MILITARY STANDARD
EXPLOSIVE : SAMPLING, INSPECTION AND TESTING

TO ALL HOLDERS OF MIL-STD-650

1. The following pages of MIL-STD-650 been revised and supersede the page listed:

NEW PAGE	DATE	SUPERSEDEDPAGE	DATE
iii	31 May 1973	iii	3 April 1972
iv	31 May 1973	iv	3 April 1972
v	31 May 1973	v	3 April 1972
vi	31 May 1973	vi	3 April 1972
vii	31 May 1973	vii	3 April 1972
viii	31 May 1973	viii	3 August 1962
1	31 May 1973	1	3 August 1962

2. The following methods have been revised and supersede the methods listed:

REVISED METHOD	DATE	SUPERSEDED METHOD	DATE
101.3.2	31 May 1973	101.3.1	3 April 1972
201.1.1	31 May 1973	201.1	3 August 1962
503.1.1	31 May 1973	503.1	3 August 1962

a. Superseded pages

NEW PAGE	DATE	SUPERSEDED PAGE	DATE
iii	3 April 1972	iii	3 August 1962
Iv	3 April 1972	iv	3 August 1962
v	31 August 1970	v	3 August 1962
v	3 April 1972	*v*	31 August 1970
vi	31 August 1970	vi	3 August 1962
vi	3 April 1972	vi	31 August 1970
vii	3 April 1972	vii	3 August 1962

NEW PAGE	DATE	SUPERSEDED METHOD	DATE
101.3.1	3 April 1972	101.3	3 August 1962
101.4.1	3 April 1972	101.4	3 August 1962
102.3.1	3 April 1972	102.3	3 August 1962
108.1.1	3 April 1972	108.1	3 August 1962
301.6.1	3 April 1972	301.6	3 August 1962
413.2.1	3 April 1972	413.2	3 August 1962

c. New methods

METHOD NO	TITLE	DATE
T109.6	Race of Detonation	31 August 1970

4. Retain this notice and Insert before the table of contents.

5. Holders of MIL-STD-650 till verify that page changes and additions indicated above have been entered and will destroy the previous notice (notice page only). The latest notice (notice page) will be retained as a check sheet. This issuance, together with appended pages, Is a separate publication. Each notice Is to be retained by stocking points until the Military Standard Is completely revised or cancelled.

CUSTODIAN:
ARMY-MU
NAVY-OS
AIR FORCE-70

PREPARING ACTIVITY:
ARMY-Mu

PROJECT NUMBER: 1376-A012

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ALPHABETICAL INDEX OF TEST METHODS

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NUMERICAL INDEX OF TEST METHODS

Group 100— General Test Methods

Group 200—Physical Test Methods

NUMERICAL INDEX OF TEST METHOD—Continued

Group 800- Sample Preperation

Group 400- Chemical Test Methods

Group 500 — Stability, Sensitivity and Surveillance Tests

NUMERICAL INDEX OF TEST METHODS—Continued

Group 600 — Standard Solutions

NUMERICAL INDEX OF INDICATOR SOLUTIONS

Group 700 — Standard Indicators

SECTION 1
INTRODUCTION

1. SCOPE

1.1 This standard describes the general methods of sampling, inspecting, and testing explosives for conformance with the material requirements of the applicable explosive specification. In the event of confiict between these methods and those in the applicable explosive specification, the later shall take precedence.

2. REFERENCED DOCUMENTS.

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

O-A-51 — Acetone

RR-S-366 — Sieves, standard for testing purposes

JAN-A-465 — Acid, acetic (for Ordnance use)

JAN-E-199 — Ether, diethyl

MIL-E-463 — Alcohol, Ethyl (for Ordnance use)

(Copies of specification required by contractors in connection with specified procurement function should be obtained from the procuring activity or as directed by the contracting officer.)

METHOD 101.3.2

MOISTURE DISTILLATION METHOD

1. SCOPE.

1.1 This method is used to determine moisture in an explosive, when appreciable amount of moisture is present and a relatively large amount of sample is available.

2. SPECIMEN.

2.1 The specimen shall consist of approximately 50 gm. of explosive. Weighed within 10 mg.

3. APPARATUS.

3.1 Round bottom "Balloon Type Flask" with a short ring neck, 500 ml.

3.2 Condenser (Liebig Type), 250 mm Straight tube with the lower end cut obliquely.

3.3 Drying tube containing calcium chloride.

3.4 Steam, hot water or oil bath.

3.5 Moisture tube (fig. 1) cleaned witj bichromate cleaning solution.

4. MATERIALS.

4.1 Triethylene Glycol
4.2 Trichloroethylene (Solvent)

5. PROCEDURE.

5.1 Place the specimen in the 500 ml balloon flask and add 200 ml of solvent.

5.2 Connect the flask with the moisture tube. Connect a caIcium chloride tube to the top of the condenser to keep out atmospheric moisture.

5.3 Maintain a sufficieat stream of cold water through the condenser jacket to condense all the solvent.

5.4 Heat the flask by means of a suitable bath so that the distillate falls from the end of the reflux condenser in a steady stream. Continue the heating for 30 minutes, then remove the apparatus from the bath and cool to room temperature.

5.5 Disconnect the apparatus from the condenser and tilt tube if necessary so that sufficient solvent drains back into the flask to bring the water layer into the graduated tube. Drain the upper part of the tube completely so that all the water is collected in the graduated area.

5.6 Hold the tube in a vertical position and read (1) the top of the upper meniscus of the water layar (straight across) and (2) The top of the so1vent layer, estimating to 0.01 ml on each reading.

Note.. Should the water layer extend beyond the graduated portion of the tube, repeat the determination using a sma11er sample.

5.7 Determine the difference in the readings and record the difference as the volume of water in the specimen.

5.8 Considering onc milliliter of water as equal to one gram, calculate {by weight) the percentage of moisture in the specimen.

5.9 calculation.

$$\text{Percent moisture} = 100\ \frac{V}{W}$$

where:

V = corrected volume of water, mi.

W = Weight of sample, gm.

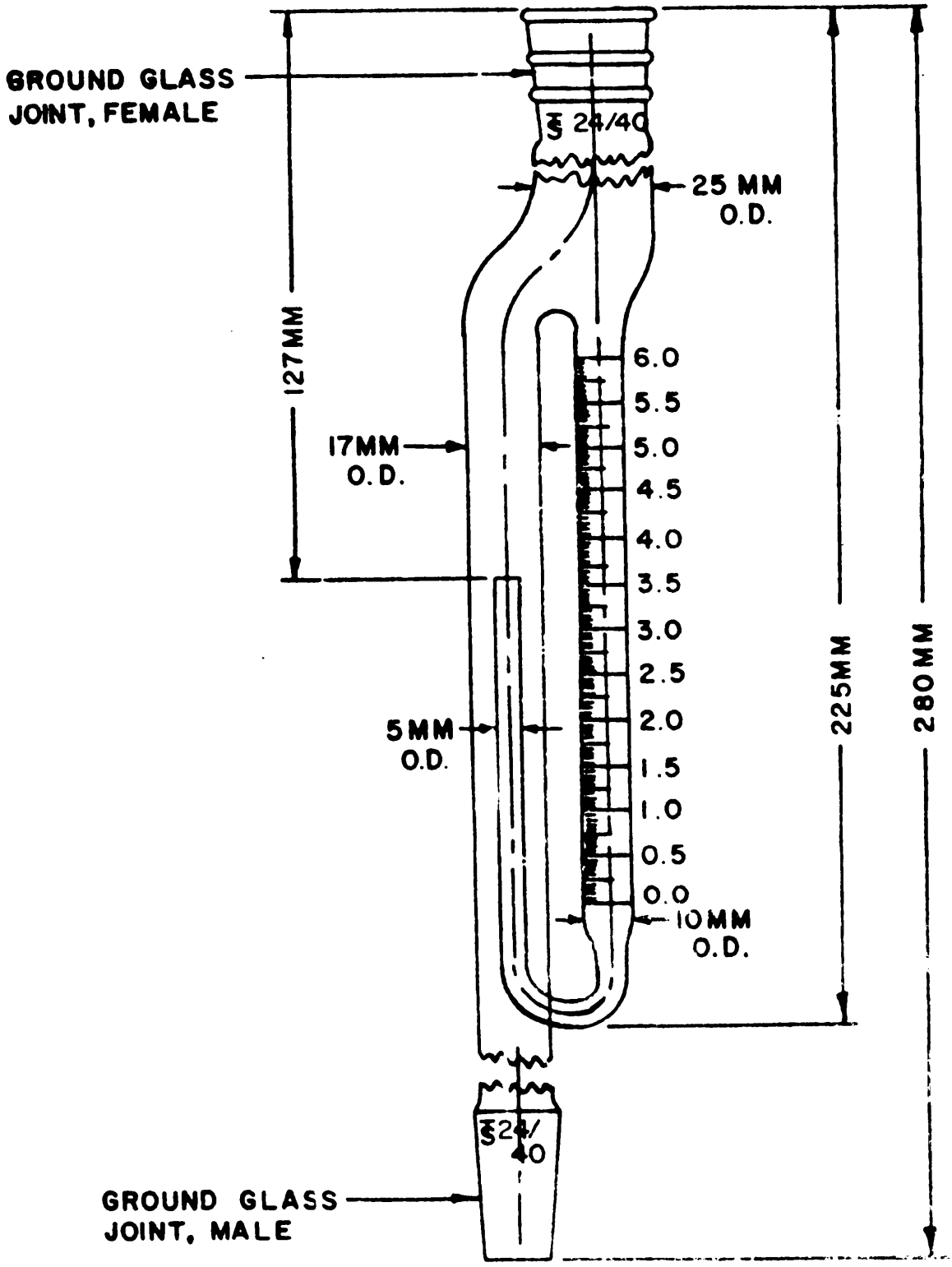


FIGURE 1. *Moisture tube.*

METHOD 101.1.1
BULK OR APPARENT DENSITY
(STANDARD VESSEL METHOD)

1. SCOPE

1.1 This method is used to determine the bulk or apparent density (weight per unit of outside volume, which may include voids) of explosive cf low sensitivity.

2. SPECIMEN

2.1 The specimen shall consist of approximately 120 grams of the explosive which has been mixed thoroughly to obtain representative distribution of large and small grains.

3. APPARATUS

3.1 Funnel - The funnel shall be machined from aluminum stock to the dimensions shown in Figure 1.

3.2 Standard cup - The standard cup shall be machined - from aluminum stock to the dimensions shown in Figure 2.

3.3 The hoe shall be made from aluminum sheet to the dimensions shown in Figure 3.

3.4 Catch pan - The catch pan shall be made from aluminum sheet to the dimensions shown in Figure 4.

3.5 Funnel stand - The funnel stand shall be made from aluminum stock in accordance with Figures 5, 6, and 7.

3.6 Funnel slide - The funnel slide shall be made from Teflon to the dimensions shown in Figure 8.

3.7 Funnel-cup assembly - The parts shall be assembled as shown in Figure 9 to provide a height from the bottom the funnel opening to the top edge of the cup of approximately 2 1/2 inches.

4. PROCEDURE

4.1 Environment-Maintain all apparatus and explosive at a room temperature of 68 degrees Fahrenheit (°F) minimum.

4.2 Cup calibration.-Standardize the cup as follows:

4.2.1 Fill the standard cup with water at 70 ± 2°F to form a convex meniscus over the top.

4.2.2 Press a glass plate down on top of the cup to remove excess water so that no air bubbles are visible under the glass plate.

4.2.3 Wipe the outside of cup and plate and weigh the entire assembly to the nearest .01 gram (gm).

4.2.4 Empty the cup, dry and weigh with glass plate to the nearest 0.01 gm. Calculate the weight of water as follows:

$$W = A - B$$

Where A = weight of standard cup, cover and water, gm

B = weight of standard cup and cover, gm

W = weight of water, gm

4.3 Cup weight determination. -Determine the weight of the cup to the nearest 0.01 gm.

4.4 Preparation. -Set up the assembly as shown in Figure 9. Attach a ground clamp, from the building grounding system, to the funnel support rod at the point where it is attached to the base of the stand. Move slide out to cover hole in funnel.

4.5 Bulk density determination

4.5.1 Sample shall be transferred to the funnel in a metal container or scoop. Grounding wire shall be attached to container or scoop prior to and during pouring sample into funnel.

4.5.2 Pour the sample into the" funnel to the funnel-fill line. Lip of sample container or scoop shall be maintained within one inch above top of funnel while pouring sample into funnel. Sample weight in funnel will be approximately 120 g. Sample should be poured into funnel so that top surface is approximately level with the funnel-fill line. The leveling of the surface is accomplished by properly distributing the sample as it is poured into the funnel. Other means of leveling and tapping are not permitted.

4.5.3 Center the cup under the funnel hole and push slide in against stop allowing the sample to flow into the cup. The sample sould fill the cup with about a 20 to 25 g spill-over. Note: Do not tap or jar the cup as this wi11 cause the powder to settle and give erroneous results.

4.5.4 Using the hoe, carefully strike off the excess explosive level with the top of the cup, avoiding any compressing or scooping of the explosive. Hoe shall be moved across the surface In one direction only with a continuous movement maintaining contact with the rim at all times to ensure that the surface of the explosive is level with the rim of the cup. Blade of hoe shall be maintained In a vertical position.

4.5.5 Tap the level full cup as necessary to settle the explosive and prevent spillage during weighing, but do not add more explosive. Brush off any explosive adhering to external surfaces of the cup.

4.5.6 Weigh the filled cup to the nearest 0.01 gm and calculate the bulk density as follows:

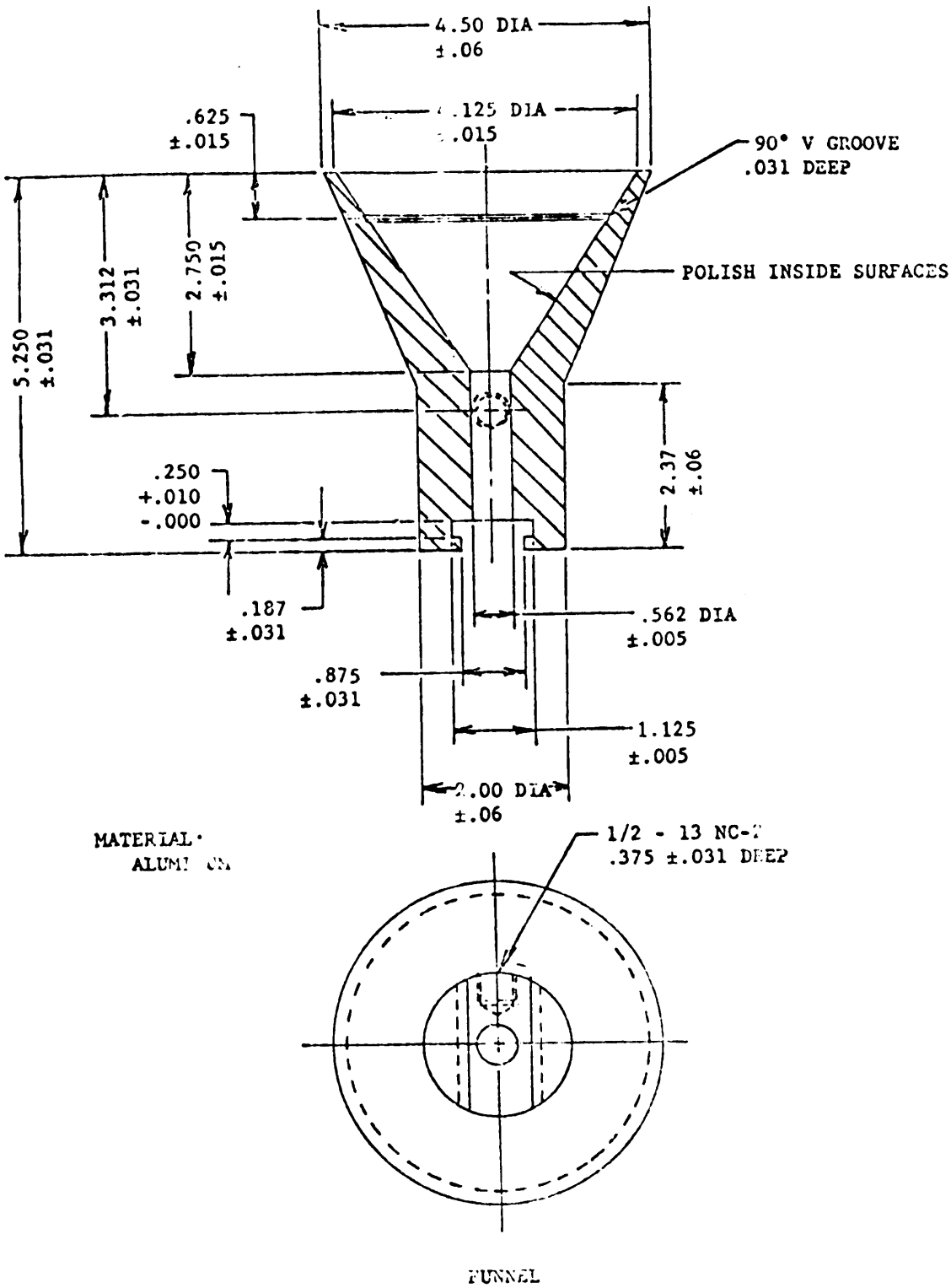
$$\text{Bulk density, g/cc} = \frac{A-B}{W}$$

Where A = weight of sample plus standard cup, gm

B = weight of standard CUP, gm

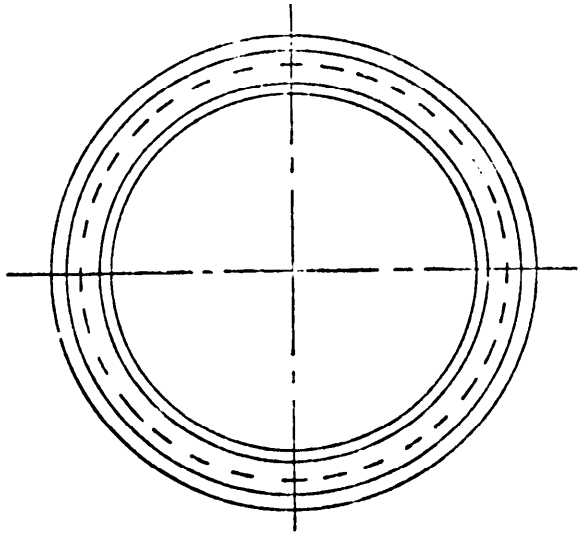
W = weight of water obtained in standardization of standard cup, g

4.5.7 Improper procedures can cause erroneous results. During the conduct of the measurement, errors in procedure or technique should not be corrected, but the test specimen should be set aside and another specimen obtained for a second trial. If only a small sample is available, it may be reprocessed to assure homogeneity and then again used as a test specimen.



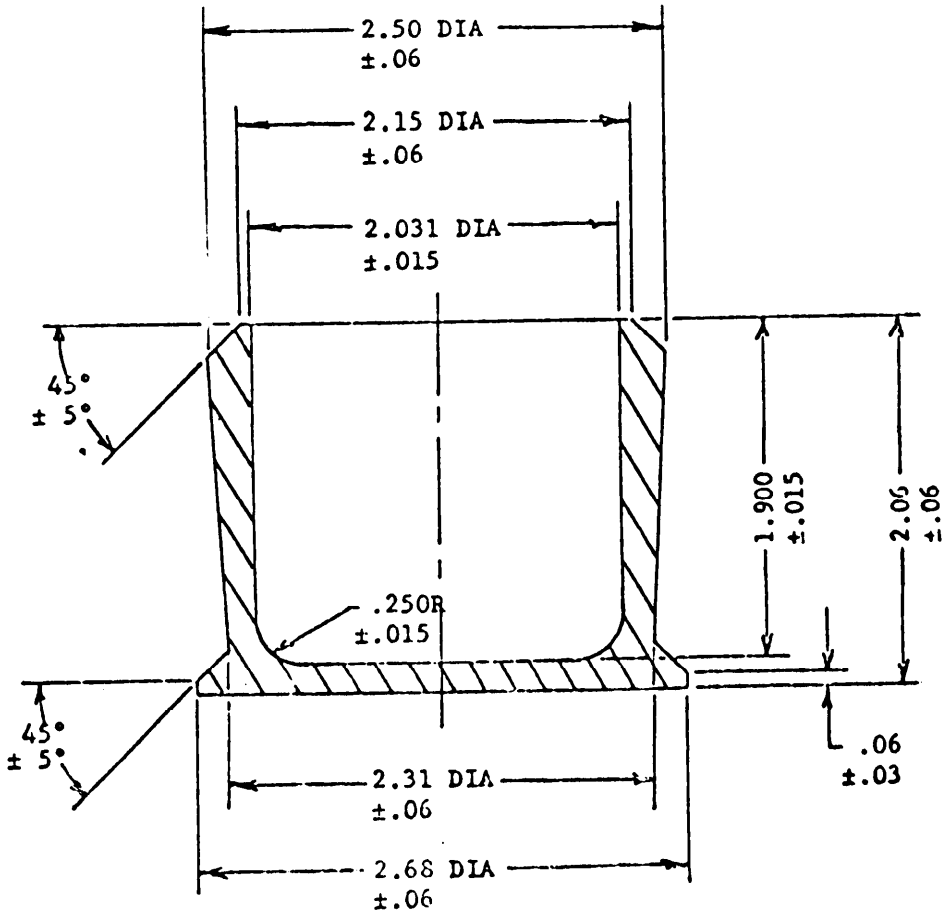
FUNNEL

FIGURE 1

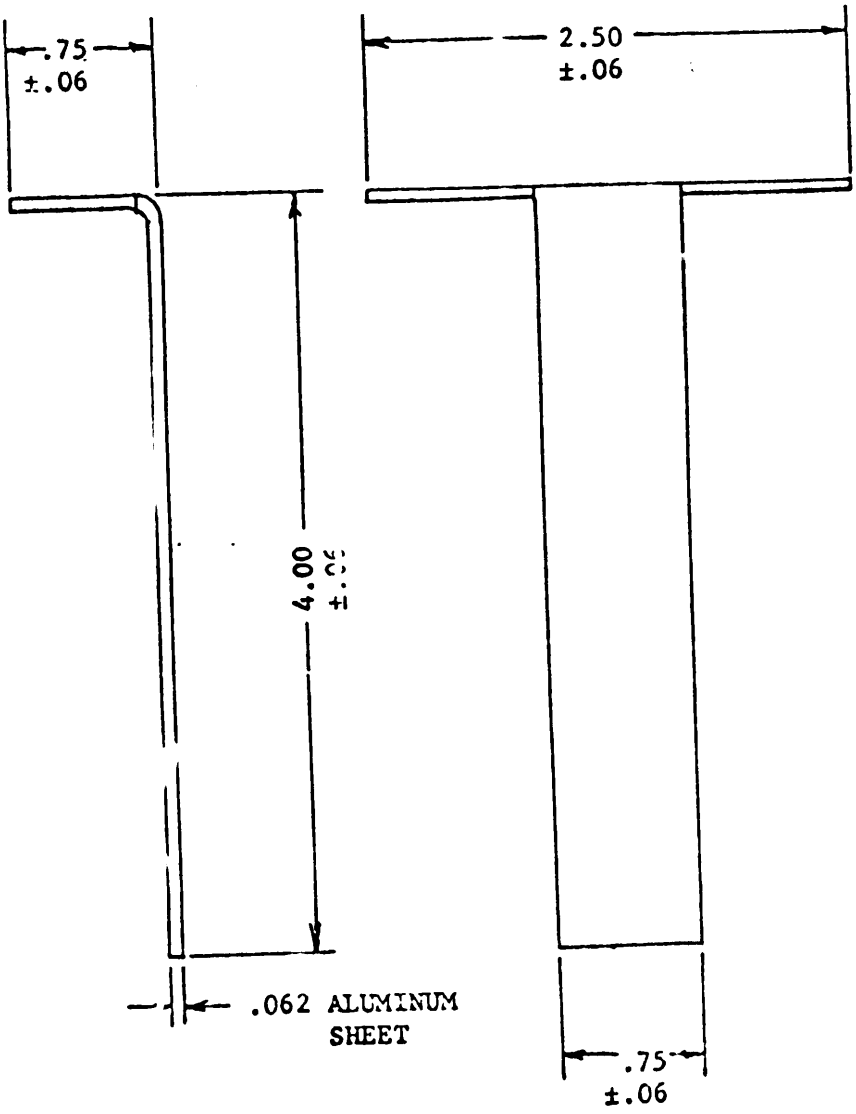


MATERIAL:
ALUMINUM

VOLUME:
100 CC NOMINAL

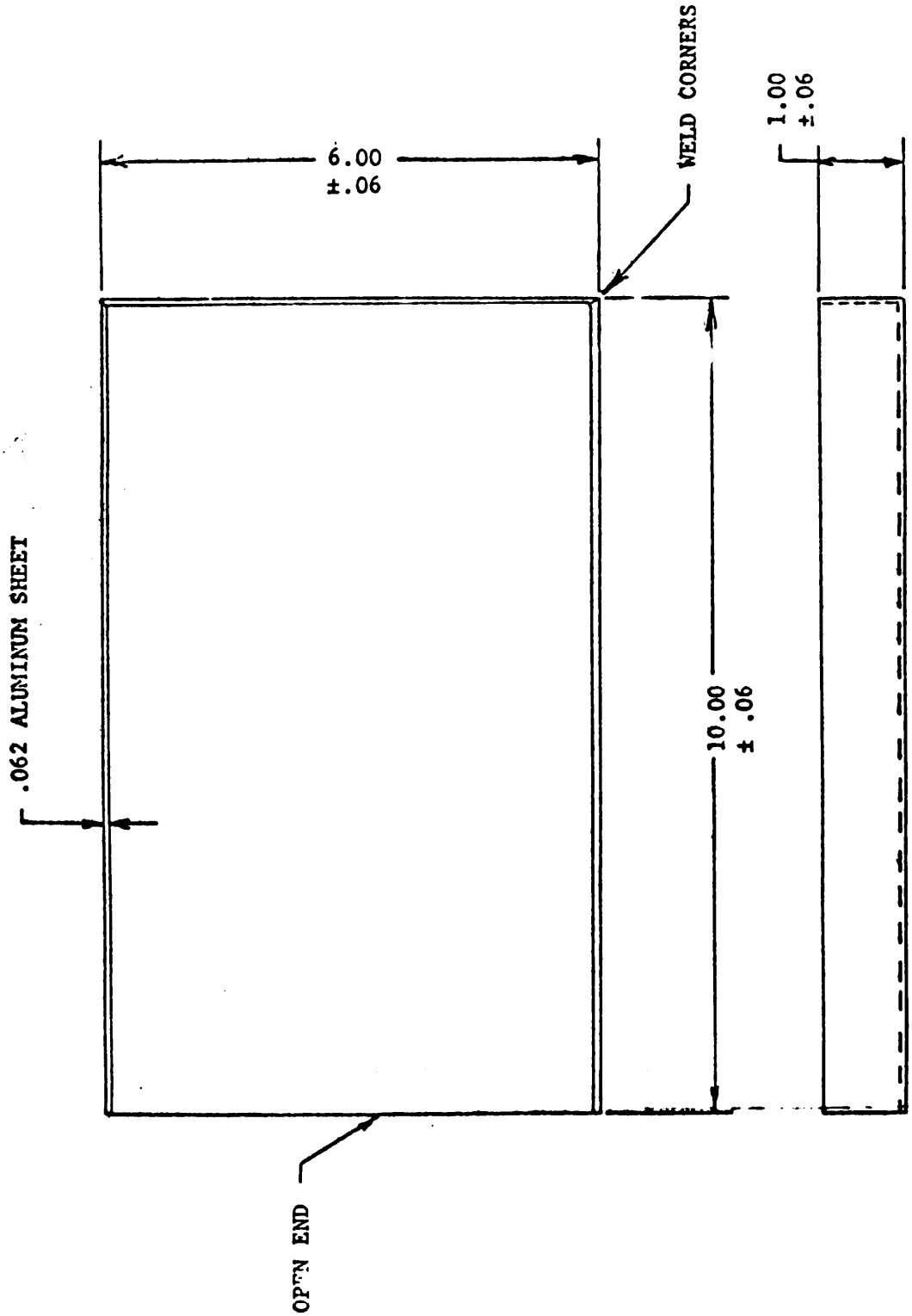


STANDARD CUP
FIGURE 2



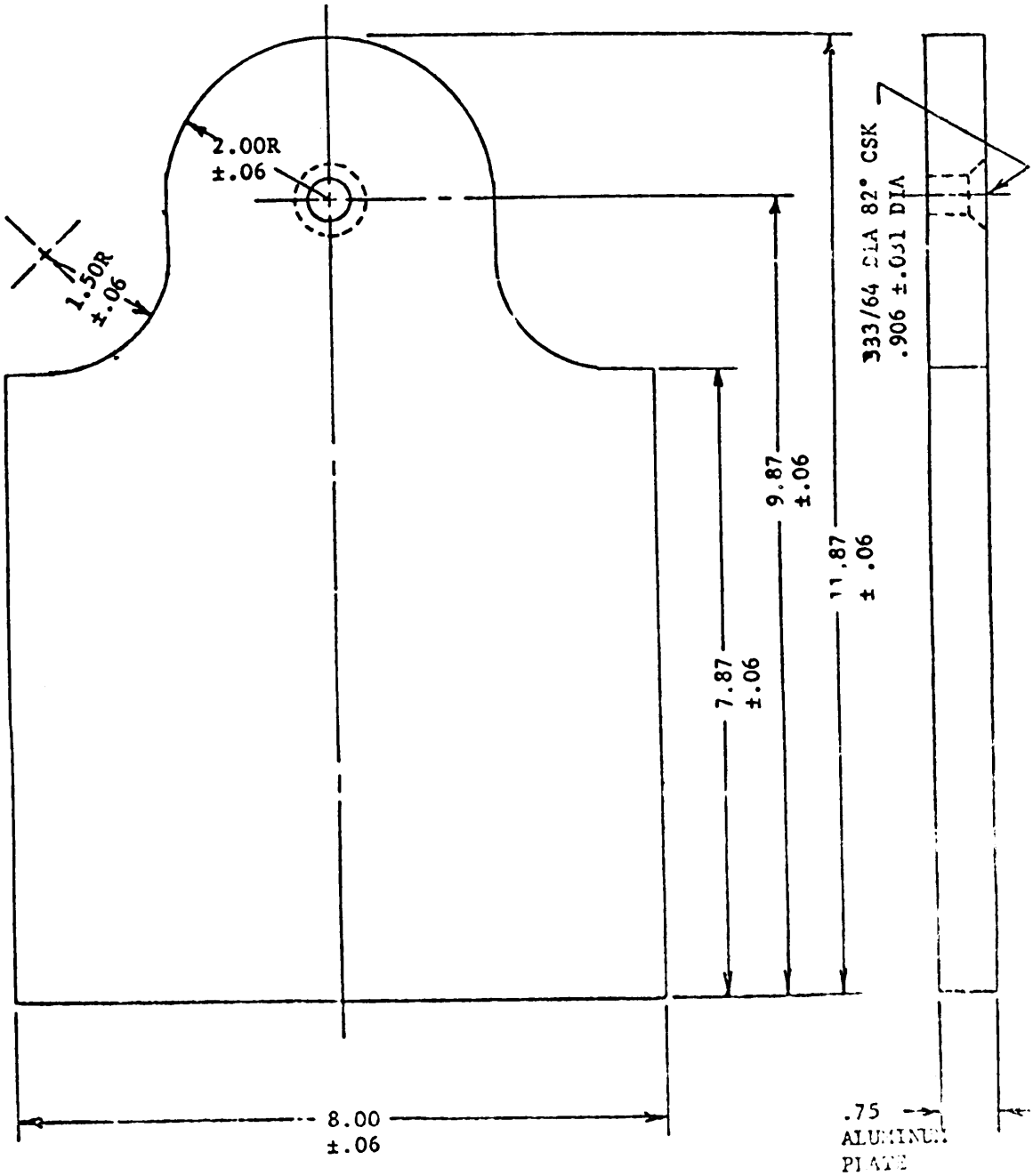
HOE

FIGURE 3



CATCH PAN

FIGURE 4



BASE PLATE

FIGURE 5

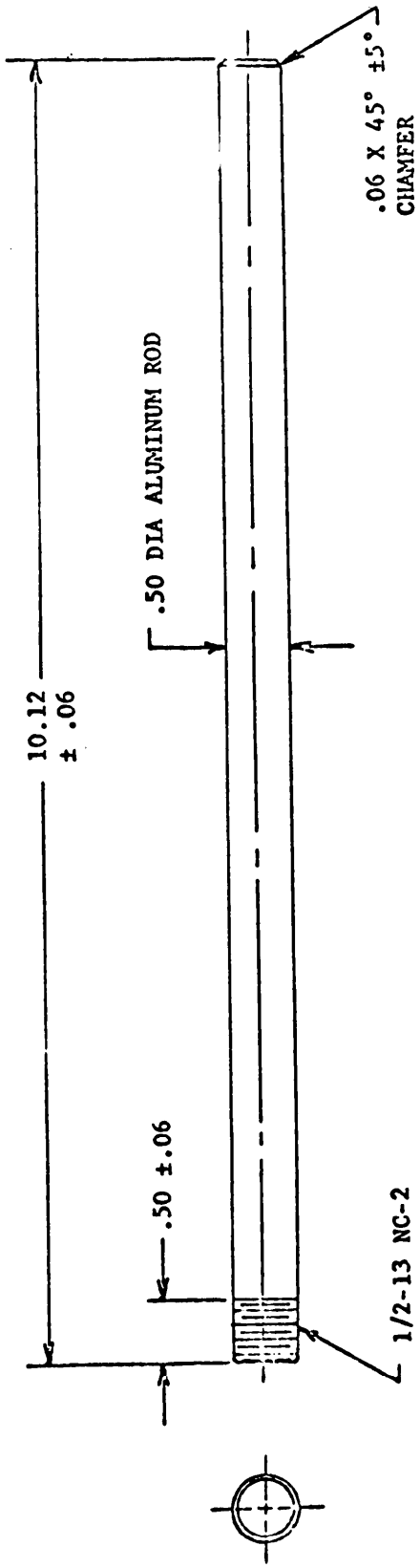
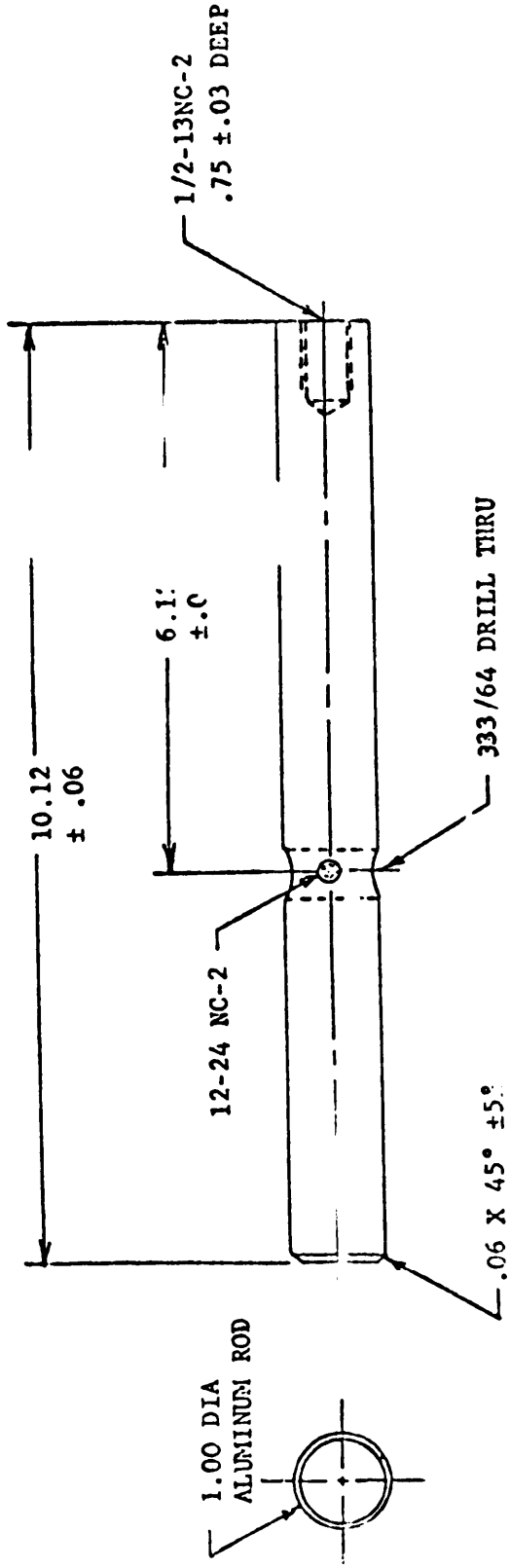
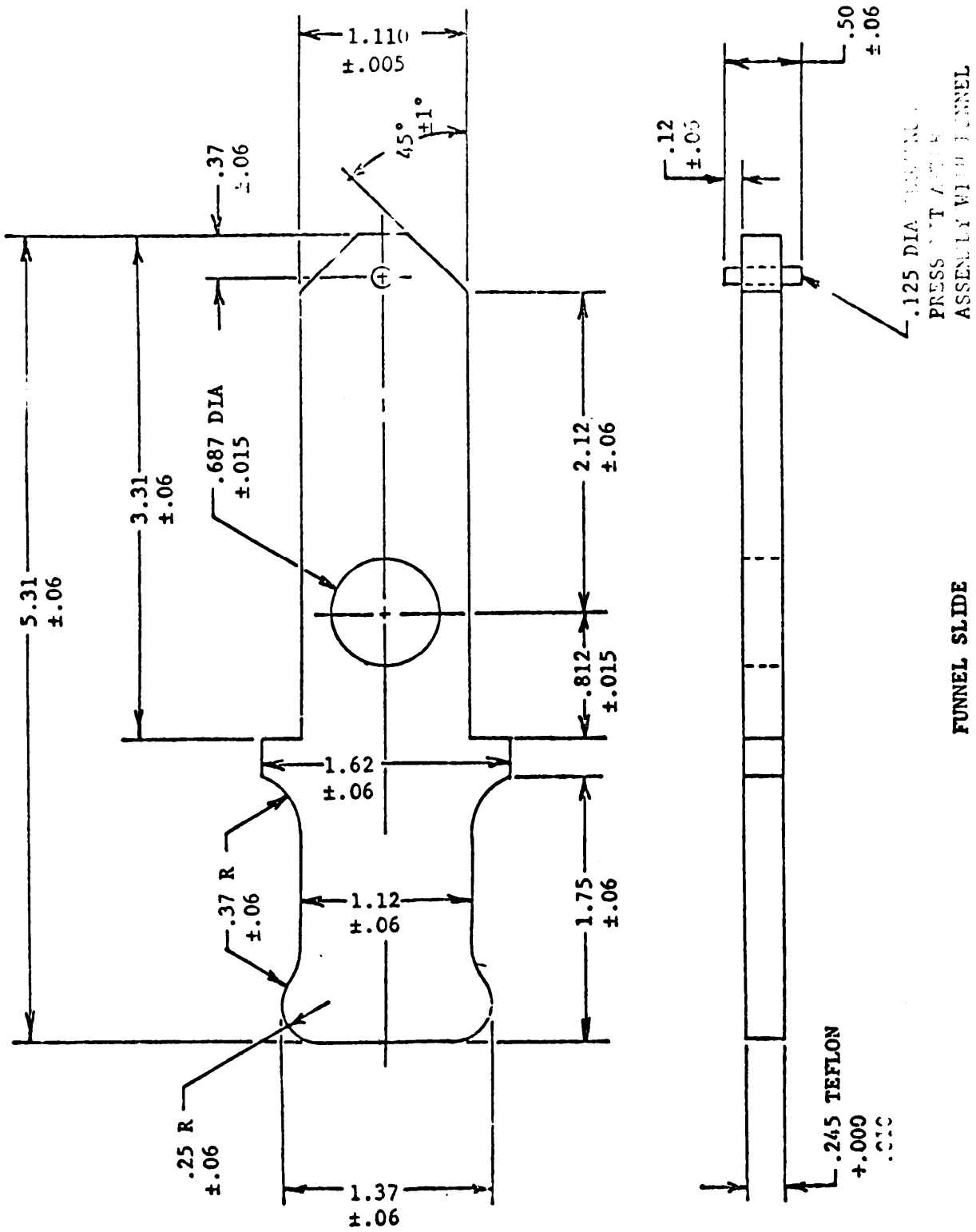


FIGURE 6
ROD



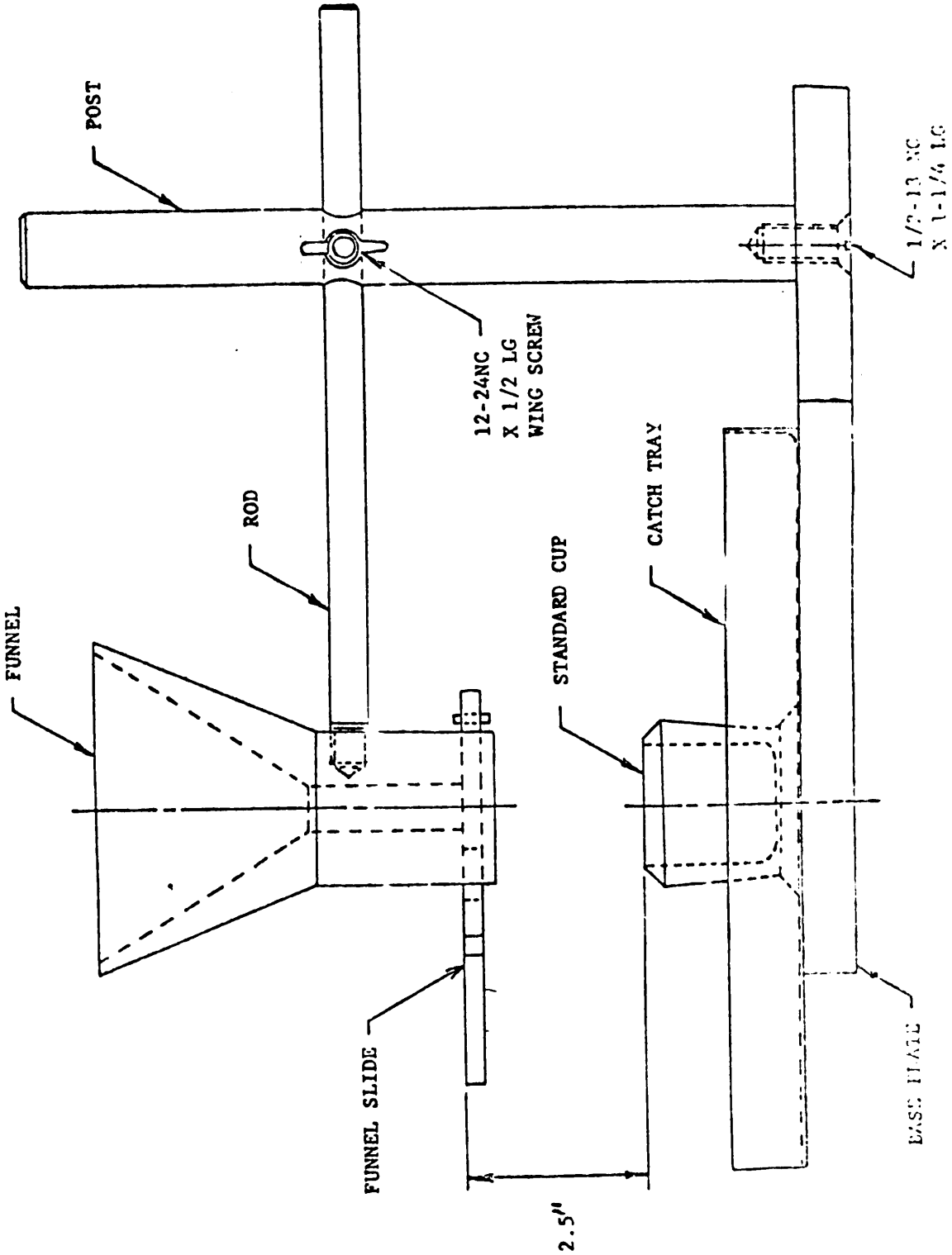
POST

FIGURE 7



FUNNEL SLIDE

FIGURE 8



APPARATUS ASSEMBLY

FIGURE 9

METHOD 503.1.1

100°C. and 120°C. Vacuum Stability Test

1. SCOPE

1.1 This method is used for comparing the resistance to decomposition by heat of any explosive with that of another; to indicate the presence or absence of unstable impurities in an explosive which is stable at 100°C or 120°C.

2. SPECIMEN

2.1 The specimen shall consist of 5 gm. of the dried explosive (or 1 .gm. of initiating explosives or explosives of similar sensitivity) weighed to within 10 mg.

3. APPARATUS

3.1 Constant temperature bath.

NOTE: A bath consisting of a solution of glycerin and water (specific gravity 1.05 for 100°C tesl and 1.21 for a 120°C test has been found satisfactory. Check the temperature of the bath by Inserting a thermometer to the bottom of the empty heating tube (fig. 1) immersed in the bath. Adjust the temperature of the bath by adding one or the other of the constituents of the solution.

3.2 Vacuum stability measuring apparatus (fig. 1) heating tube.

3.3 Vacuum pump.

4. PROCEDURE

4.1 Standardize the vacuum stability measuring apparatus (fig. 1) as follows:

a. Determine the volume of the heating tube by filling it with mercury from a buret until the mercury reaches the level at which it will contact the ground glass joint of the capillary tube.
b. Determine the unit capacity of the capillary by placing exactly 10 gm of mercury in its cup, and manipulating the tube so that all the mercury passes into the long (85-cm) section of the capillary. Be sure that the mercury remains as a continuous column. Meausre the length of the mercury column at three positions in the long section of the capillary, and average three measurements. Calculte the unit capacity of the capillary using the following formula:

$$B = \frac{W}{13.54L}$$

Where :
B = unit capacity of capillary, ml. per mm.
W = weight of mercury, gm..
L = average length of mercury column, mm.

4.2 Place the drled specimen in the heating tube (fig. 1).

4.3 Coat the ground glass joint of the capillary tube with a light film of petroleum jelly, and make an airtight connection between the heating tube and the capillary with a twisting motion.

4.4 Mount the apparatus on a rack so that the long section of the capillary is nearly vertical, and the cup at the bottom rests on a solid support.

4.5 Fill the cup with 7.0 ml. of mercury and connect a vacuum line to the mouth of the cup.

4.6 Evacuate the capillary to a pressure of approximately 5 mm. of mercury (absolute).

NOTE: Evacuation will be facilitated by tilting the apparatus until the capillary opening in the bottom of the cup is free of mercury.

4.7 When the pressure has been reduced to 5 mm.. of mercury, remove the vacuum llne and allow now the mercury to enter the capillary. Record the following data:

a. The total length of the capillary tube minus the vertical height of the column of mercury In the cup before heating (B_1).
b. The height of mercury column above surface of mercury pool at beginning of test (H_1).
c. The temperature of room at beglnnlng of test (t_1).
d. The barometric pressure in millimeters of mercury at beginning of test (P_1).

4.8 Immerse the heeling tube In the constant temperature bath (fig. 1) being careful not to loosen the connection between the heating tube and the capillary. Heat tube for 40 hours.

4.9 Remove the tub from the constant temperature bath and allow to cool to room temperature.

4.10 Record the followiing data:

a. The total length in mm. of the capillary tube minus vertical-height of mercury column in the cup after heating [B).
b. The height of merrcury column above the surface of mercury pool at the end of test (H).
c. The temperature of room at end of test (t).
d. The barometric pressure in millimeters of mercury at end of test (p).

4.11 Calculate the volume of gas (at standard temperature and pressure) liberated during test, as follows:

$$\text{Volume of gas, ml} = [A + C(B-H)]\frac{273P}{760(273+t)} - [A + C(B_1-H_1)]\frac{273P_1}{760(273+t_1)}$$

Where:

A = volume of heating tube minus 5.00 ml or 1.00 ml (volume of explosive)

B = total length in mm of the capillary tube minus the vertical height of the column In mercury in the cup at the end of the test.

B_1 - total length in mm the capillary tube minus the vertical height of the column of mercury in the cup before heating.

C = determined unit capacity tubing in cc per mm.

P = barometer reading at the end of the test minus H

P_1 = Barometer reading when the test starts d minus H.

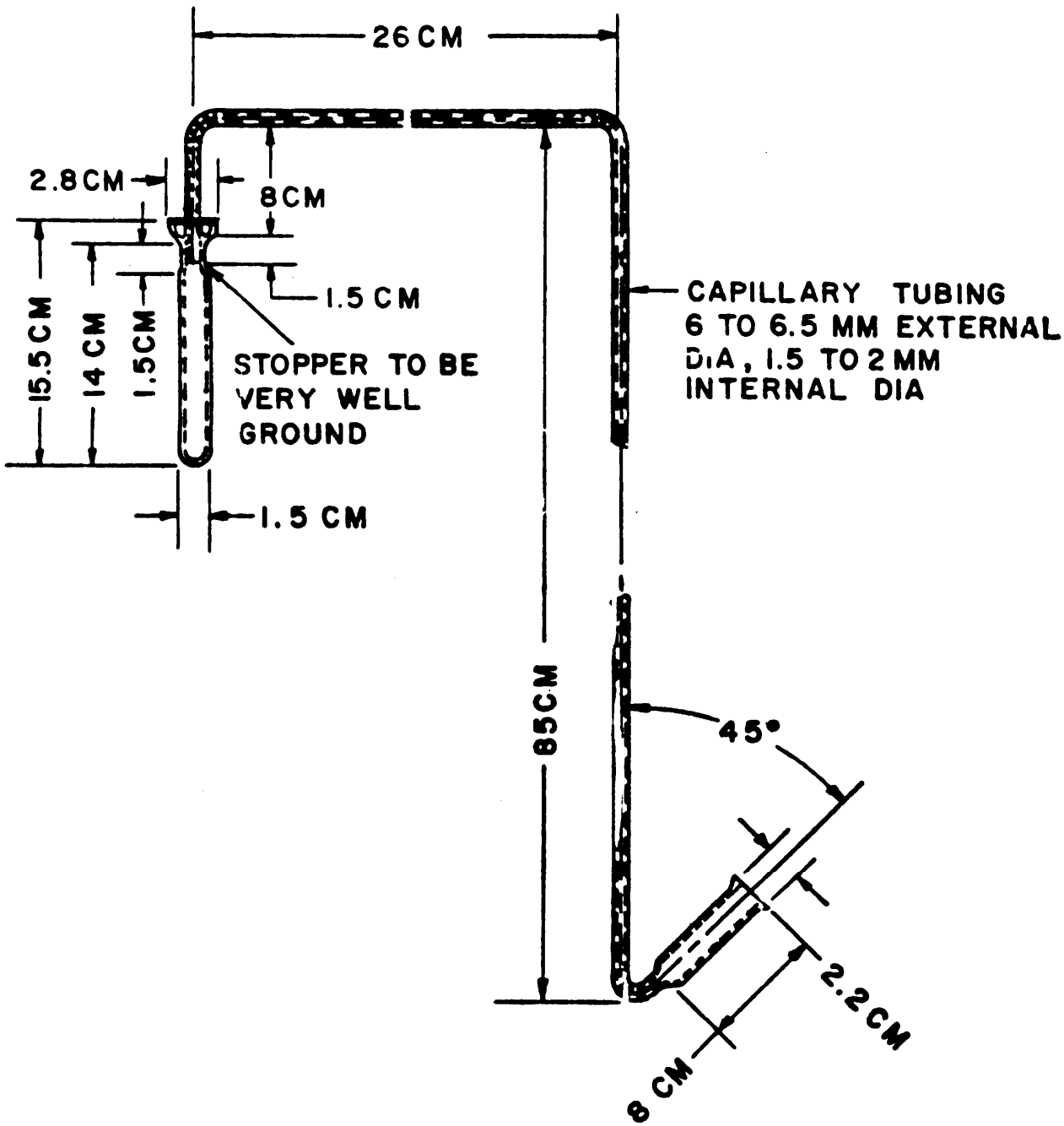


FIGURE 1. ***Apparatus for vacuum's stability test.***

SUPERSEDES PAGE 3 of 3 August 1962

METHOD 504.1.1
REACTIVITY TEST

1. SCOPE.

1.1 This method is used for determining the reactivity of an explosive with contact material.

2. SPECIMEN.

2.1 The specimen shall consist of 5 grams of the explosive and 5 gm. of the contact material. A 2.5 gm. portion of each of the materials is tested as received except in the case of solvent containing contact materials (paints, adhesives, etc.) which would in normal usage be in the dry state. In this case the materials are air dried on glass plates and removed in the form of films for testing. The remaining portion of the explosive and contact material are reduced to a practicable fineness for intimacy of contact. Explosives are pulverized under gentle pressure in an agate mortar; metals are tested as fine milled chips or fillings; films, cloth and paper are cut into 1/8 inch squares; propellant are rasped or milled to a fineness of approximately 12 mesh.

3. APPARATUS.

3.1 The apparatus used in this method is identical with that used in Method 503.1.

4.1 MATERIALS

4.1 Contact materials as specified in the appliable method or specification.

5. PROCEDURE.

5.1 Standardize the vacuum stability measuring apparatus as described in Method 503.1, Paragraph 4.1.

5.2 Place 2.5 gm. of explosive in one heating tube and 2.5 gm. of contact material in' a second heating tube.

5.3 In a third tube place a mixture of 2.5 gm. of the explosive and 2.6 gm. of contact material.

5.4 Determine the volume of gas evolved as specified in Method 503.1, Paragraph 4.3 to 4.12.

5.5 Determine from the amount of gas produced by the mixture of contact material and the explosive in excess of the amount of gas evolved by the materials themselves as follows:

$$\text{Gas due to reactivity, ml} = C-(A+B)$$

where:

C = amount of gas evolved by the 50/50 mixture of the contact material and the propellant.

A = amount of gas evolved by the propellent.

B = amount of gas evolved by the contact material.

☆U.S. GOVERNMENT PRINTING OFFICE: 1981-703-023/6033

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

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