

MIL-C-206A
24 AUGUST 1962

SUPERSEDING
JAN-C-206
30 APRIL 1945

MILITARY SPECIFICATION
CELLULOSE, COTTON
(FOR USE IN EXPLOSIVES)

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 Scope. This specification covers the requirements for cotton cellulose to be used in the manufacture of explosives.

1.2 Classification. The cotton cellulose shall be the following classes as specified (see 6.2).

- Class 1
- Class 2

2. APPLICABLE DOCUMENTS

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

SPECIFICATIONS

FEDERAL

- T-T-871 —Twine; Cotton, Wrapping.
- T-T-911 —Twine; Jute.
- QQ-S-781 —Steel Strapping, Flat.
- UU-P-31 —Paper; General Specifications and Methods of Testing.
- UU-P-271 —Paper, Wrapping, Waterproofed Kraft.
- CCC-C-429 —Cloth, Cotton, Osnaburg.
- CCC-C-467 —Cloth, Jute (or Kenaf), Burlap.

STANDARDS

MILITARY

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

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

(Copies of specifications, standards, drawings and publications 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 shall apply.

INDUSTRIAL ENGINEERING CHEMISTRY,
ANALYTICAL EDITION
Volume 1 (1929)
Volume 5 (1933)

(Copies of the above documents may be obtained from: Industrial and Engineering Chemistry, 1155 Sixteenth Street, N.W., Washington 6, D.C.)

3. REQUIREMENTS

3.1 Material. The material used in the manufacture of cotton cellulose, shall be bleached cellulose, prepared from cotton wastes or suitable short-fibered commercial cotton and shall be free from foreign matter of any kind. Only cotton linters shall be used when specified in the contract or order (see 6.2).

3.2 Properties. The cotton cellulose shall conform to the physical and chemical requirements specified in table I when tested as specified in section 4.

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TABLE I. Detail requirements

Property	Minimum	Maximum	Applicable test paragraph
Moisture content, percent.....		7.0	4.5.1
Alkali soluble matter, percent.....		5.0	4.5.2
Ether extractive matter, percent.....		0.4	4.5.3
Ash, percent.....		0.5	4.5.4
Viscosity.....			4.5.5
Poisies—			
Class 1.....	4.4	9.9	
Class 2.....	10.0	36.0	
Seconds for 20 cm drop ¹ .			
Class 1.....	20.0	45.0	
Class 2.....	46.0	165.0	
Lime.....		Trace	4.5.6
Chlorides.....		Trace	4.5.7
Sulfates.....		Trace	4.5.8
Hypochlorites.....		Trace	4.5.9

¹ These time ranges apply only when the carefully selected test spheres described in 4.5.5.1.3 are used.

3.3 Absorbency. The cellulose cotton shall sink below the surface in not more than three seconds when performed as specified in paragraph 4.5.10.

3.4 Workmanship. The cellulose cotton shall be free from foreign material of any kind (such as dirt, oil, and stains) when observed with the naked eye.

4. QUALITY ASSURANCE PROVISIONS

4.1 The supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified, the supplier may utilize his own or any other inspection facilities and services acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government as specified in the contract or order. 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 Lot. A lot shall consist of one or more batches of cotton cellulose, produced by one manufacturer, in accordance with the same specification revision, under one continuous set of operating conditions. Each batch shall consist of that quantity of cotton cellulose that has been subjected to the same unit chemical or physical mixing process intended to make the final product homogeneous.

4.3 Sampling.

4.3.1 Sampling for end item examination. Sample bales shall be selected at random in accordance with Standard MIL-STD-105 at inspection level L4 and acceptable quality level equal to 4.0 defects per hundred units to verify compliance with all requirements of this specification not involving tests.

4.3.2 Sampling for tests. Sample bales shall be selected at random in accordance with Standard MIL-STD-105 at inspection level L4 with an acceptance number of zero. Sufficient material to form a primary sample of two pounds shall be removed by means of a metal hook or suitable auger from at least two faces, preferably at more than one spot on each face and at least three inches below the surface of each selected bale. Each primary sample shall be thoroughly mixed and placed in a jar or similar container provided with a rubber gasket, and labeled so that the bale from which it was taken can be easily identified. Approximately half of each primary sample shall be removed from its container and placed on a clean sheet of paper. These portions shall be blended thoroughly by picking apart and mixing. Sufficient small portions to form a composite sample of two pounds shall be removed from different parts of the pile. These portions shall be blended thoroughly, weighed to the nearest $\frac{1}{8}$ ounce, and placed in a jar or similar container provided with a rubber gasket. The material shall be sampled in a cool room and shall not be exposed to direct sunlight; that is, the sampling shall be done under conditions which do not differ greatly from those of the place of storage. The sample shall not be exposed to the atmosphere during the blending process for more than ten minutes, with

a shorter time of exposure desirable. The remainder of the composite sample and all primary samples shall be similarly weighed and packaged and held for possible future examination should the initial sample fail to meet the requirements of this specification.

4.3.3 Sampling for examination of the preparation for delivery. Sampling for examination of the packaging and marking shall be in accordance with MIL-STD-105 at inspection level L4 and acceptable quality level equal to 4.0 defects per hundred units.

4.4 Inspection.

4.4.1 End item inspection. The samples selected as specified in 4.3.1 shall be examined for the defects and at the acceptable quality level shown in table II.

TABLE II. Classification of defects

Defect	Method of inspection
AQL=4.0 defects per hundred units	
Material not as specified (see 3.1).	Visual and standard commercial.
Evidence of poor workmanship (see 3.4).	Visual.

4.4.2 Lot acceptance tests. The samples selected in accordance with 4.3.2 shall be subjected to all tests specified in 4.5.

4.5 Test procedures.

4.5.1 Determination of moisture content. The percentage of moisture content in the cotton cellulose shall be determined in accordance with method 240 of Specification UU-P-31 using a sample of approximately five grams. The moisture content shall be calculated as follows:

$$\text{Moisture content, percent} = \frac{(A-B) \times 100}{A}$$

where:

- A = weight in grams of the original undried specimen of cotton cellulose
- B = weight in grams of the dried specimen of cotton cellulose

The dried sample shall be retained for use in determining the ether extractive material.

4.5.1.1 Determination of moisture factor. The moisture factor (F) used as a correction factor to reduce "as is" test specimens of cotton cellulose to a dry basis for use in other determinations shall be calculated as follows:

$$\text{Moisture factor (F)} = \frac{B}{A}$$

where:

A and B are those weights obtained in 4.5.1.

4.5.2 Alkali soluble matter. Weigh a portion of approximately two grams of the sample and, without drying, place it in a 250 milliliter flask. Add 100 milliliters of 7.14±0.10 percent sodium hydroxide solution, and fit the flask with a rubber stopper through which passes a long glass tube which serves as an air reflux. Heat the flask and contents for three hours at 100° C. Pour the contents of the flask into a beaker containing one liter of distilled water, and neutralize the alkali, using an excess of acetic acid. Place a dry, prepared filtering crucible in a glass-stoppered weighing bottle, and weigh the crucible and bottle together. Transfer the solution and undissolved cellulose to the crucible and filter within five minutes. Thoroughly wash the cellulose successively with hot water, alcohol, and ether. Dry the crucible and contents to constant weight at 102° to 105° C., place the crucible in the weighing bottle, and cover the bottle. Cool the crucible and bottle in a desiccator and weigh. Calculate the percentage of alkali soluble material on a moisture-free basis as follows:

$$\text{Percentage of alkali soluble matter} = \frac{(FA-B) \times 100}{A \times F}$$

where:

- A = weight in grams of original cellulose specimen undergoing test.
- B = weight in grams of dried cellulose residue (after alkali extraction).
- F = moisture factor (see 4.5.1.1).

4.5.3 Extractive matter. Place the approximately five gram portion of the sample from the moisture determination (see 4.5.1) in a Soxhlet or similar extractor. Add sufficient redistilled ether to carry out the extraction, and extract the sample on a steam bath for at least three hours. Evaporate the ether in the extraction flask, if tared previously, or transfer the ether and extract to a tared

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beaker and evaporate. Dry flask or beaker to constant weight at a temperature of 100° to 105° C. At the end of this period, the beaker shall be cooled in a desiccator and weighed. The percentage of ether extractive material shall be calculated on a moisture-free basis as follows:

$$\text{Percentage of ether extractive material} = \frac{(A-B) \times 100}{W}$$

where:

A = weight of beaker and residue in grams after evaporation.

B = weight of empty beaker in grams.

W = weight in grams of the specimen (dried).

4.5.4 Ash. Place a weighed portion of approximately two grams of the sample in an ignited and tared crucible, moisten with approximately 70 percent nitric acid solution, and digest for approximately one hour on a steam bath or hot plate, heating gently at first to avoid mechanical loss. Then heat the crucible and contents, gently at first, over a flame or in a muffle furnace until all combustible material has been consumed, cool in a desiccator and weigh. Calculate the increase in weight as percentage of ash in the sample on a moisture-free basis.

4.5.5 Viscosity.

4.5.5.1 Apparatus.

4.5.5.1.1 Dissolving bulb. For peptizing the cellulose use a bulb as shown on figure 2.

4.5.5.1.2 The falling sphere viscometer. For the falling sphere viscometer, use a tube 30 centimeters long, with an inside diameter of 1.40 ± 0.05 centimeters. The tube should be etched every five centimeters and the lower four centimeters drawn down to one centimeter outside diameter (fig. 1). Place the tube inside a larger tube which serves as a water jacket. Pump water through this jacket from a constant temperature bath maintained at $25.0 \pm 1^\circ$ C., or keep the solution at this temperature by any other suitable means. If two 200-watt lamps are placed in back of this tube, and if sheets of pasteboard, with slits cut so as to allow the light to shine only through the blue solution itself, are placed on each side of the tube, the passage of the glass sphere can be observed more

easily. A piece of Wratten filter No. 35 has been found to help, because it gives a sharper outline to the sphere. Care must be taken in using the lights because strong light causes a decrease in the viscosity, due both to photochemical action of the blue and ultraviolet light and to the heating effect of the infrared rays. Turn the light on for only a few seconds at a time while the sphere is being observed. An electric button placed on the floor serves as an excellent means of controlling the lights.

4.5.5.1.3 Spheres to be used. The test spheres shall be 3.175 ± 0.050 millimeters in diameter and as nearly spherical as possible. The specific gravity shall be within the limits of 2.4 and 2.75 (in accordance with Industrial and Engineering Chemistry, Analytical Edition, Volume 5, page 270 (1933), and as refined by further developments by the authors, a desirable test sphere would have such diameter and specific gravity that for each second of sphere fall, when measured for a centimeter fall, the cellulose solution under test would have a viscosity of 21.8 centipoises. If these spheres are used to measure viscosity through a 15 centimeter fall, each second of sphere fall would be equivalent to a solution viscosity of 29.1 centipoises. The specific gravity requirement of 2.4 to 2.75 given in this paragraph is in accordance with current practice. The remainder of the viscosity test procedure is in accordance with the method outlined in Industrial and Engineering Chemistry, Analytical Edition, Volume 1, page 49 (1929).)

4.5.5.1.4 Calibration of spheres. To calibrate the spheres, fill the viscometer tube with standard oil or solution of known viscosity, adjust the temperature and drop the spheres, timing the fall over the same distance which is to be used for the test. Determine the factor K as follows:

$$K = \frac{n}{t(D-d)}$$

where:

n = viscosity (in poises) of the oil or solution used.

t = time in seconds for sphere to fall over required distance.

D = density of the sphere.
d = density of the oil or solution used.

When one sphere has been selected by careful measurement, it should be weighed and the other spheres chosen to nearly equal it in weight. They may then all be calibrated and only those selected which have the same constant within plus or minus five percent of that of the originally selected bead. Specific gravity and density in this method are at 25° C. and referred to water at 4° C.

4.5.5.1.5 Weight of sample. An accurately weighed 2.5 gram (dry weight) sample shall be used. The moisture factor determined shall be used to calculate the weight of the "wet" sample needed.

4.5.5.1.6 Preparation of solution. Use a cuprammonium solution containing 30 ± 2 grams of copper, 165 ± 2 grams of ammonia (NH_3) and 10 grams of sucrose per liter as the solvent for the cellulose. Place clean copper turnings, wire or gauze in a glass tube approximately 26 inches in length and 4 to 6 inches in diameter and add ammonia solution (26 to 28 percent ammonia) containing 10 grams of sucrose per liter until the tube is nearly full. Bubble air, first through the 26 to 28 percent ammonia solution contained in a flask, and then through the tube for several hours. It is well to have the tube surrounded with ice during this time. When the copper concentration is more than three percent, analyze the solution for copper and ammonia. To determine when the concentration of copper is high enough for the analysis, add approximately 0.5 milliliter of the cuprammonium solution to 50 milliliters of ammonia solution and compare the color with that of another tube prepared in the same manner from a standard three percent cuprammonium solution. Adjust the cuprammonium solution to the concentration prescribed above by adding either a solution of 10 grams of sucrose per liter in distilled water or ammonia solution or both. Store the solution in a dark, cold place. It may be kept for a month in this way. Analyze the solution for copper electrolytically or by weighing as copper oxide after evaporation and ignition,

according to standard practice. In case of dispute, the electrolytic method shall be considered as standard. Analyze for ammonia by adding concentrated alkali solution to a portion of the cuprammonium solution, distilling into an excess of standard acid solution, and titrating back with standard alkali solution.

4.5.5.1.7 Dissolving the cellulose in cuprammonium solution. Place the cellulose in the dissolving bulb (see 4.5.5.1.1), slip pieces of heavy-walled rubber tubing over the ends, and wire securely. Close the large end, "a", by means of a clamp and fasten the other end to the evacuating and filling apparatus by slipping the rubber tube over the opening "b" (fig. 1). By manipulating the stopcocks, "c" and "d", evacuate the dissolving bulb and flush three or more times with hydrogen which has been purified by passing through a heated tube containing plantinized asbestos or by bubbling through alkaline pyrogallol solution. (Prepare the alkaline pyrogallol solution by adding one volume of 22 percent aqueous pyrogallol solution to five or six volumes of 60 percent potassium hydroxide solution.) After again evacuating, allow 100 milliliters of cuprammonium solution to enter the volumetric bulb, A and then allow the solution to run into the dissolving bulb, B. Apply a slight pressure by turning stopcocks "c" and "d" to hydrogen. Close a rubber tubing at "b" by means of a clamp, and remove the bulb from the apparatus. Rotate the bulb at approximately ten revolutions per minute at room temperature (preferably under water) until the cellulose is dissolved. Allow a minimum of four hours for solution of material. In case of dispute the standard time allowed for obtaining complete solution shall be 17 hours. The stopcock "c" should be especially ground as the solution tends to eat through the grease. If hydrogen from a tank is used a mercury-sealed safety valve, E, may be used to safeguard the apparatus against excessive pressures. Nitrogen, if carefully freed of oxygen, may be used in place of hydrogen.

4.5.5.1.8 Measurement of viscosity. Fill the falling sphere viscometer by connecting the

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dissolving bulb and the bottom of the viscometer by means of a "U" tube and then applying pressure to the bulb. It has been shown that air does no harm at this stage. Drop a glass sphere through a small centering tube which extends a short distance beneath the surface of the liquid. This ensures the sphere entering slowly without air bubbles. Be careful to have the axis of the viscometer tube perpendicular. Note the time in seconds required for the sphere to fall 20 centimeters (Navy installations use a 15 centimeter distance of fall). Make a total of three determinations and determine the average of the values obtained. Calculate the viscosity of the sample using the formula given in 4.5.5.1.4.

4.5.6 Lime. Place a five to ten gram portion of the sample in approximately 100 milliliters of distilled water, bring the mixture to the boiling point, and allow to boil for approximately one hour. Filter the mixture and slightly acidify a small portion of the filtrate with hydrochloric acid solution. Retain the rest of the filtrate for the detection of chlorides and sulfates as prescribed in 4.5.7 and 4.5.8. Make the acidified portion slightly ammoniacal with ammonia solution. Add a few milliliters of a saturated solution of ammonium oxalate and bring the mixture to the boiling point. Note the absence of more than a trace of lime as indicated by no more than a faint cloudiness without the formation of a precipitate.

4.5.7 Chlorides. Using nitric acid solution, slightly acidify a small portion of the filtrate obtained as described in 4.5.6. Add a few drops of five percent silver nitrate solution, and note the absence of more than a trace of chlorides as indicated by the formation of not more than a faint cloudiness.

4.5.8 Sulfates. Using hydrochloric acid solution, slightly acidify a small portion of the filtrate obtained as described in 4.5.6. Bring the solution to the boiling point, and while hot, add approximately one milliliter of five to ten percent barium chloride solution. Note the absence of more than a trace of sulfates as indicated by the formation of no more than a faint cloudiness.

4.5.9 Hypochlorites. Place approximately one gram of the sample in a uniform layer on the bottom of a 150 milliliter beaker. Carefully pour ten milliliters of a ten percent potassium iodide solution on the center of the layer of cellulose. If no color or only a slight violet coloration results, consider the sample to contain but a trace of hypochlorites.

4.5.10 Absorbency. Place a portion of approximately one gram of the dried sample in the palm of the hand and roll into a loose ball. Place this lightly on the surface of approximately 200 milliliters of distilled water in a 250 milliliter beaker. Note if the sample has satisfactory absorbency as indicated by the ball sinking below the surface within three seconds.

5. PREPARATION FOR DELIVERY

5.1 Packing. Packing shall be level A or C as specified in the contract or order (see 6.2).

5.1.1 Level A. The cotton cellulose shall be packed in bales having gross weight not exceeding 600 pounds. Each bale shall be lined with waterproof kraft wrapping paper conforming to class B-2 of Specification UU-P-271. The waterproof paper shall be of a size to provide a minimum overlap of three inches on the ends and sides. Alternatively, the waterproof paper may be polyethylene sandwich kraft paper of 30-pound basis weight, creped two ways and laminated with not less than 14½ pounds of polyethylene per ream before creping, or creped polyethylene coated kraft paper of 40-pound basis weight coated with not less than 14½ pounds of polyethylene per ream before creping or a conjoining creped kraft paper of 20-pound basis weight, both sheets creped two ways. The paper shall be creped not less than 15 percent in both the cross direction and machine direction. The outer cloth covering material of each bale shall be not less than 6.8-ounce cotton osnaburg cloth conforming to type I, class 2, finish A of Specification CCC-C-429 or 7.5-ounce per linear yard jute (or kenaf) burlap cloth conforming to Specification CCC-C-467. The cloth covering material

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used shall provide a minimum overlap of three inches on the ends and sides. The seams of the ends and sides of the bale shall be securely sewn with twine. The surplus covering material shall be gathered together on each of the four corners of the bale at the point of the seam and securely sewn into ears for handles. The twine shall be three-ply jute conforming to type B of Specification T-T-911 for burlap covered bales of 16-ply cotton twine conforming to Specification T-T-871 for osnaburg covered bales. Each bale shall be strapped with not less than six 1 $\frac{1}{4}$ by 0.035-inch flat steel straps conforming to type I, class A of Specification QQ-S-781.

5.1.2 Level C. The cotton cellulose shall be packed for shipment in compliance with common carrier regulations applicable to that mode of transportation to ensure safe delivery at destination at the lowest transportation costs without assessment of penalty charges for improper packing.

5.2 Marking. In addition to any special marking required by the contract or order, bales shall be marked in accordance with Standard MIL-STD-129.

6. NOTES

6.1 Intended use. Cotton cellulose covered by this specification is intended for use in the manufacture of nitrocellulose.

6.2 Ordering data. Procuring documents should specify the following:

- (a) Title, number, and date of this specification.
- (b) Class required (see 1.2).
- (c) When only cotton linters are to be used (see 3.1).
- (d) Level of packing required (see 5.1).
- (e) Any special marking required (see 5.2).

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.

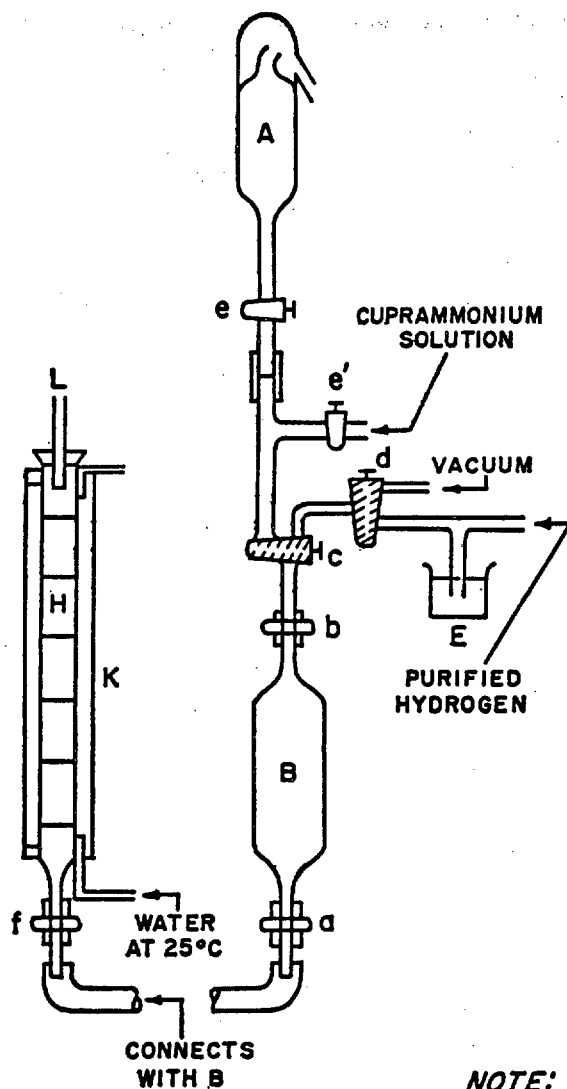
Custodians:

Army—Ord
Navy—Wep
Air Force—MOA

Preparing activity:

Army—Ord

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VISCOMETER

A. 100ML GLASS VOLUMETRIC BULB
GRADUATED TO 0.1cm. BETWEEN
98-100 AT 20°C

B. DISSOLVING BULB
SEE FIGURE 2

E. MERCURY SAFETY VALVE.

H. FALLING SPHERE VISCOMETER
CONSISTING OF A GLASS TUBE
30cm. LONG AND 1.4±0.05cm.
INSIDE DIAMETER WITH THE
LOWER 4.0cm. DRAWN DOWN TO
1.0cm. OUTSIDE DIAMETER,
ETCHED EVERY 5.0cm.

K. LARGE GLASS TUBE FOR
WATER JACKET ABOUT H.

L. SMALL GLASS TUBE FOR
CENTERING FALL OF SPHERES.

a, b, and f - SCREW CLAMPS ON
RUBBER TUBING.

c and d - 2 WAY GLASS STOPCOCKS.
e and e' - 1 WAY GLASS STOPCOCKS.

**NOTE: IF SUITABLE PRESSURE REGULATOR
IS AVAILABLE, THE MERCURY SAFETY
VALVE, E IS NOT NECESSARY.**

FIGURE 1.

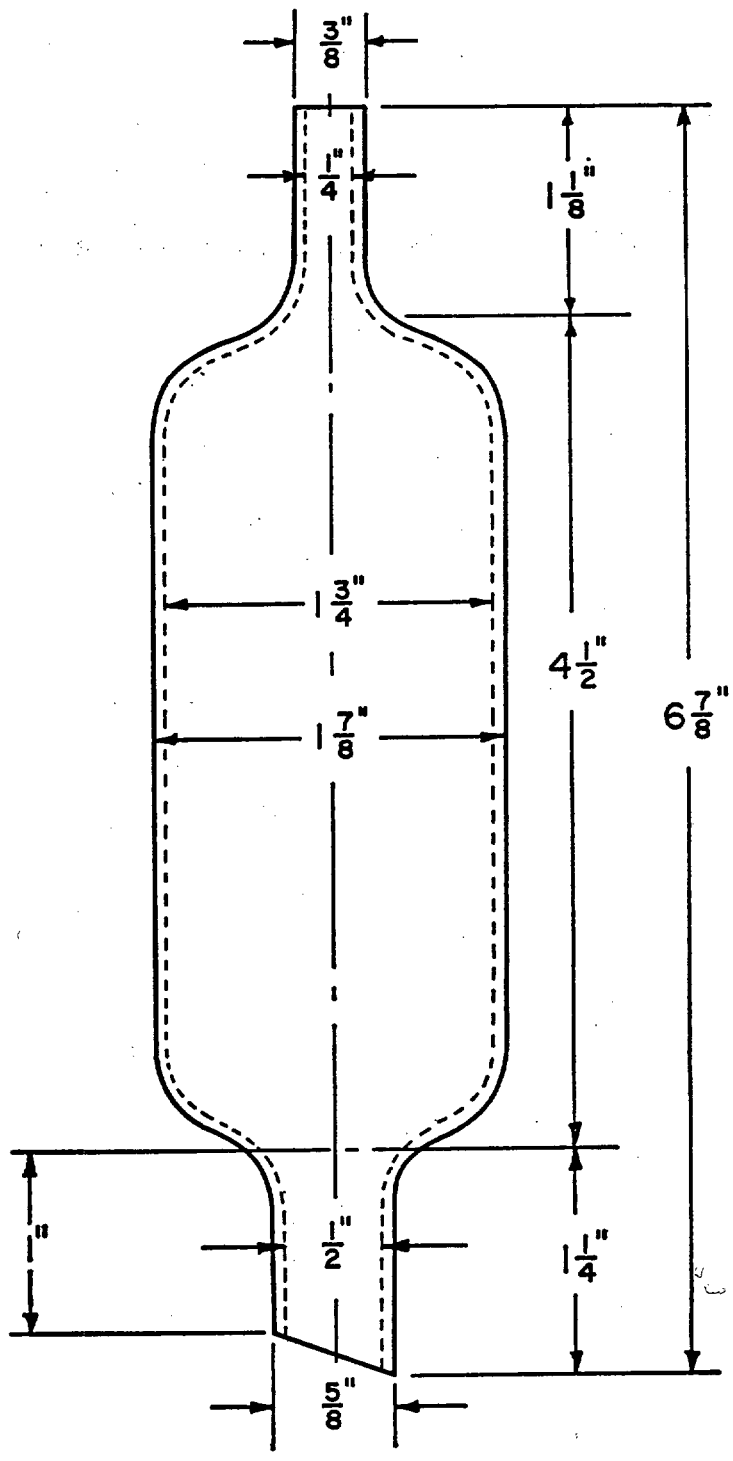
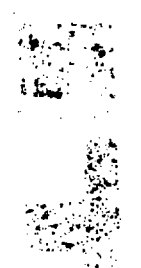


FIGURE 2.



INSTRUCTIONS: In a continuing effort to make our standardization documents better, the DoD provides this form for use in submitting comments and suggestions for improvements. All users of military standardization documents are invited to provide suggestions. This form may be detached, folded along the lines indicated, taped along the loose edge (*DO NOT STAPLE*), and mailed. In block 5, be as specific as possible about particular problem areas such as wording which required interpretation, was too rigid, restrictive, loose, ambiguous, or was incompatible, and give proposed wording changes which would alleviate the problems. Enter in block 6 any remarks not related to a specific paragraph of the document. If block 7 is filled out, an acknowledgement will be mailed to you within 30 days to let you know that your comments were received and are being considered.

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DEPARTMENT OF THE ARMY



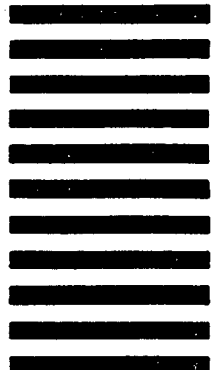
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STANDARDIZATION DOCUMENT IMPROVEMENT PROPOSAL

(See Instructions - Reverse Side)

1. DOCUMENT NUMBER

2. DOCUMENT TITLE

3a. NAME OF SUBMITTING ORGANIZATION

4. TYPE OF ORGANIZATION (Mark one)

 VENDOR USER MANUFACTURER OTHER (Specify): _____

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

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)

(TO DETACH THIS FORM, CUT ALONG THIS LINE.)