the sealant is extruded onto a triple beam balance. Open air valve and start stop watch simultaneously. After extruding approximately 50 grams of compound, close air valve and click stop watch simultaneously. Weigh to the nearest 0.01 gram the exact amount of compound extruded. Calculate the seconds per gram by dividing the number of seconds elapsed by the number of grams extruded and designate this value as S.

Determine the density of the compound using a weight per gallon cup as described in Method 4184.1 of Fed. Test Method Std. No. 141.

Extrudability, expressed in seconds per milliliter of sealant is determined by the formula:

$$E = S \times D$$

Where:

S = seconds per gram of sealant
D = density = grams per milliliter of sealant

4.4.5 Tack-free time - Major Defect, Code No. 07001.-Accessory materials required are: (1) Brass weight, 40 grams, approximately 1 1/2 by 3/4 by 1/4 inches (3.8 x 1.9 x 0.6 cm.), (2) Template steel or brass as described in 4.4.1, (3) Clear, low density polyethylene film strips, approximately 5 by 1 by 0.004 ± 0.002 inches (12.7 cm. x 2.5 cm. x 0.1 mm.), (4) Aluminum plate, approximately 3 inches (7.6 cm.) by 5 inches (12.7 cm.), (5) Spatula, steel with knife edge.

Procedure.-Center the template on the aluminum plate and completely fill the space within the template with a portion of the compound. Using the spatula, strike the surface of the compound flat to a uniform 1/8 inch (0.3 cm.) thickness. With the thin knife edge of the spatula, cut all around the outside edge of the compound and lift the template straight up and off. Expose the test specimen in the laboratory for 24 hours at standard conditions.

At the end of the exposure period, center the polyethylene film strip lengthwise along the top surface of the compound and set the brass weight in the center of the top of the strip for 30 seconds. Remove weight, and then progressively withdraw the plastic film (with thumb and forefinger) at right angles to the compound (Fig. 5). Note if any sealant compound adheres to the film.

4.4.6 Reactivity - Major Defect, Code No. 08001.-The reactivity of the sealant compound in contact with the specified explosive shall be determined using the vacuum stability test according to method 504.1 of MIL-STD-650 at 100° ± .5°C (212° ± 1°F) for 40 hours. This test shall be performed for the First Article Inspection only. (see 6.5).

4.4.7 Stability - Major Defect, Code No. 09001.-One quart of the sealant in a closed container shall be stored for 6 months at temperature of 90°F or less. The material shall be tested for conformance to the requirements of 3.3.1 thru 3.3.5 after the 6 month storage period. This test shall be performed for the First Article Inspection only.

5. PREPARATION FOR DELIVERY

5.1 Packing

5.1.1 Unless otherwise specified in the contract or purchase order, the material shall be packaged in non-returnable 55 gallon drums which conform to the requirements of PPP-D-729, Type 3, (DOT Rule 40 drum). Use of smaller non-returnable pails which conform to the requirements of PPP-P-704, Type II (DOT Rule 37A pail), lug-top lid, or a lever lock lid (no type designated), or in 55 gallon drums, as applicable may be used if specified in the contract or purchase order. The materials shall be packed to afford adequate protection against corrosion deterioration and damage during shipment from supply source to the first receiving activity for immediate use. Containers used shall comply with Uniform Freight Classification Rules and Container Specifications for rail shipment or National Motor Freight Rules and Container Specifications for truck shipment as applicable.

5.2 Marking.-In addition to any special markings required by the contract or purchase order, containers shall be marked in accordance with MIL-STD-129. Marking shall include, but is not limited to, the following information:

a. Manufacturers name
b. Product designation
c. Lot number
d. Date of manufacture
e. Number of this specification

6. NOTES

6.1 Ordering data.-Procurement documents should specify the following:

a. Title, number and date of this document
b. Data cards shall be prepared for each lot in accordance with Standard MIL-STD-1167. (NOTE: AMC Form 1059 Description and Acceptance Report, may be used instead of Data Cards).
c. Provisions for submission of first article samples. (see 6.5).
d. Type of packing required (Drums or Pails) (See 5.1.1).
e. Provisions for submission of contractor-designed equipment.

6.2 Inspection Code Numbers.-The five-digit code numbers assigned to the inspection herein are to facilitate future data collection and analysis by the Government.

6.3 Intended use.-The material covered by this specification is intended to be used as a non-reactive material for caulking cavities in ammunition items.

6.4 Inspection equipment

6.4.1 Commercial inspection equipment is defined in AMC Regulation 702-2.

6.4.2 Contractor-designed equipment.-In the event that a contractor elects to design his own inspection equipment, details of the design (drawings, description, materials, etc.) shall be submitted to: Commanding Officer, Picatinny Arsenal, ATTN: SMUPA-QA-A-P, Dover, New Jersey, 07801, for approval prior to fabrication and use. Approval of such designs may be delegated to the contract administration office for minor defects only.

6.5 The reactivity test will be performed by Picatinny Arsenal. Samples for the test shall be submitted in accordance with instructions of the Contracting Officer to Commanding Officer, Picatinny Arsenal, ATTN: SMUPA-QA-A-P, Dover, New Jersey 07801.

CUSTODIAN:
ARMY-MU

PREPARING ACTIVITY:
ARMY-MU

PROJECT NUMBER: 1325-A-441

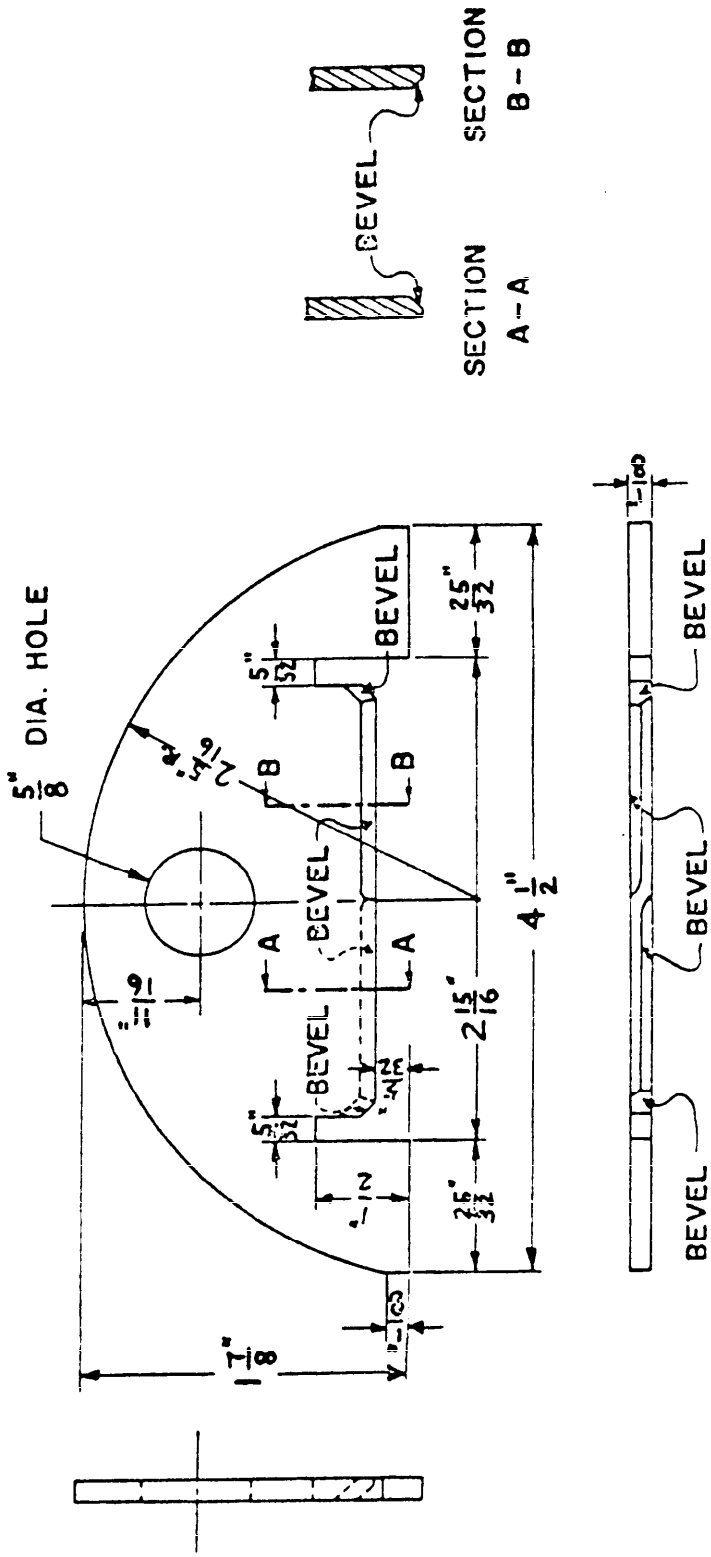

FIG. 1. TOOL FOR LEVELING SEALING COMPOUND IN THE SHRINKAGE TEST SPECIMEN.

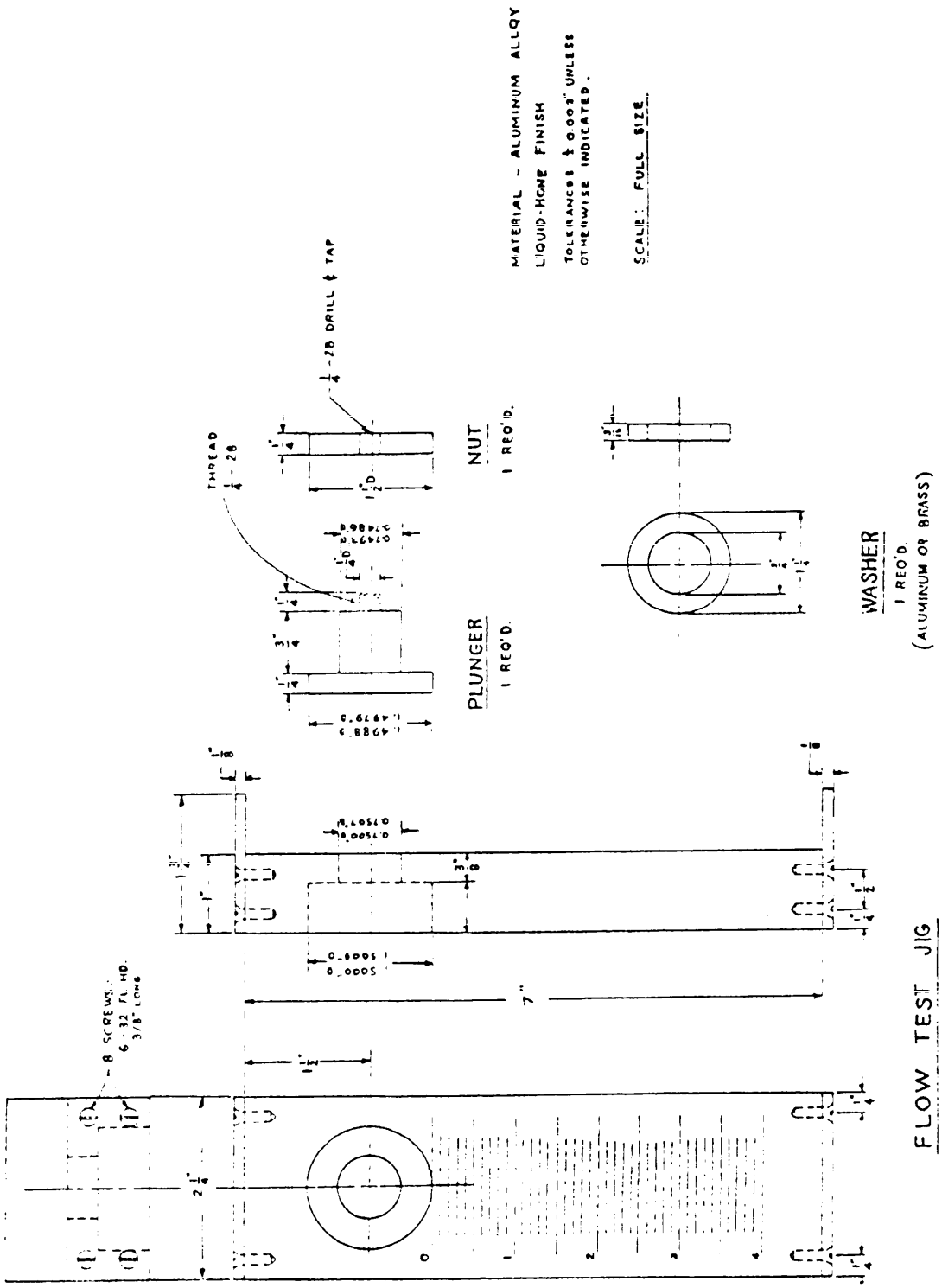

FIG. 2. FLOW TEST [illegible] FOR THE DETERMINATION OF SLUMP.

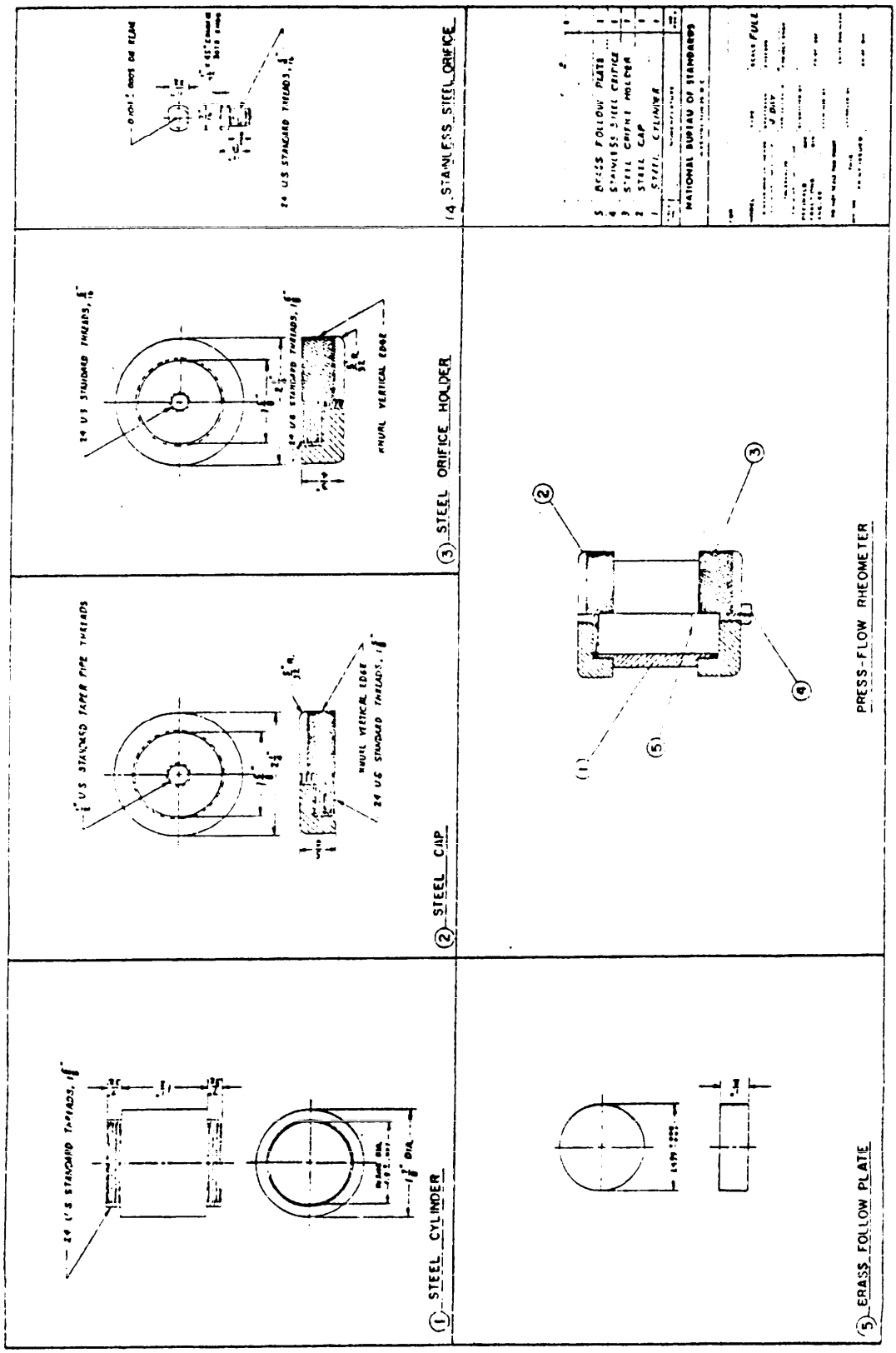

FIG. 3. DRAWING OF PRESS-FLOW EXTRUSION RHEOMETER FOR EXTRUDABILITY TEST.

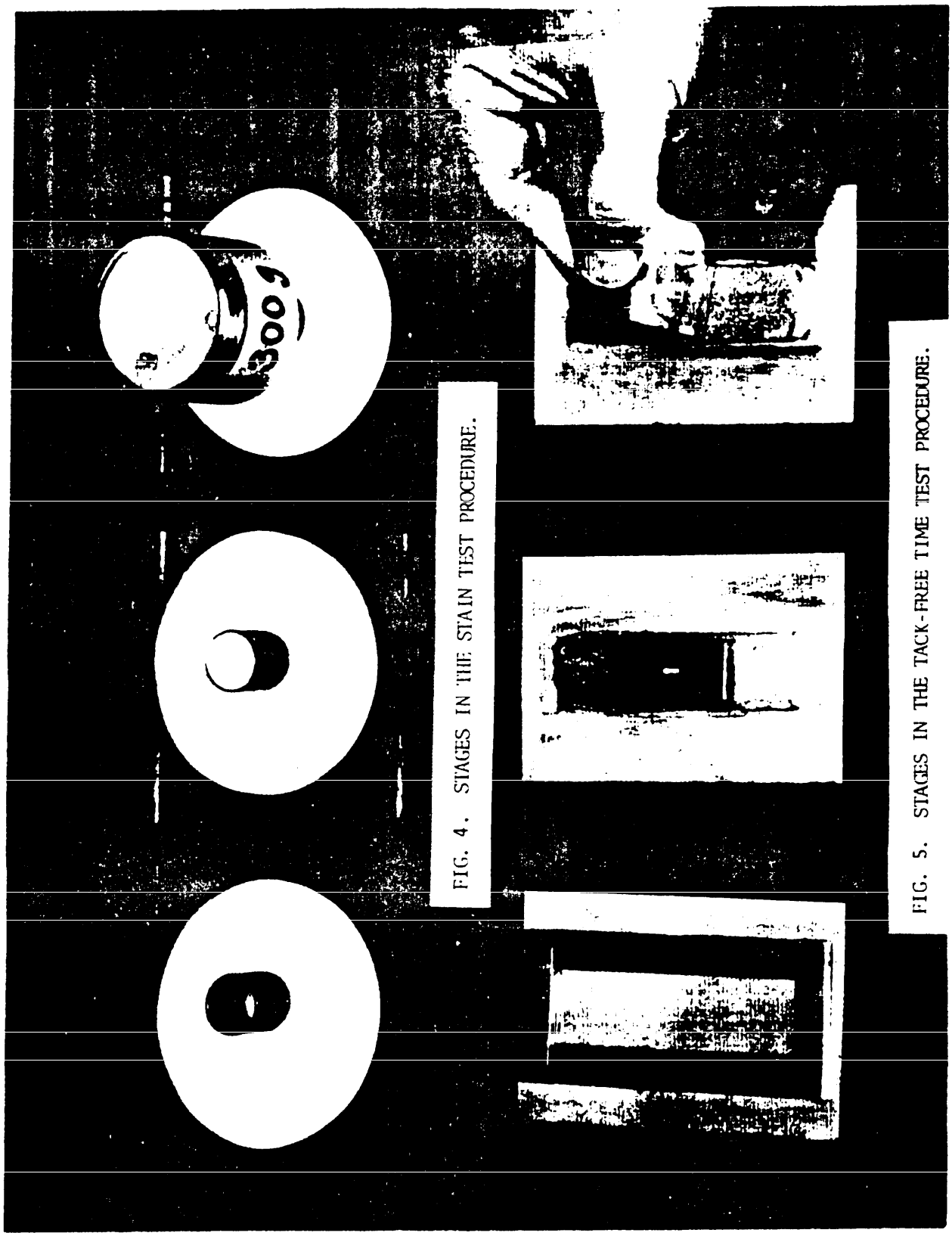

FIG. 4. STAGES IN THE STAIN TEST PROCEDURE.

FIG. 5. STAGES IN THE TACK-FREE TIME TEST PROCEDURE.

SPECIFICATION ANALYSIS SHEET

Form Approved
Budget Bureau No. 22-R255

INSTRUCTIONS: 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. Comments and suggestions submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or serve to amend contractual requirements.

SPECIFICATION

ORGANIZATION

CITY AND STATE

CONTRACT NUMBER

MATERIAL PROCURED UNDER A

☐ DIRECT GOVERNMENT CONTRACT ☐ 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?

☐ YES ☐ 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 BY *(Printed or typed name and activity - Optional)*

DATE

DD FORM 1 JAN 66 1426

REPLACES EDITION OF 1 OCT 64 WHICH MAY BE USED.

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Picatinny Arsenal
ATTN: SMUPA-MR QA-A
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