FLAME RESISTANCE OF CLOTH: VERTICAL

1. SCOPE

1.1 This method is intended for use in determining the resistance of cloth to flame and glow propagation and tendency to char. It is designed primarily for cellulosic fabrics treated with a flame retardant, but may be utilized in other applications as specified in applicable procurement documents. In addition to the vertical position of the sample and flame exposure conditions common to tests of this type, the method defines gas composition, burner, cabinet, temperature and humidity test conditions since it is designed primarily for interlaboratory testing of the same material.

2. TEST SPECIMEN

2.1 The specimen shall be a rectangle of cloth 2-3/4 inches by 12 inches with the long dimension parallel to either the warp or filling direction of the cloth. No two warp specimens shall contain the same warp yarns, and no two filling specimens shall contain the same filling yarn.

3. NUMBER OF DETERMINATIONS

3.1 Unless otherwise specified in the material specification, five specimens from each of the warp and filling directions shall be tested from each sample unit.

4. APPARATUS

4.1 Cabinet. A cabinet and accessories, fabricated in accordance with the requirements specified in figures 5903A, B and C. Galvanized sheet metal

or other suitable metal shall be used. The entire inside back wall of the cabinet shall be painted black to facilitate the viewing of the test specimen and pilot flame.

4.2 Burner. The burner shall be equipped with a variable orifice to adjust the flame height, a barrel having a 3/8 inch inside diameter and a pilot light.

4.2.1 The burner may be constructed by combining a 3/8 inch inside diameter barrel 3 ± 1/4 inches long from a fixed orifice burner with a base from a variable orifice burner.

4.2.2 The pilot light tube shall have a diameter of approximately 1/16 inch and shall be spaced 1/8 inch away from the burner edge with a pilot flame 1/8 inch long.

4.2.3 The necessary gas connections and the applicable plumbing shall be as specified in figure 5903D except that a solenoid valve may be used in lieu of the stopcock valve to which the burner is attached. The stopcock valve or solenoid valve, whichever is used, shall be capable of being fully opened or fully closed in 0.1 second.

4.2.4 On the side of the barrel of the burner, opposite the pilot light there shall be a metal rod of approximately 1/8 inch diameter spaced 1/2 inch from the barrel and extending above the burner. The rod shall have two 5/16 inch prongs marking the distances of 3/4 inch and 1-1/2 inches above the top of the burner.

4.2.5 The burner shall be fixed in a position so that the center of the barrel of the burner is directly below the center of the specimen.

4.3 A control valve system with a delivery rate designed to furnish gas to the burner under a pressure of 2-1/2 ± 1/4 lbs. per square inch at the burner inlet. (See Note) The manufacturer's recommended delivery rate for the valve system shall include the required pressure.

4.4 A synthetic gas mixture of the following composition within the following limits (analyzed at standard conditions): 55 ± 1 percent hydrogen, 24 ± 1 percent methane, 3 ± 1 percent ethane, and 18 ± 1 percent carbon monoxide, which will give a specific gravity of 0.380 ± 0.005 (air = 1) and a B.t.u. content of 539 ± 7 per cubic foot (dry basis) at 21°C. (69.8°F).

4.5 Metal hooks and weights to produce a series of total loads to determine length of char. The metal hooks shall consist of No. 19 guage steel wire or equivalent and shall be made from 3 inch lengths of the wire and bent 1/2 inch from one end to a 45 degree hook. One end of the hook shall be fastened around the neck of the weight to be used.

4.6 Stop watch or other device to measure the burning time to 0.2 second.

4.7 Scale, graduated in 0.1 inch to measure the length of char.

5. PROCEDURE

5.1 The material undergoing test shall be evaluated for the characteristics specified in the applicable procurement document, i.e. after-flame time, after-glow time and char length on each specimen as applicable.

5.2 All specimens to be tested shall be at moisture equilibrium under standard atmospheric conditions in accordance with Section 4 of this Standard.

Each specimen to be tested shall be placed in a specimen holder before removal from the standard atmosphere and shall be exposed to the test flame within 20 seconds after removal from the standard atmosphere.

5.2.1 In case of dispute all testing will be conducted under Standard Atmospheric Conditions in accordance with Section 4 of this Standard.

5.3 The specimen in its holder shall be suspended vertically in the cabinet in such a manner that the entire length of the specimen is exposed and the lower end is 3/4 inch above the top of the gas burner. The apparatus shall be set up in a draft free area.

5.4 Prior to inserting the specimen, the pilot flame shall be adjusted to approximately 1/8 inch in height measured from its lowest point to the tip. The burner flame shall be adjusted by means of the needle valve in the base of the burner to give a flame height of 1-1/2 inches with the stopcock fully open and the air supply to the burner shut off and taped. The 1-1/2 inch flame height is obtained by adjusting the valve so that the uppermost portion (tip) of the flame is level with the tip of the metal prong (see figure 5903B) specified for adjustment of flame height. It is an important aspect of the evaluation that the flame height be adjusted with the tip of the flame level with the tip of the metal prong. After inserting the specimen, the stopcock shall be fully opened, and the burner flame applied vertically at the middle of the lower edge of the specimen for 12 seconds and the burner turned off. The cabinet door shall remain shut during testing.

5.5 The after-flame time shall be the time the specimen continues to flame after the burner flame is shut off.

5.6 The after-glow time shall be the time the specimen continues to glow after it has ceased to flame. If the specimen glows more than 30 sec., the specimen holder containing the specimen shall be removed from the test cabinet without any unnecessary rate of movement of the specimen which will fan the glow, and suspended in a draft-free area in the same vertical position as in the test cabinet. When more than one glowing specimen is suspended outside the test apparatus, the specimens shall be spaced at least six inches apart. The specimens shall remain stationary until all glowing has ceased. The glow shall not be extinguished even when the after-glow time is not being determined.

5.7 After each specimen is removed, the test cabinet shall be cleared of fumes and smoke prior to testing the next specimen.

5.8 After both flaming and glowing have ceased, the char length shall be measured. The char length shall be the distance from the end of the specimen, which was exposed to the flame, to the end of a tear (made lengthwise) of the specimen through the center of the charred area as follows: The specimen shall be folded lengthwise and creased by hand along a line through the highest peak of the charred area. The hook shall be inserted in the specimen (or a hole, 1/4 in. diameter or less, punched out for the hook) at one side of the charred area 1/4 in. from the adjacent outside edge and 1/4 inch in from the lower end. A weight of sufficient size such that the weight and hook together shall equal the total tearing load required in 5.9.1 shall be attached to the hook.

5.9 A tearing force shall be applied gently to the specimen by grasping the corner of the cloth at the opposite edge of the char from the load and raising the specimen and weight clear of the supporting surface. The end of the tear shall be marked off on the edge and the char length measurement made along the undamaged edge.

5.9.1 Loads for determining char length. The specific load applicable to the weight of the test cloth shall be as follows:

Specified weight per square yard of cloth before any fire retardant treatment or coating - Ounces	Total tearing weight for determining the charred length - Pound
2.0 to 6.0	0.25
Over 6.0 to 15.0	0.5
Over 15.0 to 23.0	0.75
Over 23.0	1.0

5.10 The after-flame time and after-glow time of the specimen shall be recorded to the nearest 0.2 second and the char length to the nearest 0.1 inch.

6. REPORT

6.1 The after-flame time, after-glow time and char length of the sample unit shall be the average of the results obtained from the individual specimens tested. All values obtained from the individual specimens shall be recorded.

6.2 The after-flame time and after-glow shall be reported to the nearest 0.2 second and the char length to the nearest 0.1 inch.

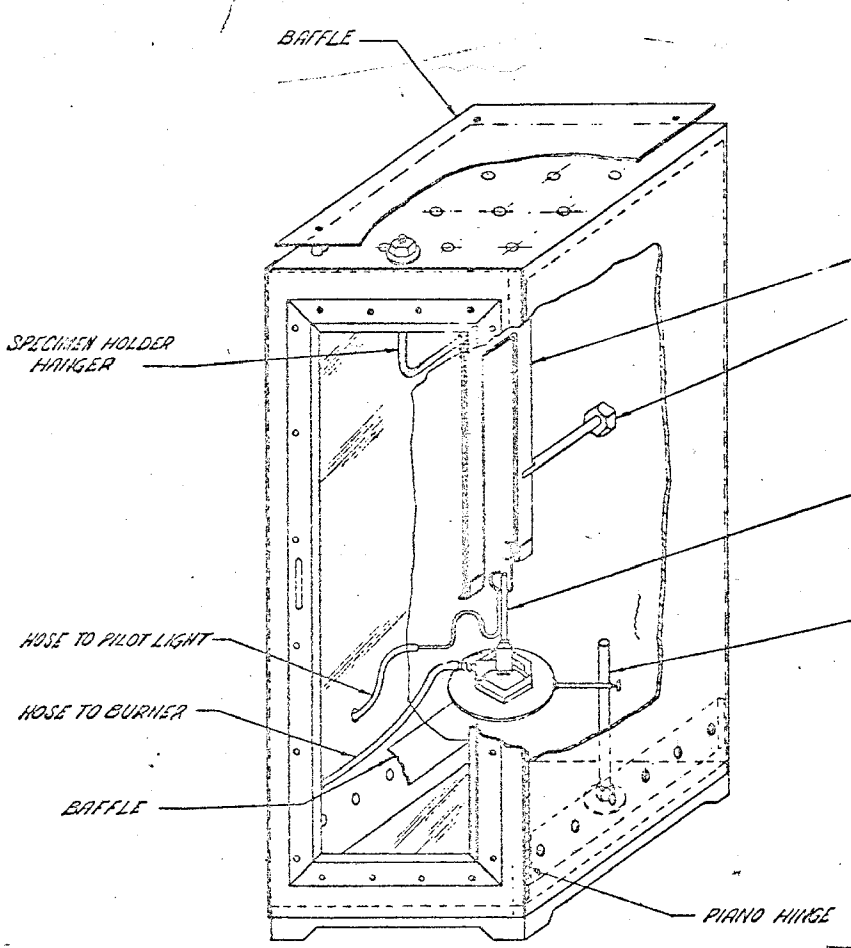
7. NOTES

7.1 The gas mixture described and the valve system may be obtained from the Matheson Company, Inc., 33 Paterson Plank Road, East Rutherford, N.J.

7.2 The regulator used in the development of this method in Model 70 Low Pressure Regulator, supplied by the Matheson Company, Inc., P. O. Box 85, East Rutherford, N. J. 07073.

7.3 The test cabinet of the type described in this test method may be obtained from U.S. Testing Company, 1415 Park Avenue, Hoboken, New Jersey 07030.

REVISIONS						
SYM	D. C. NO.	DR	CK	DESCRIPTION	DATE	APPR
A	TC 2168	VA	CAV	REVISED SPECIMEN HOLDER, HANGER AND SUPPORT; DELETED CATCH	4 JUN 68	AV.



ILLUSTRATION

ITEM NO	DESCRIPTION	NO. REQD	MATERIAL	MATL SPEC	NO.
ITEM LIST					

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. FABRICATING TOLERANCES (WIRE AND METAL GAGES EXCLUDED): FRACTIONS ____ DECIMALS ____ ANGLES ____

NEXT ASSY | USED ON

DO NOT APPLY PART NO. DO AS SPECIFIED

SUPERSEDES DRAWING

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CHECKED: [illegible]

PROJ ENGR: [illegible]

CHIEF DESIGN: [illegible]

APPROVAL DESIGN ACTIVITY

APPROVAL OTHER

DRAFTING WORK ORDER NO. TC 2128

DATE 12 APR 1968

U. S. ARMY NATICK LABORATORIES
NATICK, MASS.

VERTICAL FLAME RESISTANCE TEXTILE APPARATUS; ILLUSTRATION

CODE 81337 | SIZE C | DWG NO. 2-3-294

SCALE 1/4 | UNIT WT | SPEC NO. | SHEET OF

SET OF DWGS 2-3-294 & 2-3-297

REVISIONS						
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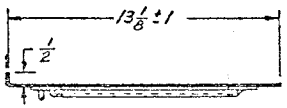

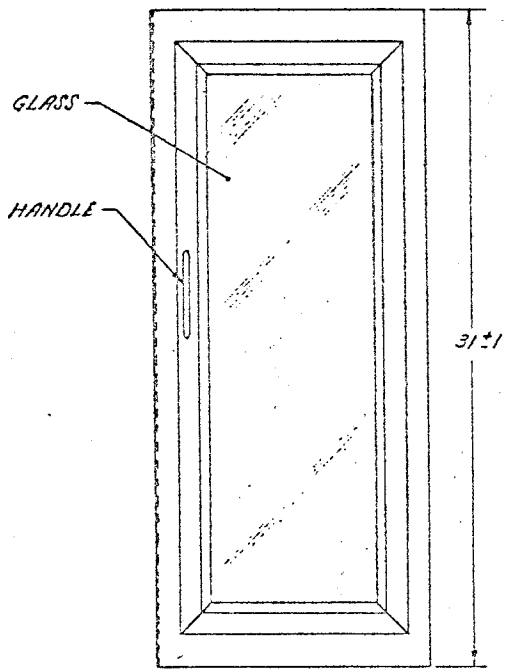

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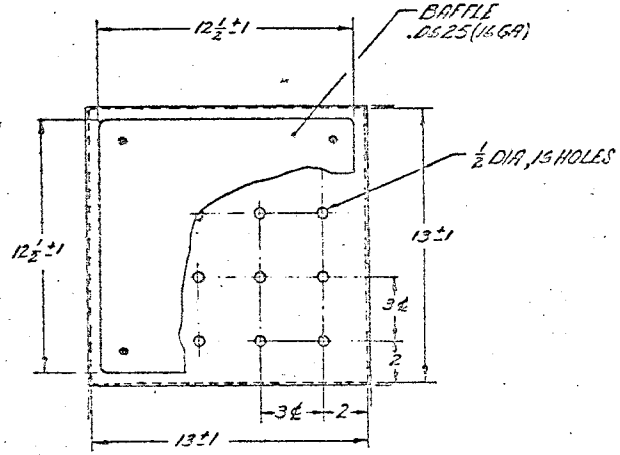
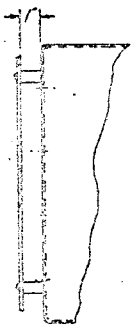


TOP VIEW SHOWING HOLES AND BAFFLE



ITEM NO	DESCRIPTION	NO. REQ'D	MATERIAL	MATL SPEC	NO.
ITEM LIST					

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. FABRICATING TOLERANCES: ONE AND TWO PLACE DECIMALS ±; FRACTIONS ±; ANGLES —

DRAWN: PEDROI
CHECKED:
ENGR APPROVAL:
MFG APPROVAL:
APPROVAL (OTHER):

U. S. ARMY NATICK LABORATORIES
NATICK, MASS.

VERTICAL FLAME RESISTANCE TEXTILE APPARATUS;
DOOR AND TOP VIEW W/BAFFLE

NEXT ASSY | USED ON

DO NOT | APPLY PART NO. AS SPECIFIED

SUPERSEDES DRAWING

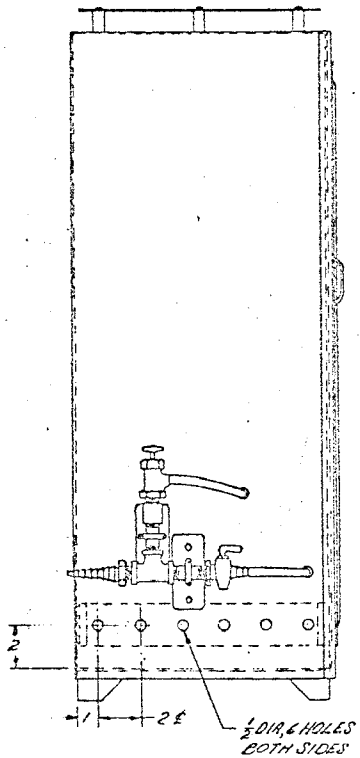
DWG. NO. & PURCH. ORDER NO.: TC 2128

DATE: 10 MAR 1960

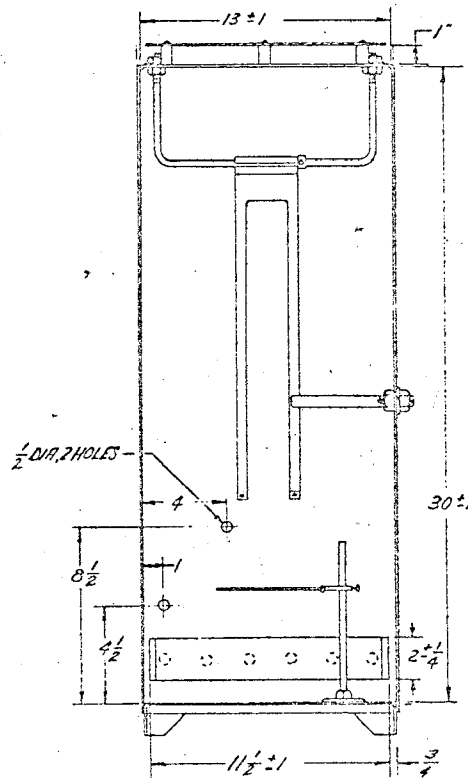
CODE: 61537 | SIZE: C | DRAWING NO.: 2-3-255

SCALE: 1/2 | UNIT WT. | SHT. NO. | SHEET OF

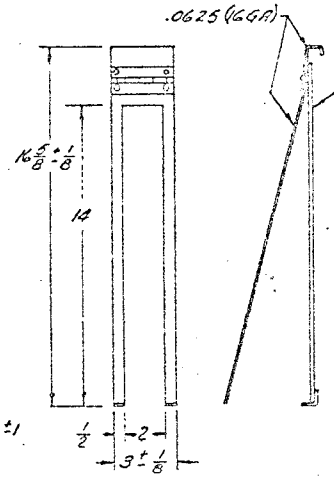
REVISIONS						
SYM	D.W.G. NO.	CP	CK	DESCRIPTION	DATE	TR
A	TC 2160	VA	AA	REVISED SPECIMEN HOLDER, SUPPORT; ADDED HANGER; DELETED CATCH	4 JUN 68	71



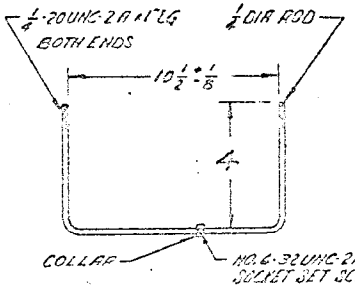
LEFT SIDE VIEW



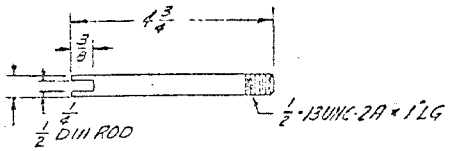
RIGHT SIDE VIEW
(SIDE PANEL REMOVED)



SPECIMEN HOLDER



SPECIMEN HOLDER HANGER



SPECIMEN HOLDER SUPPORT

ITEM NO	DESCRIPTION	NO. REQ'D	MATERIAL	MATL SPEC	NO.

ITEM LIST

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. FABRICATING TOLERANCES: PIPE AND METAL CASTS EXCLUDED. FRACTIONS ± — DECIMALS ± — ANGLES ±

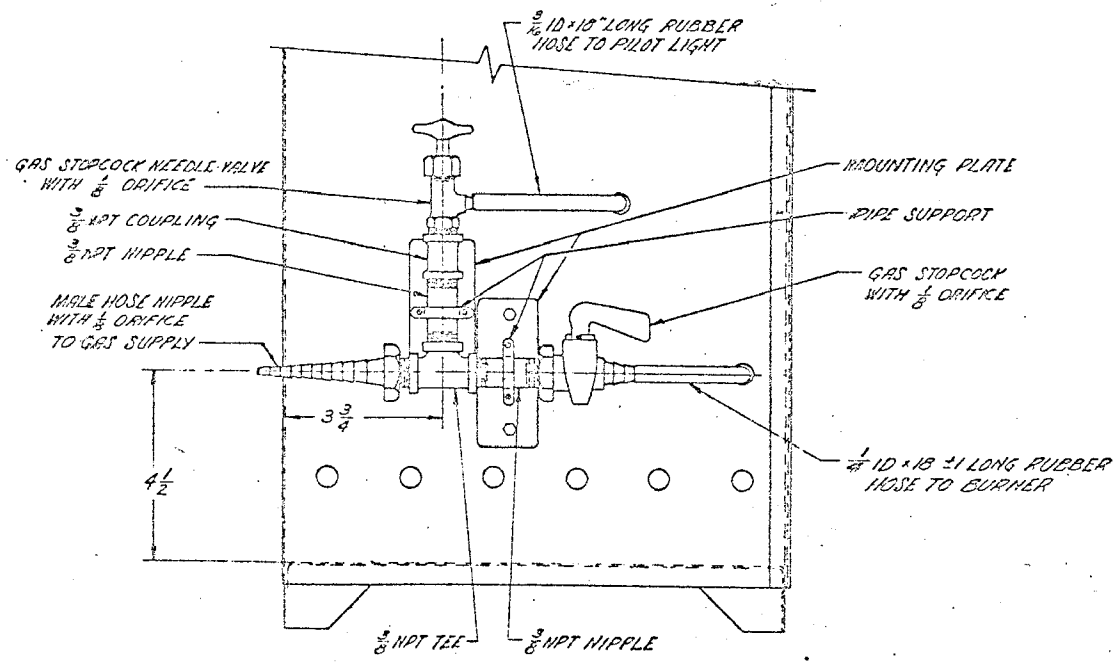
DRAWN: RICAHILL
CHECKED: H. C. Silvestri
PROJ ENGR: [illegible]
CHIEF, DIV: [illegible]
ARMY/NAVY DESIGN ACTIVITY
2-3-294
NEXT ASSY | USED ON
NATIONAL OTHER
DO NOT / DO — APPLY PART NO. AS SPECIFIED
CLOTHING WORK ORDER NO. TC 2123
SUPERSEDES DRAWING
DATE 12 SEPTEMBER 1966

U. S. ARMY NATICK LABORATORIES
NATICK, MASS.

VERTICAL FLAME RESISTANCE TEXTILE APPARATUS; VIEWS AND DETAILS

CODE 81337 | SIZE C | DWG NO. 2-3-295
SCALE ½ | SHEET 1 | SPEC NO. | REV

REVISIONS						
SYM	BY	DR	CK	DESCRIPTION	DATE	APP'D



SIDE VIEW SHOWING GAS HOSE CONNECTION

NOTE:
ALL PIPE FITTING TO BE BLACK IRON PIPE

ITEM NO	DESCRIPTION	NO. REQD	MATERIAL	MATL SPEC	NO.
ITEM LIST					

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. FABRICATING TOLERANCES: WIRE AND METAL GAGES EXCLUDED; FRACTIONS ~ DECIMALS ~ ANGLES ~

DRAWN: RICAPPOLI
CHECKED: [illegible]
PROJ. ENGR. [illegible]
CHIEF [illegible]
APPROVAL DESIGN ACTIVITY [illegible]
APPROVAL OTHER

NEXT ASSY | USED ON

DO NOT DO | APPLY PART NO. AS SPECIFIED

DRAWING WORK ORDER NO. TC 2128

SUPERSEDES DRAWINGS

DATE [illegible]

U. S. ARMY NATICK LABORATORIES
NATICK, MASS.

VERTICAL FLAME RESISTANCE TEXTILE APPARATUS;

SIDE VIEW SHOWING GAS HOSE CONNECTION

CODE 61537A | SIZE C | DWG NO. 2-3-297

SCALE 1/2 | UNIT WT | DWG NO. | SHEET OF