MMM-A-121
December 16, 1966

SUPERSEDING
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FEDERAL SPECIFICATION

ADHESIVE, BONDING VULCANIZED SYNTHETIC RUBBER TO STEEL

This specification was approved by the Commissioner, Federal Supply Service, General Services Administration, for the use of all Federal agencies

1. SCOPE AND CLASSIFICATION

1.1 This specification covers adhesives for bonding vulcanized synthetic rubber gaskets, matting, and similar items to steel.

2. APPLICABLE DOCUMENTS

2.1 Specifications 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:

PPP-C-96—Cans, Metal, 28 Gage and Lighter.

PPP-G-460—Glass Containers, One Gallon Capacity and Smaller, For Other Than Medicinal Products; Packaging and Packing Of.

Federal Standard:

Fed Std. No 128—Marking For Domestic Shipment (Civilian Agencies).

(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 product specifications required by activities outside the Federal Government for bidding purposes are available without charge at the General Services Administration Regional Offices in Boston, New York, Washington, D C., Atlanta, Chicago, Kansas City, Mo., Dallas, Denver, San Francisco, Los Angeles, and Seattle, Wash.

(Federal Government activities may obtain copies of Federal Specifications, Standards, and Handbooks and the Index of Federal Specifications and Standards from established distribution points in their agencies.)

Military Standards:

MIL-STD-105—Sampling Procedures and Tables for Inspection by Attributes.

MIL-STD-129—Marking For Shipment and Storage.

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

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.

Official Classification Committee (OCC):
Uniform Freight Classification Rules.

(Copies may be obtained from the Official Classification Committee, 1 Park Ave. at 33rd St., New York, N. Y., 10016.)

Department of Commerce:
Code of Federal Regulations.
49 CFR 71-78—Interstate Commerce Commission Rules and Regulations For Transportation of Explosives and Other Dangerous Articles.

(Copies may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington, D C., 20402.)

Manufacturing Chemists Association Manual:

L-1—Warning Labels.

(Copies may be obtained from the Manufacturing Chemists Association, Inc., 1625 Eye St., N. W., Washington, D. C., 20006.)

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

3. REQUIREMENTS

3.1 **Qualification.** The adhesive furnished under this specification shall be products which are qualified for listing on the applicable qualified product list at the time set for opening of bids (see 4.2 and 6.3).

3.2 **Material.** The adhesive material shall be of the best commercial quality, ready for use, and shall have no deleterious effect on steel surfaces to which it is applied. The adhesive shall be free from material which will be toxic to personnel under normal conditions of use.

3.3 **Physical requirements.** The adhesive material shall conform to the requirements specified in table I.

3.4 **Marking.** Each container of material shall be labeled giving adequate instructions for use and application of contents. The name of the manufacturer, specification number, and month and year of manufacture shall also be indicated on the label.

TABLE I. *Physical requirements for adhesive*

	Requirement	Test procedure
Viscosity, flow time, seconds, maximum	150	4.6.1
Solids content, variation from qualification test values, percent, maximum	10	4.6.2
Weight of filled containers, variation from average of qualification test values, percent, maximum	6	4.6.3

TABLE I. *Physical requirements for adhesive (cont'd)*

	Requirement	Test Procedure
Wet adhesion, inches, maximum	3	4.6.4
Initial adhesion, inches, maximum	3	4.6.4
Adhesion after salt water immersion, inches, maximum	3	4.6.4
Adhesion at 140° F., (60° C.), inches, maximum	3	4.6.4
Stability of adhesive (wet adhesion test), inches, maximum	3	4.6.5
After storage for one year at room temperature, the adhesive shall be certified to meet the requirements of this specification		4.6.6

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, the supplier 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 prescribed requirements.

4.2 **Qualification tests.**[1] Qualification tests shall be conducted at a laboratory satisfactory to the Naval Ship Engineering Center. These tests shall consist of the tests specified in 4.6.

4.2.1 Standard gasket stocks having the following recipes shall be used to evaluate adhesive materials:

[1] Application for qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.3 and 6.4).

Class 1		
Stabilized chloroprene polymer (neoprene WRT)	100	
Stearic acid (triple pressed)	2	
Extra light calcined magnesia (Maglite D)	2	
Medium thermal carbon black (Thermax)	10	
Clay (Dixie)	45	Cure for 1/4 inch thickness 30 min. at 310° F. (154° C.)
Phenyl-alpha-naphthylamine (Neozone A)	2	
Paraffin (mp 125 to 127° F.) (mp 51.6 to 52.7° C.)	2	
Solid petrolatum	2	
Whiting (Atomite)	60	
Light process oil (Circo)	15	
Zinc oxide (Protox 166)	2	
2-Mercapto-imidazoline (NA-22)	0.5	
Class 2		
Cold polymerized styrene-butadiene rubber (Synpol 1500)	100	
Fine furnace carbon black (Statex B)	20	
Sulfur (spider)	2	
Stearic acid (triple pressed)	2	Cure for 1/4 inch thickness 20 min. at 310° F. (154° C.)
Zinc oxide (Protox 166)	5	
Fine thermal carbon black (P33)	20	
Whiting (Atomite)	70	
Naphthenic hydrocarbons plasticizer (Califlux 510)	25	
Tetramethyl thiuram disulfide (methyl tuads)	0.4	
Class 3		
Medium low acrylonitrile-butadiene copolymer (Paracril B)	100.0	
Medium thermal carbon black (Thermax)	91.5	
Whiting (Atomite)	27.7	
Zinc oxide (Protox 166)	5	
Stearic acid (triple pressed)	1	Cure for 1/4 inch thickness 20 min. at 310° F. (154° C.)
Coumarone indene softener (Cumar P10)	20	
Dibutyl phthalate	10	
Phenyl-beta-naphthylamine (Agerite powder)	1	
Tetramethyl thiuram disulfide (methyl tuads)	0.3	
Sulfur (spider)	1.5	

4.3 Sampling.

4.3.1 *Lot.* For purposes of sampling, examination, and tests, a lot shall consist of material from one production batch and offered for delivery at one time

4.3.2 *Sampling for examination of filled containers.* A random sample of filled containers shall be taken in accordance with the sampling plan specified in table II for examination as specified in 4.4

4.3.2.1 *Defects defined* A major defect is a defect that is likely to result in failure, or to reduce materially the usability of the unit of product for its intended purpose. A minor defect is a defect that is not likely to reduce materially the usability of the unit of product for its intended purpose, or is a departure from established standards having little bearing on the effective use or operation of the unit.

4.3.3 *Sampling for quality conformance tests.* From each lot, filled containers shall be selected in sufficient quantity to make the two one-quart samples for testing as specified in 4.5.

4.4 Examination of filled containers. Each of the filled containers selected in accordance

TABLE II. *Sampling for examination of all containers*

Lot size number of filled containers	Sample size number of filled containers to be sampled	Number of nonconforming or defective containers			
		Major defects		Total defects (major plus minor)	
		Accept	Reject	Accept	Reject
Up to 5	All	-	--	0	1
6 to 25	5	0	1	1	2
26 to 62	8	0	1	2	3
63 to 160	13	1	2	2 2	3
161 to 410	20	1	2	3	4
411 to 1000	32	2	3	5	6
1001 to 2560	50	3	4	7	8
2561 to 6250	80	5	6	10	11
6251 to 16,000	125	7	8	14	15

with 4 3 2, shall be examined to determine compliance with the requirements of weight (see 3.3) and section 5 Containers shall be examined for the defects listed in table III. Any container that is found not in conformance with the requirements for weight or section 5 shall be rejected, and if the number of defective containers exceeds the applicable acceptance numbers specified in table II, this shall be cause for rejection of the lot represented by the sample

4.5 Quality conformance tests. The containers of material taken in accordance with 4.3.3, shall be formed into two test samples of one-quart each. Each test sample shall be separately subjected to the following tests·

Test	Reference
Viscosity	4.6 1
Solids content	4.6 2
Wet adhesive strength	4 6 4

4.5.1 *Rejection.* If any sample representing a lot is found to be not in conformance with this specification, it shall be cause for rejection of the lot represented by the sample

4.6 Test procedures.

4.6.1 *Viscosity test.*

4.6.1.1 *Apparatus.* A cup of the dimensions specified in figure 1 (commonly called a Ford cup), shall be used.

4.6.1.2 *Procedure.* Both the sample of adhesive and the apparatus shall be conditioned for 4 hours at the testing temperature of 23° ±1.1° C. (73.5° ±2° F.) before starting the test. Mix the adhesive material thoroughly. Level the apparatus and then place one finger over the 1/4 inch orifice of the cup and immediately fill with the adhesive. Allow air bubbles to rise momentarily and then take the finger away from the orifice of the cup, and simultaneously start a stopwatch. Observe the stream flowing from the orifice and at the first break in the stream, stop the watch. This test shall be run in duplicate using a new sample of material for each determination. Record the time in seconds for each determination.

TABLE III. *List of defects*

Examine	Defects
	Major
Containers	Warning marking or labels not provided to protect personnel from burns, toxicity, asphyxiation, or explosion
	Evidence of unit container leakage.
	Container not type specified, not new
	Container metal thickness (cans only) not in accordance with established commercial practice for type of container and product container.
	Closure not the type specified, not tight (a) Screwcap. (b) Multiple friction plug (c) Lug cover (d) Tight head plug and vent
	Size (capacity) not as specified
	Inner seal (metal friction type) not seated, damaged.
	Gasket missing; not seated or damaged
	Gaskets not of material compatible with the product contained.
	Marking (as to content) not as specified, incomplete, or illegible; damaged.
	Container coating (internal) not compatible with product contained, external coating damaged.
Packing	Product containers not all of same type and capacity.
	Arrangement of product containers not as specified
	Separators, buffer-pads, cell spacers not as specified, closures, handles, or bails not protected.
	Commercial packing (level C) (when specified) not conforming to carriers rules and regulations; does not insure safe delivery at destination
Shipping containers	Not conforming to the applicable specification, damaged
	Not filled
	Closing and strapping (level A) not as specified
	Reinforcing tape (fiber boxes) (when used) not applied as specified, not type of tape specified.
	Steel strapping not the type specified
	Palletized unit loads (when authorized for pails and drums) not palletized as specified
	Closing of class 1 fiber boxes (level B packing) (when specified by Army) not accomplished as specified

TABLE III. *List of defects (cont'd)*

Examine	Defects
	Minor
Shipping containers (Cont'd)	Dents, scratches, not clean.
	Closures damaged (burrs, sharp edges).
	Evidence of rust or corrosion.
	Bail or handle missing or damaged.
	Marking of intermediate container incorrect, incomplete, not legible.
	Marking of shipping container incorrect, incomplete, not legible, omitted, improper size, location, sequence, or method of application.

4.6.2 *Solids content.*

4.6.2.1 *Procedure.* A suitable container with cover shall be weighed, and approximately ten grams of thoroughly mixed adhesive shall be poured into the tared container, covered, and weighed. After removing the cover, the container shall be placed in an oven at 70° ±1.1° C. (158° F. ±2° F.), until the sample reaches a constant weight. The covered container with the sample shall be cooled to 28° ±1.1° C. (73.5° ±2° F.), in a desiccator before weighing. The test shall be run in duplicate.

4.6.2.2 *Calculations.* The percentage of total solids shall be calculated as follows:

$$\text{Total solids, percent} = \frac{\text{the weight of the residue}}{\text{the weight of the sample}} \times 100$$

Both determinations shall be reported.

4.6.3 *Weight.* The weight of each filled container sampled shall be determined The weights of the filled containers in the qualification sample shall be averaged

4.6.4 *Strip adhesion.*

4.6.4.1 *Specimens.* The rubber gasket materials used for this test shall be prepared as specified in 4.2.1, and the sheet steel panels to which the rubber strips are bonded shall be hot rolled sheet, commercial quality. Strips of rubber material measuring 1 by 6 by 1/4 inch shall be bonded to steel panels, 2 by 6 by 1/8 inch in dimensions Strip ad-

hesion tests shall be conducted in triplicate on specimens prepared from each of the classes 1, 2, and 3 rubber gasket materials for each of the following test conditions:

(1) Wet adhesion before and after aging the adhesive for 2 weeks at 49° ±1.1° C. (120° ±2° F.).

(2) Initial adhesion.

(3) Adhesion after immersion in salt water solution.

(4) Adhesion at 60° ±1.1° C. (140° ±2° F.).

The rubber strips shall be roughened with a coarse grinding wheel or other suitable means, and the steel panels shall be ground smooth and then cleaned with a suitable solvent. When the solvent has evaporated completely, one brush coat of the adhesive material shall be applied to the prepared surfaces of the rubber strips and panels. The adhesive shall be permitted to dry for 1 hour at 23° ±1.1° C (73.5° ±2° F.) and 50 ±3 percent relative humidity before bonding, unless the manufacturer specifically recommends a shorter drying time. Immediately after the strips have been bonded to the panels, they shall be rolled down with six single passes of a 10 pound roller, 2 inches wide, requiring about two seconds per pass The panels with the bonded strips shall be conditioned and tested as shown in table IV. The rubber strips shall be used only once for the adhesion tests

Notes:

L – Dead weight load of 2.5 pounds per square inch of rubber gasket area applied as a loading pressure on the strips bonded to the steel panel, condition at 23° ±1.1° C. (73.5° ±2° F.).

R – Rest time under no load at 23° ±1.1° C. (73.5° ±2° F.).

I – Specimens immersed in salt water (5 percent sodium chloride), under no load at 23° ±1.1° C. (73.5° ±2° F.).

T – Tests conducted at 23° ±1.1° C. (73.5° ±2° F.) within one hour after end of conditioning period except where otherwise indicated.

T1 – Tests conducted at 60° ±1.1° C. (140° ± 2° F.).

4.6.4.2 *Procedure for determining strip adhesion wet, initially, and after immersion.* The tests for wet adhesion before and after aging of the adhesive, initial adhesion, and adhesion after immersion shall be conducted on the assemblies prepared as specified in 4.6.4.1, and conditioned as specified in table III. The steel panel shall be supported at the ends in a horizontal position. One end of the bonded rubber strip shall be separated from the metal panel for a distance of about two inches. The weight specified in table V shall be suspended from the free end of the rubber strip. The weight shall be allowed to act on the strip for 3 minutes, and the aver-

TABLE IV. *Conditioning and testing schedule*

	Elapsed time after assembly, hours				
Strip adhesion test	1.0 ± 0.1	0 to 48	48 to 120	120 to 144	144
Wet adhesion	T				
Stability (wet adhesion)	T				
Initial		L	R	R	T
After immersion		L	I	R	T
At 60° C.		L	R	R	T1

age distance of stripping of the specimen from the panel under the influence of the weight shall be recorded.

TABLE V. *Weights for adhesion stripping*

Strip adhesion test	Weight to be hung on rubber strip to [illegible] pounds
Wet adhesion, initial	1.5
Wet adhesion, after aging (stability test)	1.5
Initial:	
Using classes 1 and 2 gasket stocks	5
Using class 3 gasket stock	4
After immersion	4
At 60° C.	1

4.6.4.3 *Procedure for determining strip adhesion at 60° C.* The specimen panels, conditioned as specified in table III, shall be supported at the ends in a horizontal position in an oven at a temperature of 60° ±1.1° C. (140° ±2° F.). The panels shall be conditioned for 20 minutes with the rubber strips facing down. While still in the oven and after the conditioning period, one end of each rubber strip shall be separated from the metal panel for a distance of about 2 inches and a 1-pound weight suspended from each strip. After 3 minutes, the distance of stripping of each specimen from the panel shall be noted and the results averaged.

4.6.5 *Stability test.* A closed 1-pint container of the adhesive material shall be placed in an oven for 2 weeks at 49° ±1.1° C. (120° ±2° F.). It shall then be removed from the oven and allowed to cool for 3 hours at 23° ±1.1° C. (73.5° ±2° F.). The wet adhesion test specified in 4.6.4.2 shall then be conducted.

4.6.6 *Storage.* The manufacturer shall certify and shall support his certification with test data that the adhesive, after being stored in its original unopened container for one year at room temperature 27° ±5° C. (80° ±9° F.), shall meet the requirements of this specification.

4.7 **Examination of preparation for delivery.** An examination shall be made to determine that the packaging, packing, and marking comply with the requirements specified in section 5. Examination for defects shall be made in accordance with table III. For examination, the sample unit shall be one shipping container fully prepared for delivery. Sampling and acceptable quality level (AQL) shall be in accordance with MIL-STD-105.

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 adhesive shall be furnished in 4 ounce glass containers with a screw type closure. A gasket which does not effect and is not effected by the packaged contents shall be provided to assure an airtight seal between the screwcap and the glass container. One-half pint, one pint, one quart quantities or quantities as specified in the contract or order (see 6.2), shall be furnished in round cans conforming to PPP-C-96, type V, class 2. The exterior plan B coating and side seam striping of PPP-C-96 shall be required.

5.1.1.1 *Intermediate packaging.* Four ounce or one-half pint containers shall be intermediately packaged in accordance with PPP-G-460 and the appendix to PPP-C-96, respectively.

5.1.2 *Level B (civil agency procurements).* The adhesive shall be packed in accordance with 5.1.1.

5.1.3 *Level C.* The adhesive shall be packaged to afford adequate protection against corrosion, deterioration, and damage during shipment from the supply source to the first receiving activity for immediate use, and

may conform to the supplier's commercial practice when such meets the requirements of this level.

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

5.2.1 *Levels A and B.*

5.2.1.1 *Glass containers.* Unit packages of adhesive in four ounce glass containers shall be packed in accordance with the level A or B requirements of PPP-G-460, as specified (see 6.2).

5.2.1.2 *Cans.* The unit packages of one-half pint containers or the larger containers shall be arranged and packed for level A or B as specified (see 6.2), in accordance with the appendix of PPP-C-96. Cans arranged in tiers shall have fiberboard pads placed between tiers in accordance with the appendix of PPP-C-96.

5.2.2 *Level C.* Packing shall be accomplished in a manner which will insure acceptance by common carrier, at lowest rate, and will afford protection against physical or mechanical damage during direct shipment from the supply source to the using activity for early installation. The shipping containers or method of packing shall conform to the Uniform Freight Classification Rules and Regulations, or other carrier regulations as applicable to the mode of transportation, and may conform to the supplier's commercial practice when such meets these requirements

5.3 Marking.

5.3.1 *Civil agencies.* In addition to any special marking required by the contract or order (see 6.2), marking of shipping containers shall be in accordance with Fed. Std. No. 123 and shall contain the labeling specified in 5.3.3.

5.3.2 *Military activities.* In addition to any special marking required in the contract or order (see 6.2), marking of interior packages and exterior shipping containers shall be in accordance with MIL-STD-129 and shall contain the labeling specified in 5.3.3.

5.3.3 *Hazardous chemicals.* All packages containing hazardous chemicals shall have affixed thereto such warning labels and markings required by the Interstate Commerce Commission Regulations CFR Title 49, Parts 71-78 and the Manufacturing Chemists Association Manual L-1.

6. NOTES

6.1 Intended use. Adhesives conforming to this specification are intended for bonding rubber to steel in miscellaneous nonstructural uses, where high adhesive strength bonds are not required. Bond strengths obtainable are low (about 5 pounds per inch of width).

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*) Unit quantity per container (see 5.1.1).

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

(*d*) Any special marking required (see 5.3).

6.3 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 (QPL) MMM-A-121, whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Govern-

ment 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 Ship Engineering Center, Department of the Navy, Washington, D.C., 20360, and information pertaining to qualification of products may be obtained from that activity. Application for qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.4).

6.4 Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Ave., Philadelphia, Pa., 19120.

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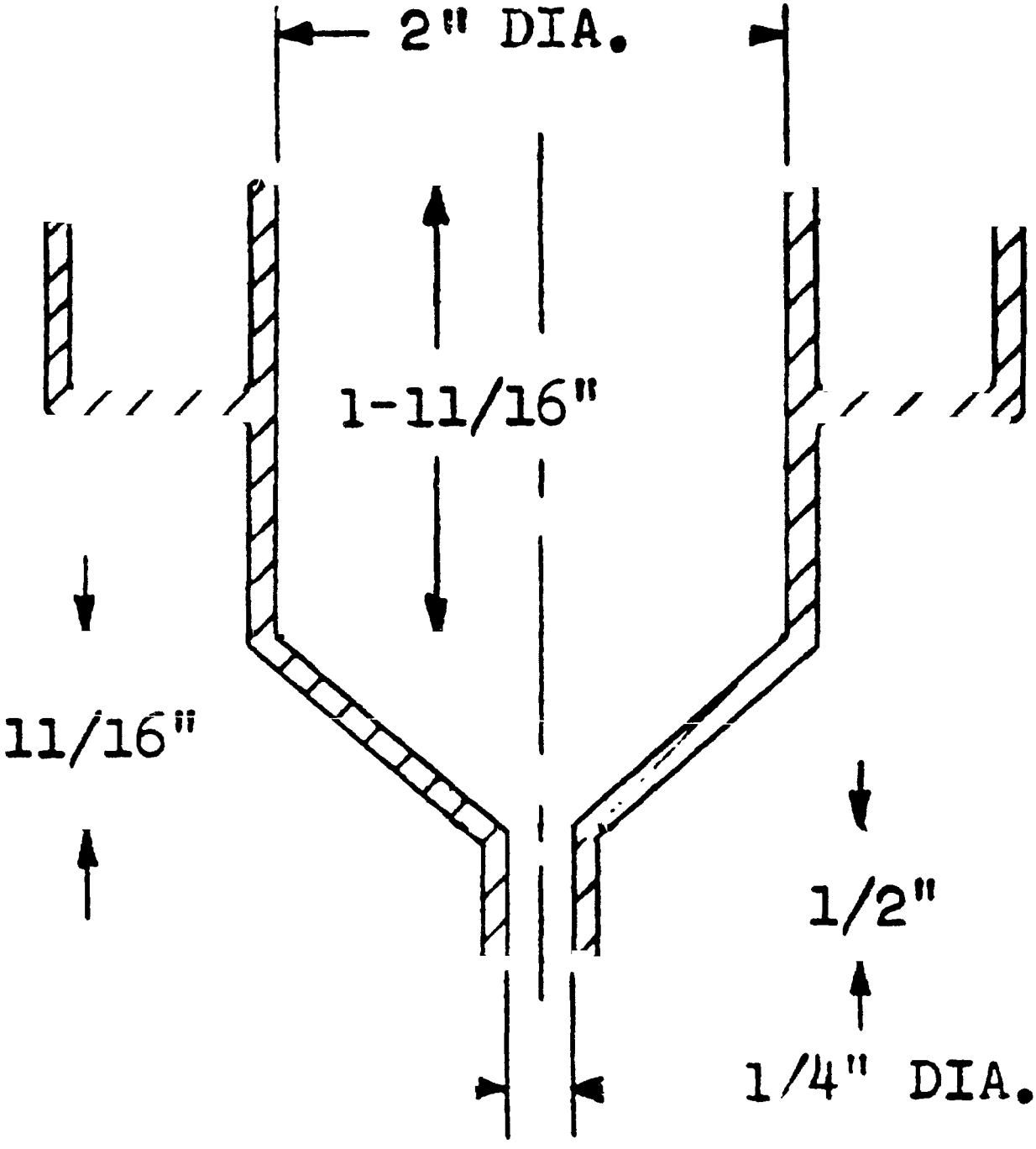

FIGURE 1 Schematic sketch of viscosity cup.

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(See Instructions – Reverse Side)

1. DOCUMENT NUMBER | 2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

b. ADDRESS *(Street, City, State, ZIP Code)*

4. TYPE OF ORGANIZATION *(Mark one)*

- ☐ VENDOR
- ☐ USER
- ☐ MANUFACTURER
- ☐ OTHER *(Specify)*.

5. PROBLEM AREAS

a. Paragraph Number and Wording

b. Recommended Wording

c. Reason/Rationale for Recommendation

6. REMARKS

7a. NAME OF SUBMITTER *(Last, First, MI)* – Optional

b. WORK TELEPHONE NUMBER *(Include Area Code)* – Optional

c. MAILING ADDRESS *(Street City State, ZIP Code)* – Optional

8. DATE OF SUBMISSION *(YYMMDD)*

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