EXPERIMENT OF DAMAGE CONTROL MATERIALS AND METHODS FOR FLEET HANDLING OF PACKAGED LIQUID PROPELLANTS (U)

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By
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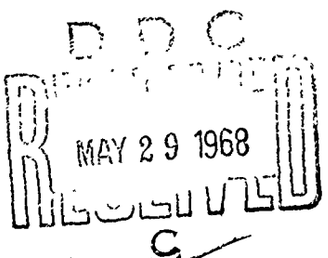

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I. CALIBRATION OF THE GAS ANALYZER FOR MHF-3 SERVICE

Since the Billion-Aire Trace Gas Analyzer was not calibrated for MHF-3 by the manufacturer, it was necessary to do the calibration in our laboratories. One basic method was used for the calibration with two different sources of MHF-3 vapor. A 2-liter flask was used as a sampling chamber through which a continuous flow of dilute MHF-3 at a desired concentration could be maintained. To achieve the low concentration of MHF-3 needed to calibrate the analyzer (0 to 20 ppm) the two different source methods were used.

The first method used the vapor pressure of the MHF-3 at 32°F as the basis for a standard source (see Figure A). A flask containing MHF-3 was cooled to 32°F and maintained at this temperature. A constant amount of vapor was fed to the sampling chamber where it was further diluted with additional air. The analyzer was tested by inserting the probe into the flask and sampling the various concentrations of MHF-3. This method could not achieve accurate concentrations below 5 ppm so another source method had to be used to supplement the results.

The second method used as the source of MHF-3 was a Davis instrument shown in Figure B. This instrument consisted of a syringe containing air saturated with MHF-3. The vapor in the syringe was ejected at a steady rate by a motor-controlled screw pushing the syringe piston at a rate of 1/40th inch per minute. From the vapor pressure of MHF-3 at room temperature, it was possible to know how much gas was delivered per unit of time into the system leading to the sampling chamber. This vapor was then further diluted in the chamber with additional air (see Figure C).

The analyzer was tested by inserting the probe into the flask and sampling the various concentrations of MHF-3. With this method it was possible to complete the calibration below 5 ppm. A plot of concentration vs. analyzer reading is shown in Figure D. When the analyzer was tested on the pitch-and-roll table, the readings were the same as when tested under stable conditions.

II. THE PROTECTIVE SUIT COVERALL

The neoprene-coated nylon protective coverall was received from the manufacturer, but unfortunately it did not meet our specifications as ordered. The following defects were noted in the coverall:

(1) The neoprene-nylon material was used as the overlay on the seams instead of the specified black pure neoprene.

(2) Some stitching was exposed.

(3) The neoprene-nylon material appeared to be different in many ways from the original material tested and ordered. The new material was noticeably thicker, and measured 0.0195" thick vice 0.0170". The weave of the base fabric of the nylon material was of a different pattern. This material was brittle as evidenced by lingering creases when bent. When inspected under a 15 power microscope, there appeared to be numerous pits and holes in the neoprene surface layer of the smooth side.

A sample of this new material was obtained from the manufacturer and subjected to the CTF exposure tests. The samples failed all the tests, both with gaseous and liquid CTF.

Because of the defects, especially the failure of the material when exposed to CTF, the suit was rejected and sent back to the manufacturer. Another suit was ordered according to our original specifications and delivery is awaited.

III. THE EFFECT OF CTF ON THE SKIN

In evaluating the oxygen breathing apparatus (OBA) we arbitrarily selected a CTF concentration of 1% for two hours as the criterion for evaluating material suitability. We assumed that exposure to higher concentrations would have an adverse effect on personnel. Therefore, protective clothing rather than an OBA alone would be indicated in concentrations of CTF above 1%.

To test this assumption we arranged to have Dr. D. Lester of Rutgers University, New Jersey, determine the effect of CTF gas on the skin of live rabbits. Shaved areas of the rabbits were exposed to several low concentrations of CTF for various periods. A 1% CTF exposure for 30 minutes produced serious burns that required several weeks to heal. In fact, a 30 minute exposure to a concentration of 0.1% produced noticeable skin effects. This test program emphasizes the necessity for providing adequate protection for personnel entering a CTF-contaminated atmosphere. An OBA alone will not provide the necessary protection.

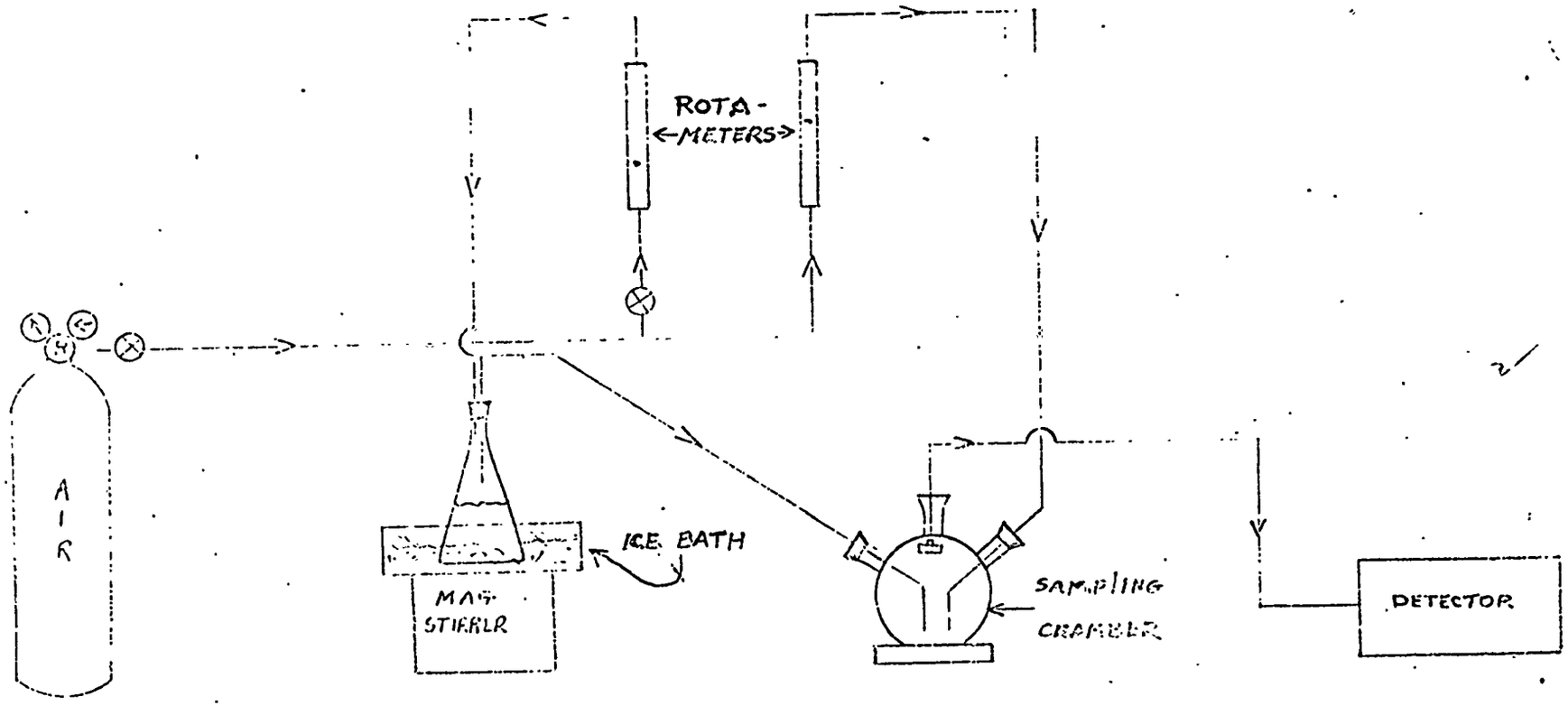
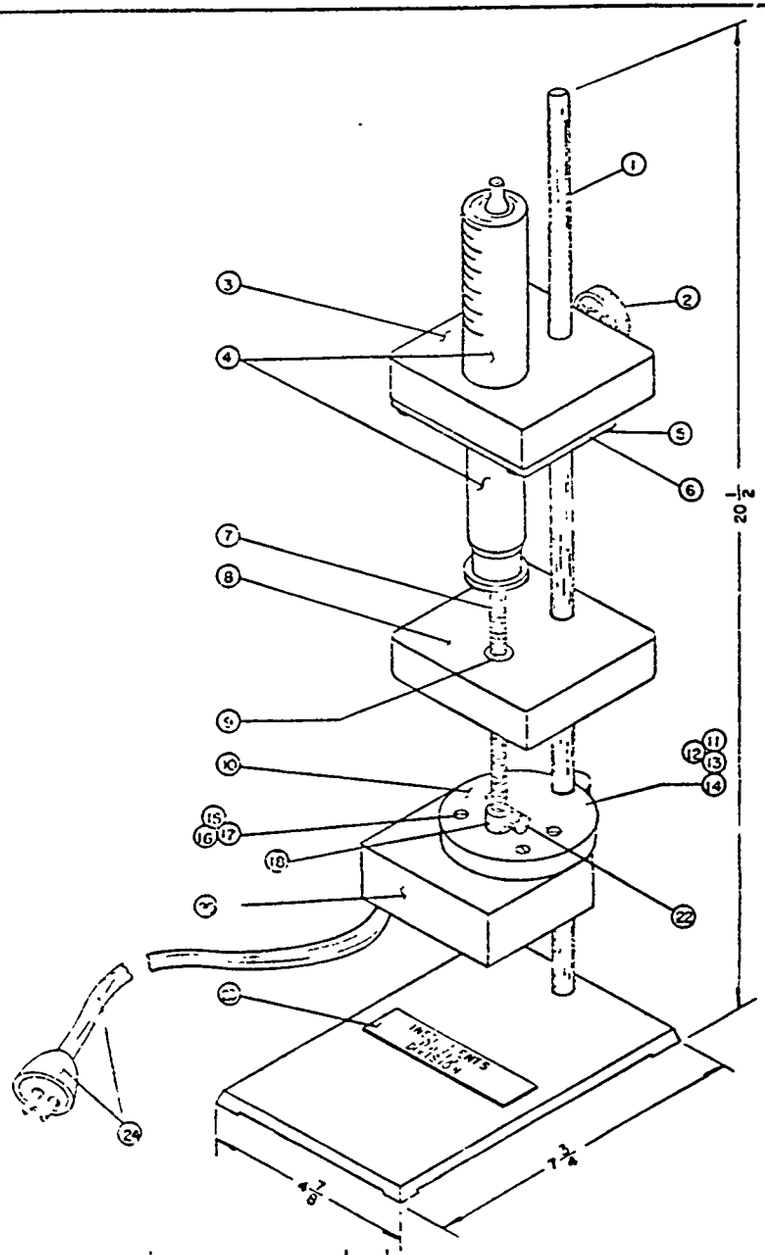


FIGURE A. FLASK DILUTION ASSEMBLY



PART LIST	
1	RING STAND
2	ADJUSTING KNOB
3	SYRINGE HOLDER
4	SYRINGE
5	SYRINGE RETAINING PLATE
6	SCREW (4)
7	MICROMETER FEED SHAFT
8	FEED SHAFT HOLDER
9	FEED SHAFT BUSHING
10	MOTOR MOUNTING PLATE
11	BRACKET
12	SCREW (4)
13	WASHER (4)
14	NUT (4)
15	SCREW (4)
16	WASHER (4)
17	NUT
18	COUPLING
20	MOTOR
22	SCREW COUPLING LOCK
23	NAMEPLATE
24	CORD

FIGURE B. THE DAVIS INSTRUMENT

TITLE	DRAWING NO	ISS
REFERENCE DRAWINGS		

TITLE: ELECTRO-CONDUCTIVITY ANALYZER CALIBRATOR ASSEMBLY

DAVIS INSTRUMENTS
DIVISION OF DAVIS EMERGENCY EQUIPMENT CO., INC.
NEWARK NEW JERSEY

ALL FRACTIONAL DIMENSIONS HAVE A TOLERANCE OF PLUS OR MINUS 1/32
ALL DECIMAL DIMENSIONS HAVE A TOLERANCE OF PLUS OR MINUS .010
UNLESS OTHERWISE SPECIFIED

DRAWN	CHKD	DATE	SCALE
CG		3-26-59	1 = 2

DWG. NO. 11-A-7950

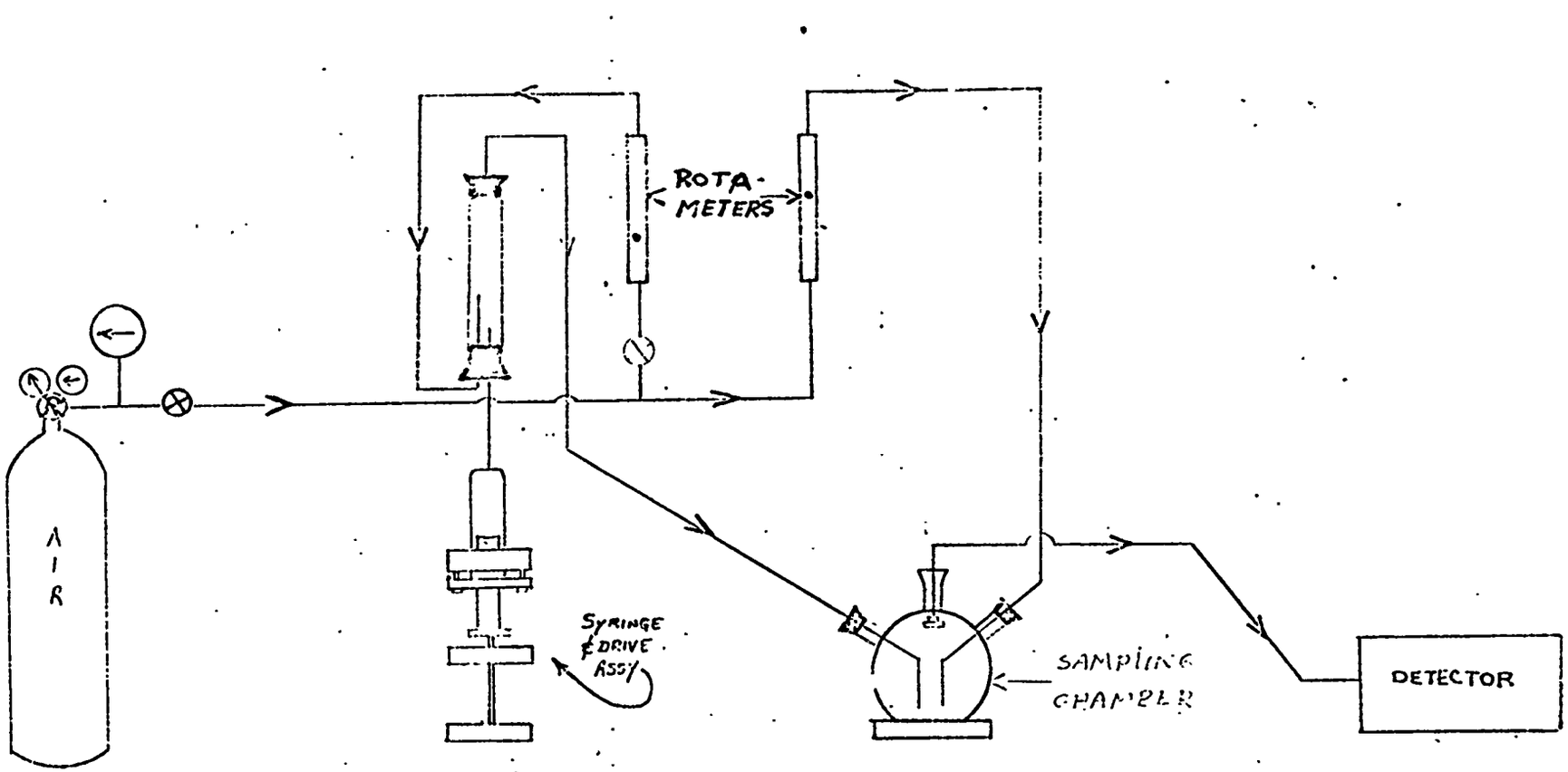


FIGURE C. THE DAVIS INSTRUMENT ASSEMBLY

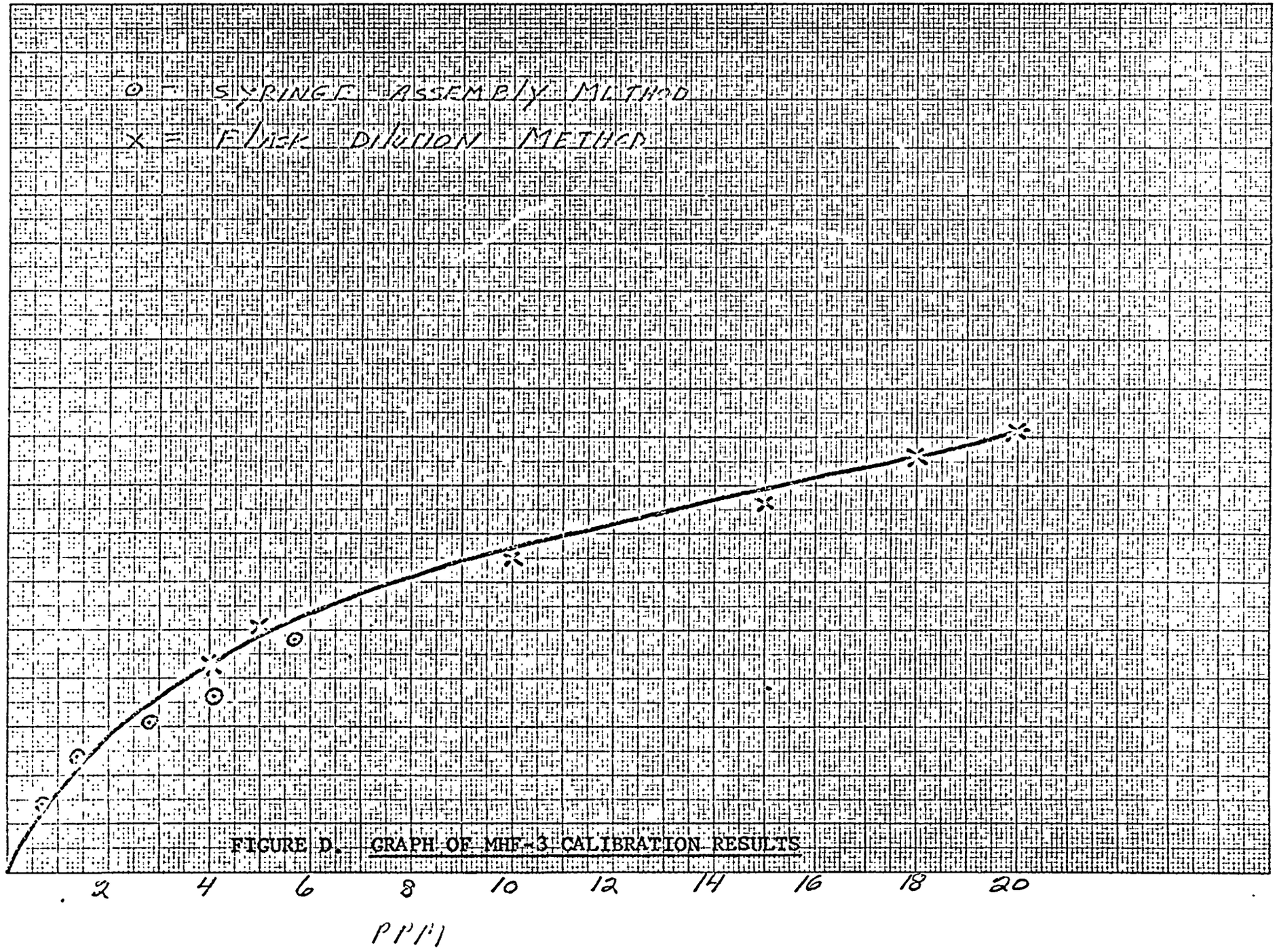


FIGURE D. GRAPH OF MHF-3 CALIBRATION RESULTS

UNCLASSIFIED

Security Classification

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13 ABSTRACT

An investigation is being conducted to evaluate the compatibility of certain damage control materials and equipment with chlorine trifluoride (CTF), a liquid propellant. The trace gas analyzer previously tested and approved for CTF service was calibrated for MHF-3 in the range of 0 to 20 ppm. The analyzer was calibrated under stable and shipboard-like conditions and produced protective responses. The prototype protective suit made of the neoprene-coated nylon cloth was received from the manufacturer, but was rejected because it did not comply with our specifications. Exposure tests were conducted on the skin of live rabbits with low concentrations of CTF. It was found that a 30 minute exposure of CTF even as dilute as 0.1% had an adverse effect on this skin.

DD FORM 1 NOV 68 1473 REPLACES DD FORM 1473, 1 JAN 64, WHICH IS OBSOLETE FOR ARMY USE.

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Chlorine Trifluoride						
Hydrazine Fuels						
Damage Control						
Protective Clothing						
Fume Detection						
Neoprene-coated Fabrics						