

MIL-A-21016D  
28 November 1962  
SUPERSEDING  
MIL-A-21016C  
2 November 1960

## MILITARY SPECIFICATION

### ADHESIVE, LINOLEUM AND PLASTIC TILE

This specification has been approved by the Department of Defense and is mandatory for use by the Departments of the Army, the Navy, and the Air Force.

#### 1. SCOPE

1.1 This specification covers adhesive for securing fire-retardant linoleum and plastic tiles to steel decks.

#### 2. APPLICABLE DOCUMENTS

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

##### SPECIFICATIONS

###### FEDERAL

PPP-C-96 - Cans, Metal, 28 Gage and Lighter.  
PPP-P-704 - Pails: Shipping, Steel (1 Through 12 Gallon).

###### MILITARY

MIL-T-2904 - Tile, Linoleum, Fire Retardant.  
MIL-T-18830 - Tile, Plastic, Fire Retardant.  
MIL-A-21366 - Adhesive, Plastic Table Top Material to Aluminum Bonding.

##### STANDARDS

###### 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 ~~requirements~~ required by suppliers in connection with specific procurement functions should be obtained from the ~~contracting officer~~ or as directed by the contracting officer.)

2.2 Other publications. - The following document forms 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 Uniform Freight Classification Rules.

(Application for copies should be addressed to the Official Classification Committee, 1 Park Avenue at 33rd St., New York 16, N. Y.)

#### 3. REQUIREMENTS

3.1 Qualification. - The adhesive furnished under this specification shall be a product which has been tested, and passed the qualification tests specified herein, and has been listed on or approved for listing on the applicable qualified products list.

3.2 Material. - Adhesive shall be a water-base latex, free of all ingredients which may affect the serviceability or have a deleterious effect on metal, linoleum tile, or plastic tile.

FSC 8040

MIL-A-21016D

3.2.1 General requirement.- The adhesive shall be free from grits, lumps, and skins, and shall be suitable for application with a trowel (see 4.5.1). It shall be suitable and effective for the purpose intended without heating or addition of other ingredients.

3.2.2 Stability.- The adhesive shall not liver, settle or otherwise deteriorate when stored for a period of 1 year in airtight containers (see 4.5.2).

3.3 Edge adhesive strength.- When tested as specified in 4.5.3, the adhesive shall have edge adhesive strengths not less than those specified in table I.

TABLE I. - Edge adhesive strength

| Drying time (hours) | Type of tile | Load at separation (pounds) |
|---------------------|--------------|-----------------------------|
| 1                   | Linoleum     | 3.0                         |
| 1                   | Plastic      | 1.5                         |
| 96                  | Linoleum     | 10.0                        |
| 96                  | Plastic      | 7.5                         |

3.4 Edge adhesive strength after water immersion.- When tested as specified in 4.5.4, the adhesive shall have edge adhesive strengths not less than those specified in table II.

TABLE II. - Edge adhesive strength after immersion

| Type of tile | Load at separation (pounds) |
|--------------|-----------------------------|
| Linoleum     | 8.0                         |
| Plastic      | 6.0                         |

3.5 Fire resistance.- Fire retardant linoleum tile, when secured to metal plate with the adhesive and tested as specified in 4.5.5, shall exhibit an average length of char no greater than 10 inches. The combustion plus ignition time shall not exceed 4.00 minutes. The maximum length of flame shall not exceed 13 inches. The density of smoke shall be light.

3.6 Corrosion of metal.- The adhesive shall not corrode metal (see 4.5.6).

3.7 Viscosity.- When tested as specified in 4.5.7 the viscosity of the adhesive shall be 20,000 centipoises, minimum.

3.8 Workmanship.- Workmanship shall be in accordance with the best commercial practice.

3.9 Marking.- Each container of material shall be provided with a label giving adequate instructions for its use and application.

#### 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 supplies and services conform to prescribed requirements.

4.2 Qualification tests<sup>1/</sup>. - Qualification tests shall be conducted at a laboratory satisfactory to the Bureau of Ships. Qualification tests shall consist of the tests specified in 4.5.

<sup>1/</sup> Application for Qualification tests shall be made in accordance with "Provisions Governing Qualification" (see 6.2 and 6.3).

#### 4.3 Sampling for inspection.-

4.3.1 Lot.- For purposes of inspection, a lot shall consist of all adhesive from one production batch offered for delivery at one time.

4.3.2 Sampling for examination of filled containers.- A random sample of filled containers shall be selected from each lot in accordance with Standard MIL-STD-105 at inspection level I and acceptable quality level equal to 2.5 percent defective for the examination specified in 4.4.1.

4.3.3 Sampling for inspection tests. From each lot, two containers shall be selected. From each of the containers, two-quart samples shall be taken for the tests specified in 4.4.2.

#### 4.4 Inspection.-

4.4.1 Examination of filled containers.- Each sample filled container selected in accordance with 4.3.2 shall be examined to verify compliance with this specification. Any container in the sample having one or more defects or under required fill shall be cause for rejection, and if the number of defective containers in any sample exceeds the acceptance number for the appropriate sampling plan of Standard MIL-STD-105, it shall be cause for rejection of the lot which it represents.

4.4.2 Inspection tests.- The sample specimens selected in accordance with 4.3.3 shall be separately subjected to the tests specified in 4.5.3 and 4.5.7. If any one of the samples tested is found to be not in conformance with this specification, it shall be cause for rejection of the lot which it represents.

#### 4.5 Test procedures.-

4.5.1 Preparation of specimens.- Unless otherwise specified herein, linoleum tile conforming to Specification MIL-T-2904 and plastic tile conforming to Specification MIL-T-18830, as required, shall be used in the test procedures of this specification. One-eighth inch mild steel plates shall be roughened using number 60 silicon carbide paper or equivalent and shall be free from mill scale, rust, and organic matter. The steel plates having square corners shall be cleaned with methylethyl ketone (MEK) before adhering the tiles. Uniformly apply the adhesive onto the steel plates using a floor trowel having 1/16 inch deep by 1/16 inch wide notches spaced 3/32 inch apart between adjacent edges of the notches. After exposing the adhesive to the air for a period of  $12 \pm 2$  minutes, place the tile specimen on the plate and move it back and forth a distance of 1/4 to 1/2 inch. The tile shall then be rolled into firm contact (a minimum of 10 passes) with a 7 inch diameter roller weighing 10 pounds/inch of specimen width. Unless otherwise specified herein, all tests shall be conducted at a temperature of  $70 \pm 2^\circ$  F. and a relative humidity of  $50 \pm 5$  percent.

4.5.2 Stability.- The adhesive shall be stored for a period of 1 year in an airtight container. At the end of this period, the compound shall be examined to determine conformance with 3.2.2.

#### 4.5.3 Edge adhesive strength.-

##### 4.5.3.1 Preparation of specimens.-

4.5.3.1.1 The wearing surfaces of 3 inch by 4-1/2 inch pieces of linoleum tile or plastic tile, as required (see 3.3), shall be backed with 1/32 inch aluminum using a contact adhesive conforming to Specification MIL-A-21366. After a proper bond between the aluminum and the wearing surface of the tiles has been insured, the pieces of tile shall be secured to the steel plates in accordance with 4.5.1 in such a manner that a 1 inch by 3 inch portion of the tile extends beyond the edge of the plate. Support the extended portion of the tile with a 1/8 inch thick steel plate. The entire tile shall then be rolled to insure that the tile at the edge of the steel plate is securely bonded. The longer dimension of the specimen shall be in the machine direction of the tile.

4.5.3.1.2 The specimens shall be divided into two groups. One group shall be allowed to set for 1 hour prior to test, the second group for 96 hours.

4.5.3.2 Procedure.- The steel plate shall be securely fixed to suitable testing machine (such as an Instron Tester). A 1/4 inch diameter rod shall be placed under the extended portion of the specimen and shall be raised (relative to the steel plate) in a direction perpendicular to the plane of the tile at a rate of 1 inch per minute in order to lift the tile away from the steel plate. The load at 1/8 inch separation of the tile from the plate shall be determined to the nearest 0.1 pound and shall be taken as the edge adhesive strength.

4.5.4 Edge adhesive strength after water immersion.- Specimens shall be prepared as specified in 4.5.3.1.1 and shall be allowed to set for 96 hours prior to test. Then the specimens shall be immersed

MIL-A-21016D

horizontally under a 1 inch head of tap water at  $70 \pm 2^\circ$  F. for 48 hours. The specimens shall be removed from the water, blotted dry, and tested as specified in 4.5.3.2.

#### 4.5.5 Fire resistance test.

4.5.5.1 Apparatus. - The fire resistance of the adhesive shall be determined by an apparatus as shown on figure 1, which consists of communicating horizontal and vertical flues constructed of asbestos board sheets supported on an angle-iron frame, with the exception of the horizontal bottom plate, which is steel. The enclosure shall be 36 inches long overall; the flue shall be 8 inches wide by 6 inches high. The bottom plate shall be cut away 3 inches from the firing end to provide clearance for the flames of four open blast gas burners. Details of the test hood and specimen holder are shown on figure 2. Details of the burner supply manifold and open burner nozzle are shown on figure 3.

4.5.5.2 Procedure. - Linoleum tiles shall be applied with the adhesive to a 1/8 inch mild steel plate 31-1/2 inches long by 7 inches wide, with longitudinal flanges for mounting in the horizontal flue. The test plates shall then be allowed to dry for 96 hours. The plate shall be secured in the flue, 2 inches above the bottom plate and with the inner end spaced 3 inches from the flue end, to permit hot gases passing beneath the test plate to be vented through the vertical flue. The four open blast burners shall be located side by side and parallel to the front end of the test plate, on 1-3/4-inch centers, equidistant from each side of the flue. The center of the burners shall be located 4 inches below the bottom surface of the test plate, and shall be 1/2 inch in front of the firing end of the test plate. The gas used shall be commercial propane having a heating value of 2550 British thermal unit (B.t.u.) per cubic feet at a temperature of  $60^\circ$  F. and atmospheric pressure of 30 inches of mercury. The gas and air shall be supplied to a common manifold at a rate of 9.6 and 150 cubic feet per hour respectively, when referred to standard conditions of  $60^\circ$  F. and 30 inches of mercury. The burner flames shall be applied to the test plate for 4 minutes and then immediately removed. A draft of 0.06 (plus 0.01 minus 0.00 inches) of water shall be maintained in the flue of the apparatus for the duration of the test.

4.5.5.2.1 Combustion plus ignition time, and average length of char shall be noted. These quantities are defined as follows:

- (a) Combustion plus ignition time. The time taken from the initial application of burner flames until all flaming of the specimen ceases.
- (b) Average length of char. The average length of specimen permanently damaged by burning or charring. This measurement shall be taken after all flaming ceases. The density of smoke shall be noted.

4.5.6 Corrosion of metal. - All steel plates, upon completion of the test specified in 4.5.4, shall be cleaned with a suitable solvent until free of adhesive and immediately examined for rusting, pitting, or other evidence of corrosion.

4.5.7 Viscosity. - The viscosity of the adhesive shall be determined using a Brookfield viscosimeter operated at 20 revolutions per minute (rpm) using a spindle which will give a reading in the center area of the scale. The test shall be conducted at a temperature of  $70^\circ \pm 2^\circ$  F. and the adhesive shall be preconditioned at this temperature a minimum of 3 hours immediately prior to testing.

4.6 Preparation for shipment. - Examination for packing and marking for shipment shall be made for conformance with the requirements of Section 5.

## 5. PREPARATION FOR DELIVERY

5.1 Packaging. - Packaging shall be level A or C, as specified (see 6.1).

5.1.1 Level A. - The adhesive shall be furnished in 1-gallon multifriction top cans conforming to type V, class 2 of Specification PPP-C-96 or 5-gallon lug cover pails conforming to type II of Specification PPP-P-704.

5.1.2 Level C. - Packaging shall be sufficient to afford adequate protection against physical damage during shipment from the supply source to the using activity and until early use.

5.2 Packing. - Packing shall be level A, B or C, as specified (see 6.1).

MIL-A-21016D

5.2.1 Level A.-

5.2.1.1 The 1-gallon multifriction top can shall be arranged and packed in accordance with the overseas equipment requirements of the appendix to Specification PPP-C-96.

5.2.1.2 The 5-gallon lug cover pails shall require no packing.

5.2.2 Level B.-

5.2.2.1 The 1-gallon multifriction top cans shall be arranged and packed in accordance with the domestic shipment requirements of the appendix to Specification PPP-C-96.

5.2.2.2 The 5-gallon lug cover pails shall require no packing.

5.2.3 Level C.- Adhesive shall be packed in containers, at the lowest rates, in a manner which will insure acceptance by common carrier and will afford protection against physical or mechanical damage during direct shipment from the supply source to the first receiving activity for immediate use. This level in general shall conform to the Uniform Freight Classification Rules and Regulations or other carrier regulations as applicable to the mode of transportation and may be the supplier's commercial practice when such meets the requirements of this level.

5.3 Marking.- In addition to any special marking required, interior packages and exterior shipping containers shall be marked in accordance with Standard MIL-STD-129 as follows:

**WARNING**  
**PROTECT FROM FREEZING**  
**STORE INDOORS.**

## 6. NOTES

6.1 Ordering data. Procurement documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Selection of applicable level of packaging and level of packing required (see 5.1 and 5.2).
- (c) Quantity required (see 5.1.F and 5.1.2).
- (d) Special markings required (see 5.3 and 5.3).

6.2 With respect to products requiring qualification, awards will be made only for such products as have, prior to the time set for opening of bids, been tested and approved for inclusion in Qualified Products List QPL-21016, 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 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 Bureau of Ships, Department of the Navy, Washington 25, D.C., 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 6.3).

6.3 Copies of "Provisions Governing Qualification" may be obtained upon application to Commanding Officer, Naval Supply Depot, 5801 Tabor Avenue, Philadelphia 20, Pennsylvania.

Notice. When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Custodians:  
Army - MR  
Navy - Ships  
Air Force - MOA

Preparing activity:  
Navy - Ships  
(Project 8040-0111)

MIL-A-21016D

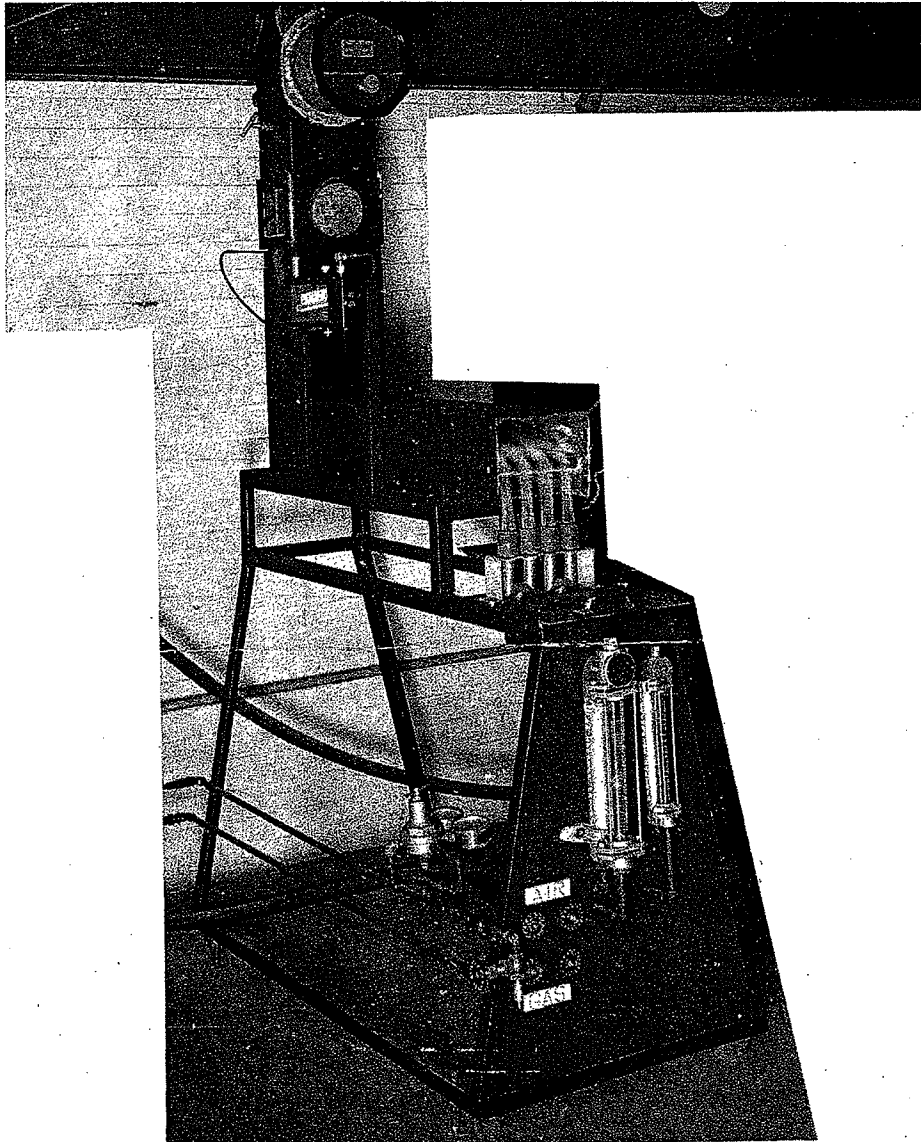


Figure 1 - Fire resistance test apparatus.



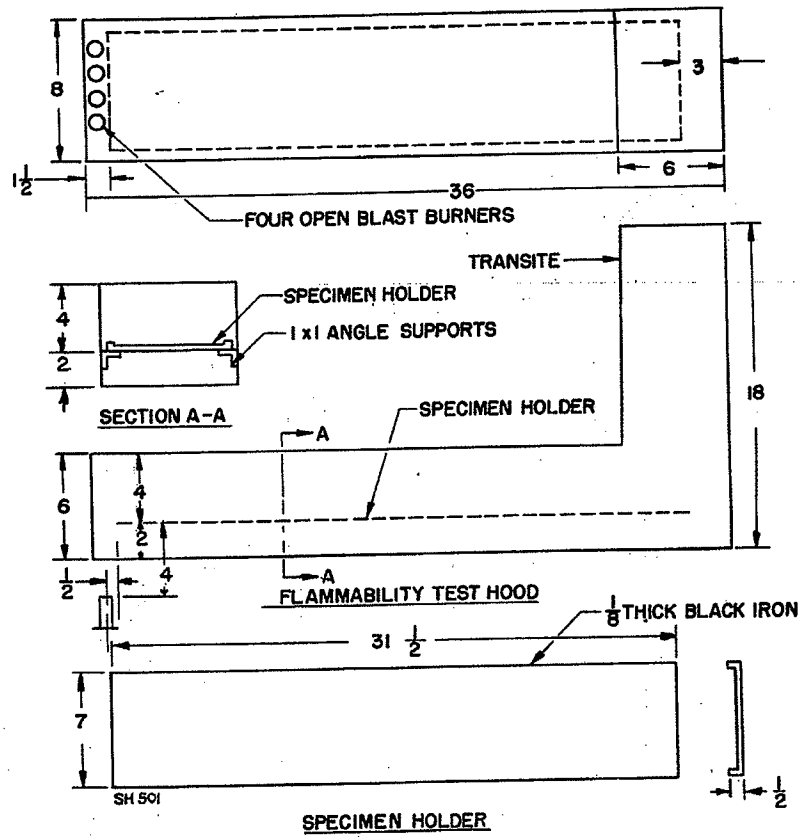


Figure 2 - Detail of fire resistance test apparatus.

MIL-A-21016D

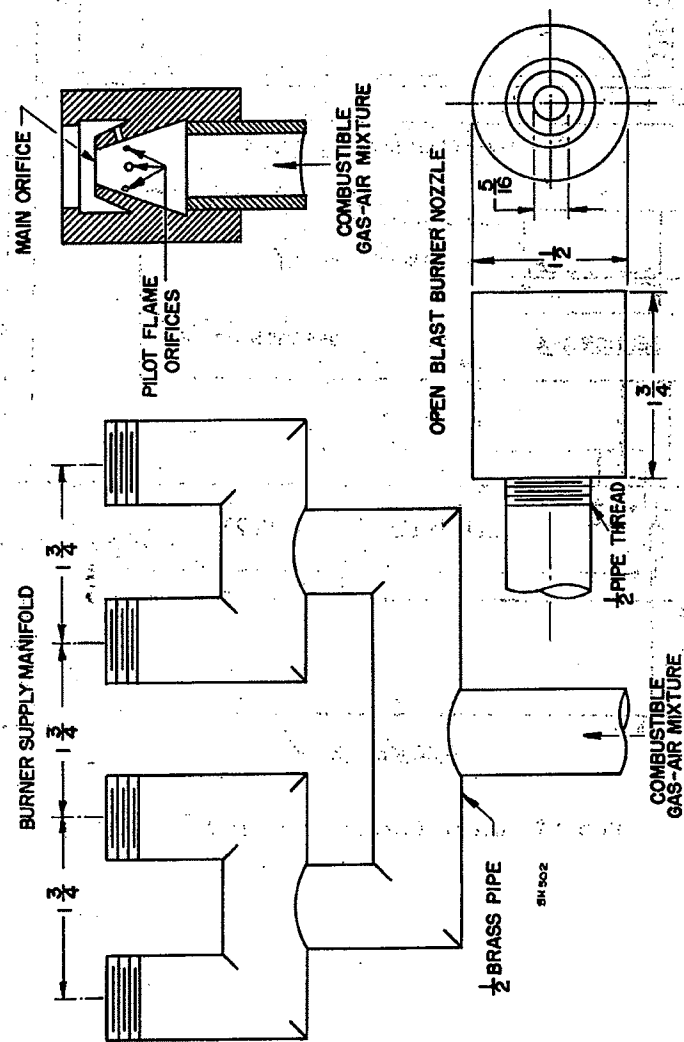


Figure 3 - Burner supply manifold and open blast burner nozzle.



**SPECIFICATION ANALYSIS SHEET**  
**NAVSHIPS-4863 (8-61)**

**INSTRUCTIONS**

BUDGET BU. NO. 45-R309

*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 Bureau of Ships*

*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 dotted lines on reverse side, staple in corner, and send to Bureau of Ships, Specifications and Standardization Branch, Washington 25, D.C.*

**SPECIFICATION**

ORGANIZATION

CITY

STATE

CONTRACT NO.

QUANTITY OF ITEMS PROCURED

DOLLAR AMOUNT

\$

MATERIAL PROCURED UNDER A DIRECT GOVERNMENT CONTRACT

OR A 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?

IF THE ANSWER IS "YES", IN WHAT WAY?

YES

NO

4. REMARKS (Attach any pertinent data which may be of use in improving this specification.) PLACE THIS FORM AND PAPERS IN AN ENVELOPE AND SEND TO THE BUREAU.

SUBMITTED BY (Print name and activity)

DATE

Fold

DEPARTMENT OF THE NAVY  
BUREAU OF SHIPS  
WASHINGTON 25, D. C.  
OFFICIAL BUSINESS

POSTAGE AND FEES PAID  
NAVY DEPARTMENT

CHIEF, BUREAU OF SHIPS  
SPECIFICATIONS AND STANDARDIZATION BRANCH  
DEPARTMENT OF THE NAVY  
WASHINGTON 25, D. C.

Fold