

MIL-STD-1234
CHANGE NOTICE 2
30 March 1967

MILITARY STANDARD
PYROTECHNICS: SAMPLING,
INSPECTION AND TESTING

TO ALL HOLDERS OF MIL-STD-1234:

1. The following pages of MIL-STD-1234 have been revised and supersede the pages listed:

| New Page | Date | Superseded Page | Date |
|----------|---------------|-----------------|------------------|
| ii | 30 March 1967 | ii | 18 December 1965 |
| iii | 30 March 1967 | iii | 22 June 1962 |
| iv | 30 March 1967 | iv | 18 December 1965 |
| v | 30 March 1967 | v | 18 December 1965 |
| vi | 30 March 1967 | vi | 22 June 1962 |

2. The following methods have been added:

| Method No. | Title | Date |
|------------|--|---------------|
| 101.6 | Moisture (Electrolytic Hygrometer Method) | 30 March 1967 |
| 506.1 | Friction Sensitivity (By the Roto-Friction Method) | 30 March 1967 |

3. The following is a cumulative list of earlier changes:

a. Superseded pages,

| New Page | Date | Superseded Page | Date |
|----------|----------------|-----------------|--------------|
| ii | 18 December 65 | ii | 22 June 1962 |
| iv | 18 December 65 | iv | 22 June 1962 |
| v | 18 December 65 | v | 22 June 1962 |

FSC 1370

MIL-STD-1234
30 March 1967

b. Superseded methods.

| New Method | Date | Superseded Method | Date |
|------------|----------------|-------------------|--------------|
| 101.1.1 | 18 December 65 | 101.1 | 22 June 1962 |
| 101.2.1 | 18 December 65 | 101.2 | 22 June 1962 |
| 101.3.1 | 18 December 65 | 101.3 | 22 June 1962 |
| 101.3.1 | 18 December 65 | 101.4 | 22 June 1962 |
| 102.1.1 | 18 December 65 | 102.1 | 22 June 1962 |
| 102.2.1 | 18 December 65 | 102.2.1 | 22 June 1962 |

c. New methods.

| Method No. | Title | Date |
|------------|---|------------------|
| 101.5 | Moisture (Karl Fischer Distillation Method) | 18 December 1965 |

4. Retain this notice and insert before table of contents.

5. Holders of MIL-STD-1234 will verify that page changes and additions indicated 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.

Custodians:
Army - MU
Navy - OS
Air Force - 11

Preparing Activity
Army - MU

Review Activities:
Army - MU
Navy - OS
Air Force - 70

Project No. 1370-0227

MIL-STD-1234
30 March 1967

DEPARTMENT OF DEFENSE
WASHINGTON 25, D. C.

Pyrotechnics: Sampling, Inspection and Testing

MIL-STD-1234

1. This Military Standard has been approved by the Department of Defense and is mandatory for use by all Departments and Agencies of the Department of Defense.
2. Recommended corrections, additions, or deletions should be addressed to Commanding Officer, Picatinny Arsenal, Dover, New Jersey 07801, ATTN: SMUPA-DC7.

Supersedes page ii of 18 December 1965

MIL-STD-1234
30 March 1967

CONTENTS

| | Page |
|---|----------|
| Alphabetical Index of Test Methods | iii |
| Numerical Index of Test Methods | v |
| SECTION 1. INTRODUCTION | 1 |
| SAMPLING AND INSPECTION | 2 |
| TESTING | 3 |
| TEST METHODS. | |
| Group 100 — General test methods. | |
| Group 200 — Physical test methods. | |
| Group 300 — Sample preparations. | |
| Group 400 — Chemical test methods. | |
| Group 500 — Sensitivity brisance and Sta- bility test methods. | |
| Group 600 — Standard solutions. | |
| Group 700 — Indicator solution. | |

ALPHABETICAL INDEX OF TEST METHODS

| Title | Method No. |
|--|------------|
| Aluminum (Ammonium Hydroxide Method) | 407.1 |
| Aluminum (8-Hydroxy-quinoline Method) | 407.2 |
| Ammonium Thiocyanate Indicator Solution (20-percent) | 706.1 |
| Antimony Sulfide (Permanganate Method) | 410.1 |
| Average Particle Size (Fischer Subsieve Sizer) | 202.1 |
| Barium Diphenylamine Sulfonate Indicator Solution | 708.1 |
| Barium Salts (Chromate Method) | 406.2 |
| Barium Salts (Sulfate Method) | 408.1 |
| Bromophenol Blue Indicator Solution | 710.1 |
| Chlorate (Ferrous Sulfate Method) | 402.1 |
| Chloride (Silver Nitrate Method) | 401.1 |
| Dissolution | 801.1 |
| Dissolution-Extraction | 801.2 |
| Eriochrome Black T Indicator Solution | 709.1 |
| Extraction | 801.8 |
| Ferric Ammonium Sulfate Indicator Solution | 706.1 |
| Ferric Ammonium Sulfate (0.1N Standard Solution) | 608.1 |
| Friction Sensitivity (by the Roto-Friction Method) | 506.1 |
| Granulation | 201.1 |
| 100°C. Heat Test | 802.1 |
| Hexachlorobenzene (Para Bomb Method) | 404.1 |
| Hydrochloric Acid (0.1N Standard Solution) | 604.1 |

MIL-STD-1234

30 March 1967

ALPHABETICAL INDEX OF TEST METHOD—Continued

| Title | Method No. |
|--|------------|
| Hygroscopicity (Equilibrium Method) | 203.1 |
| Impact Sensitivity Test (U.S. Bureau of Mines Apparatus) | 605.1 |
| 75°C. International Test | 601.1 |
| Iron (Jones Reductor Method) | 414.1 |
| Leaching | 301.4 |
| Lead Sulfo cyanate (Silver Nitrate Method). | 405.1 |
| Magnesium (Eudiometer Method) | 412.1 |
| Magnesium (Pyrophosphate Method) | 412.2 |
| Methyl Orange Indicator Solution | 704.1 |
| Methyl Red Indicator Solution | 702.1 |
| Moisture (Desiccation Method) | 101.1.1 |
| Moisture (Karl Fischer Extraction Method) | 101.4.1 |
| Moisture (Karl Fischer Distillation Method). | 1 0 1 . 5 |
| Moisture, (Electrolytic Hygrometer Method) | 101.6 |
| Moisture (Karl Fischer Method) | 101.2.1 |
| Moisture (Modified Karl Fischer Method) | 101.3.1 |
| Multiple Solvent Extraction | 301.7 |
| Nickel (Dimethylglyoxine Method) | 411.1 |
| Nitro-Compounds (Titanous Chloride Method) | 420.1 |
| Organic Destruction and Sample Dissolution | 301.5 |
| Perchlorate (Ammonium Chloride Method) | 403.1 |
| Phenolphthalein Indicator Solution. | 703.1 |
| Potassium and Barium Salts (Flame Spectrophotometric Method) | 421.1 |
| Potassium Bichromate (0.1N Standard Solution) | 605.1 |
| Potassium Permanganate (0.1N Standard Solution) | 606.1 |
| Potassium Salts (Tetraphenyl Boron Method) | 416.1 |
| Potassium Thiocyanate (0.1N Standard Solution) | 608.1 |
| Reactivity Test | 504.1 |
| Selective Solvent Extraction (Extraction Method) | 204.2 |
| Selective Solvent Extraction (Insoluble Residue Method) | 204.4 |
| Selective Solvent Extraction (Leaching) | 204.1 |
| Selective Solvent Extraction (Soxhlet Method) | 204.3 |
| Silver Nitrate (0.1N Standard Solution) | 607.1 |
| Sodium Diphenylbenzidine Sulfonate Indicator Solution | 707.1 |
| Sodium Hydroxide (0.1N Standard Solution) | 602.1 |
| Sodium Oxalate (Potassium Permanganate Method) | 416.1 |
| Soxhlet Extraction | 301.6 |
| Starch Indicator Solution | 701.1 |
| Strontium Nitrate (Sulfate Method) | 418.1 |
| Sulfur (Carbon Disulfide Insoluble) | 409.1 |
| Sulfur (Carbon Disulfide Soluble) | 409.2 |
| Titanous Chloride (0.2N Standard Solution) | 601.1 |
| Titanium and Titanium Dioxide (Jones Reductor Method) | 413.1 |
| Total Lead (Chromate Method) | 408.1 |
| Total Lead (Sulfate Method) | 408.2 |
| 100°C. Vacuum Stability Test | 603.1 |
| Volatiles (Oven Method) | 102.1 |
| Volatiles (Vacuum Method) | 102.2.1 |
| Zinc Oxide | 419.1 |
| Zirconium or Zirconium Hydride (Cupferron Method) | 416.1 |

MIL-STD-1234
30 March 1967

NUMERICAL INDEX OF TEST METHODS

GROUP 100—GENERAL TEST METHODS

Method No.

- 101.1.1 Moisture (Desiccation Method)
- 101.2.1 Moisture (Karl Fischer Method)
- 101.1.1 Moisture (Modified Karl Fischer Method)
- 101.4.1 Moisture (Karl Fischer Extraction Method)
- 1 0 1 . 5 M o i s t u r e (K a r l F i s c h e r D i s t i l l a t i o n M e t h o d)
- 101.6 M o i s t u r e (E l e c t r o l y t i c H y g r o m e t e r M e t h o d)
- 102.1.1 V o l a t i l e s (O v e n M e t h o d)
- 102.2.1 V o l a t i l e s (V a c u u m O v e n M e t h o d)

GROUP 200—PHYSICAL TEST METHODS

- 201.1 G r a n u l a t i o n
- 202.1 A v e r a g e P a r t i c l e S i z e (F i s c h e r S u b s i e v e S i z e r)
- 203.1 H y g r o s c o p i c i t y (E q u i l i b r i u m M e t h o d)
- 204.1 s e l e c t i v e S o l v e n t E x t r a c t i o n (L e a c h i n g M e t h o d)
- 204.2 S e l e c t i v e S o l v e n t E x t r a c t i o n (E x t r a c t i o n M e t h o d)
- 204.3 S e l e c t i v e S o l v e n t E x t r a c t i o n (S o x h l e t M e t h o d)
- 204.4 S e l e c t i v e S o l v e n t E x t r a c t i o n (I n s o l u b l e R e s i d u e M e t h o d)

GROUP 300—SAMPLE PREPARATIONS

- 301.1 D i s s o l u t i o n
- 301.2 D i s s o l u t i o n — E x t r a c t i o n
- 301.3 E x t r a c t i o n
- 301.4 L e a c h i n g
- 301.5 O r g a n i c D e s t r u c t i o n a n d S a m p l e D i s s o l u t i o n
- 301.6 S o x h l e t E x t r a c t i o n
- 301.7 M u l t i p l e S o l v e n t E x t r a c t i o n

GROUP 400—CHEMICAL TEST METHODS

- 401.1 C h l o r i d e (S i l v e r N i t r a t e M e t h o d)
- 402.1 C h l o r a t e (F e r r o u s S u l f a t e M e t h o d)
- 403.1 P e r c h l o r a t e (A m m o n i u m C h l o r i d e M e t h o d)
- 404.1 H e x a c h l o r o b e n z e n e (P a r r B o m b M e t h o d)
- 405.1 L e a d S u l f o c y a n a t e (S i l v e r N i t r a t e M e t h o d)
- 406.1 B a r i u m S a l t s (S u l f a t e M e t h o d)
- 406.2 B a r i u m S a l t s (C h r o m a t e M e t h o d)
- 407.1 A l u m i n u m (A m m o n i u m H y d r o x i d e M e t h o d)
- 407.2 A l u m i n u m (8 - H y d r o x y - q u i n o l i n e M e t h o d)
- 408.1 T o t a l L e a d (C h r o m a t e M e t h o d)
- 408.2 T o t a l L e a d (S u l f a t e M e t h o d)
- 409.1 S u l f u r (C a r b o n D i s u l f a t e I n s o l u b l e)
- 409.2 S u l f u r (C a r b o n D i s u l f i d e S o l u b l e)
- 410.1 A n t i m o n y S u l f i d e (P e r m a n g a n a t e M e t h o d)
- 411.1 N i c k e l (D i m e t h y l g l y o x i m e M e t h o d)
- 412.1 M a g n e s i u m (A u d i o m e t e r M e t h o d)
- 412.2 M a g n e s i u m (P y r o p h o s p h a t e M e t h o d)
- 413.1 T i t a n i u m a n d T i t a n i u m D i o x i d e (J o n e s R e d u c t o r M e t h o d)
- 414.1 I r o n (J o n e s R e d u c t o r M e t h o d)
- 415.1 P o t a s s i u m S a l t s (T e t r a p h e n y l B o r o n M e t h o d)
- 416.1 Z i r c o n i u m o r Z i r c o n i u m H y d r i d e (C u p f e r r o n M e t h o d)
- 417.1 S o d i u m O x a l a t e (P o t a s s i u m P e r m a n g a n a t e M e t h o d)
- 418.1 S t r o n t i u m N i t r a t e (S u l f a t e M e t h o d)
- 419.1 Z i n c O x i d e (F o r m i c A c i d M e t h o d)
- 420.1 N i t r o - C o m p o u n d s (T i t a n o u s C h l o r i d e M e t h o d)
- 421.1 P o t a s s i u m a n d B a r i u m S a l t s (F l a m e S p e c t r o p h o t o m e t r i c M e t h o d)

MIL-STD-1234
30 March 1967

NUMERICAL INDEX OF TEST METHODS-Continued

GROUP 600 — SENSITIVITY, BRISANCE AND STABILITY TEST METHODS

| <i>Method No.</i> | |
|-------------------|--|
| 501.1 | 75°C. International Test |
| 502.1 | 100°C. Heat Test |
| 503.1 | 100°C. Vacuum Stability Test |
| 504.1 | Reactivity Test |
| 505.1 | Impact Sensitivity Test (U.S. Bureau of Mines Apparatus) |
| 506.1 | Friction Sensitivity (By the Roto-Friction Method). |

GROUP 600 — STANDARD SOLUTIONS

| | |
|-------|---|
| 601.1 | Titanous Chloride (0.2N Standard Solution) |
| 602.1 | Sodium Hydroxide (0.1N Standard Solution) |
| 603.1 | Ferric Ammonium Sulfate (0.15N Standard Solution) |
| 604.1 | Hydrochloric Acid (0.1N Standard Solution) |
| 605.1 | Potassium Bichromate (0.1N Standard Solution) |
| 606.1 | Potassium Permanganate (0.1N Standard Solution) |
| 607.1 | Silver Nitrate (0.1N Standard Solution) |
| 608.1 | Potassium Thiocyanate (0.1N Standard Solution) |

GROUP 700 — INDICATOR SOLUTIONS

| | |
|-------|--|
| 701.1 | Starch Indicator Solution |
| 702.1 | Methyl Red Indicator Solution |
| 703.1 | Phenolphthalein Indicator Solution |
| 704.1 | Methyl Orange Indicator Solution |
| 705.1 | Ferric Ammonium Sulfate Indicator Solution |
| 706.1 | Ammonium Thiocyanate Indicator Solution (20-Percent) |
| 707.1 | Sodium Diphenylbenzidine Sulfonate Indicator Solution |
| 708.1 | Barium Diphenylamine Sulfonate Indicator Solution |
| 709.1 | Eriochrome Black T Indicator Solution |
| 710.1 | Bromophenol Blue Indicator Solution |

MIL-STD-1234
30 March 1967

METHOD 101.6

MOISTURE (ELECTROLYTIC HYGROMETER METHOD)

This method has been coordinated and approved for use by the Departments of the Army and Air Force.

1. SCOPE

1.1 This method is used for determining the moisture content of small grain or flaked propellants. The principle of the method is measurement of the current required for electrolysis of water that has been volatilized from the specimen. Other volatile compounds such as alcohols, amines and ammonia may interfere.

2. SPECIMEN

2.1 The specimen shall consist of 0.2-0.6 gm of propellant weighed to the nearest 0.2 mg.

3. APPARATUS

3.1 Solids Moisture Analyzer (Consolidated Electrodynamics Corporation, 360 Sierra Madre Villa, Pasadena, Cal. , or equivalent) See figure 1.

3.2 Nitrogen, extra-dry grade, in a cylinder with a pressure regulator to supply gas at 5 psig.

4. PROCEDURE

4.1 Prepare the instrument for operation according to the manufacturer's directions. For calibration of the instrument, use accurately weighed samples of either 0.05 to 0.1 gm of sodium tartrate dihydrate or 0.3 to 0.5 gm of potassium tartrate hemihydrate. On drying for 45 minutes at 150°C, the sodium salt should give a moisture content of 15.66 ± 0.05 percent while the potassium salt should give a moisture content of 3.83 ± 0.02 percent.

4.2 Place the weighed specimen in the sample boat, insert into the oven with the aid of tweezers provided with the instrument and close the oven,

CAUTION: These steps must be done as rapidly as possible in order to minimize changes in moisture content.

4.3 Turn the temperature timer controls to the settings required in the applicable specification. When the test is completed, read the weight of moisture shown on the dial and convert to grams.

MIL-STD-1234
30 March 1967

4.4 Calculate the moisture content of the propellant as follows:

$$\text{Percent of water} = \frac{100A}{W}$$

A = Weight of water shown on dial, gm

W = Weight of specimen, gm

Method 101.6

MIL-STD-1234
30 March 1967

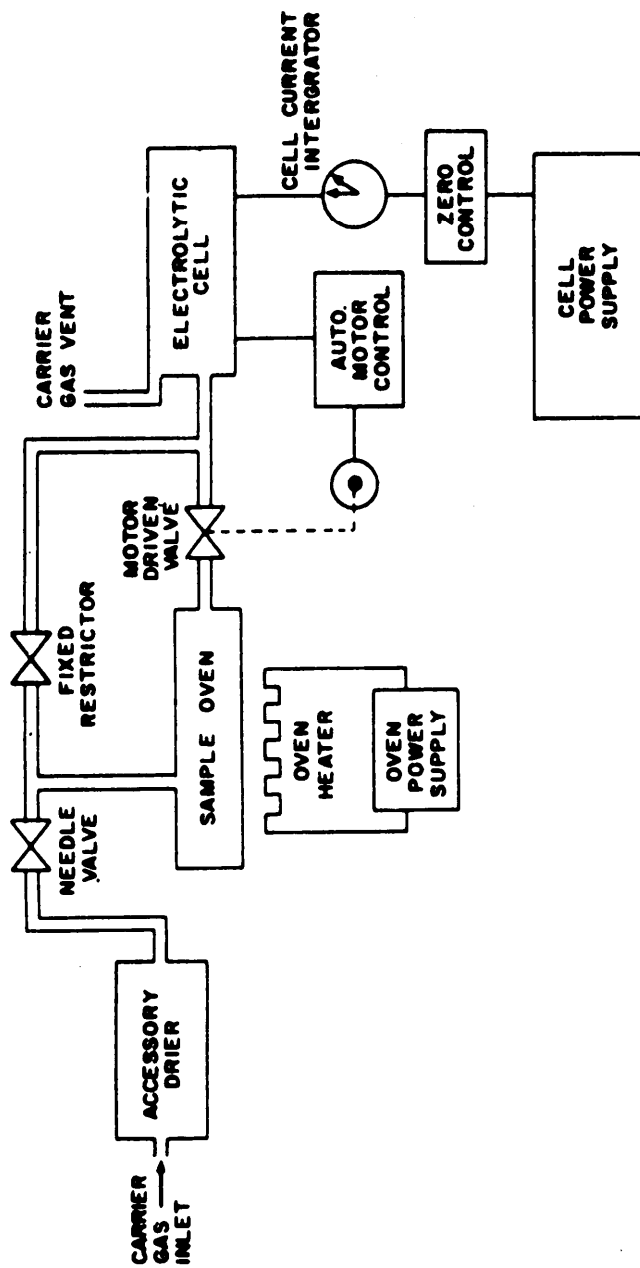


FIGURE 1. BLOCK DIAGRAM OF ELECTROLYTIC HYGROMETER

Method 101. 6

MIL-STD-1234
30 March 1967

METHOD 506.1

Friction Sensitivity by the Rob-Friction Method

1. SCOPE

1.1 This method is used for determining the sensitivity to friction of pyrotechnics, explosives, propellants and other high energy compositions. The frictional energy of ignition is obtained by spinning a rod on a sample held in an alundum sample holder.

2. SPECIMEN

2.1 The specimen shall consist of approximately 20 ± 1 milligram (mg) of powder.

3. APPARATUS

3.1 The apparatus shall consist of an alundum sample holder (Drawing (Dwg) No. RDT 2883) mounted in an aluminum cam torque converter (Dwg No. RDT 2822-2837) which turns on bearings. A friction rod (Dwg No. RDT 2884) spins on top of the sample held in the alundum sample holder. A selected force is applied to the rod by means of a weight as indicated in Figure 1. A variable speed electric motor, or a motor fitted with a variable belt drive, turns the rod at the desired revolutions per minute (r.p.m.). The r.p.m.'s are checked with a strob-o-scope. Any suitable bench drill press may be used as the driving force for the rod. A calibrated weight is attached to the cam by a line, run over a grooved drum. Table I converts the cam's degrees of revolution to inches so that the torque is read in ounce-inches.

The test apparatus is operated behind a $\frac{1}{2}$ inch safety glass, at room temperature.

4. PROCEDURE

4.1 Place a sample weighed to 20 ± 1 mg in the alundum sample holder.

4.2 Place weights on the friction rod to produce the desired force.

4.3 Select the desired r.p.m. and the torque load.

MIL-STD-1234
30 March 1967

4.4 Lower safety shield.

4.5 Start the motor.

4.6 The spinning rod shall be lowered to rest on the sample and the timer shall be started at the same time.

4.7 The timer shall be stopped the moment the sample fires, and the spinning friction rod disengaged, before the friction rod motor is shut off. The firing may be noted as a flash of fire, a cloud of smoke or as an audible report.

4.8 If the time of fire is too short to be read, the weights on the friction rods or the r.p.m., shall be reduced. (A desirable time range is 2 to 10 seconds.)

4.9 The torque reading in degrees should be between 5° and 355°. The torque reading in this range may be obtained by adjusting the r.p.m. , the weights applied to the friction rod, the torque weight or a combination of these factors.

4.10 The energy shall be calculated in foot-pounds (ft - lbs) by use of the following formula:

$$E = \frac{\pi W t (.0052T)}{30} = WtT (.000544)$$

Where:

E= energy in ft-lbs.

W= the angular velocity in revolutions per minute (r. p. m.) of the rotating friction rod.

t = time to fire in seconds

T= torque on the rod in ins. - oz.

NOTE: Since energy is to be calculated in ft-lbs and the torque value (T) is obtained in oz-ins, the product of these two values is converted to ft-lbs by multiplying by .0052. Calculation of the formula is simplified by calculating the three constants, $\frac{\pi .0052}{30} = .000544$ and multiplying the product of the three variables by this value.

MIL-STD-1234
30 March 1967

4.11 The factors defining the conditions of the test may be entered in a table as follows:

| TORQUE | | RPM | Time to Fire Sec | lbs Load on friction Rod | Ignition energy ft-lbs | Notation of observation |
|----------|--------------------|-----|------------------|--------------------------|------------------------|-------------------------|
| Load oz. | Degrees Deflection | | | | | |

4.12 Degrees deflection shall be converted to torque in inches by multiplying the number of degrees deflection by .00381 and adding 1.25 or by use of Table 1.

4.13 A standard powder should be checked periodically to verify reproducibility of the apparatus.

TABLE 1

MIL-STD-1234
30 March 1967

| <u>Rotation in Degrees</u> | <u>Torque Arm Length in Inches</u> |
|----------------------------|------------------------------------|
| 0° | 1.25000 |
| 5° | 1.26905 |
| 10° | 1.28810 |
| 15° | 1.30715 |
| 20° | 1.32620 |
| 25° | 1.34525 |
| 30° | 1.36430 |
| 35° | 1.38335 |
| 40° | 1.40240 |
| 45° | 1.42145 |
| 50° | 1.44050 |
| 55° | 1.45955 |
| 60° | 1.47860 |
| 65° | 1.49765 |
| 70° | 1.51670 |
| 75° | 1.53575 |
| 80° | 1.55480 |
| 85° | 1.57385 |
| 90° | 1.59290 |
| 95° | 1.61195 |
| 100° | 1.63100 |
| 105° | 1.65005 |
| 110° | 1.66910 |
| 115° | 1.68815 |
| 120° | 1.70720 |
| 125° | 1.72625 |
| 130° | 1.74530 |
| 135° | 1.76435 |
| 140° | 1.78340 |
| 145° | 1.80245 |
| 150° | 1.82150 |
| 155° | 1.84055 |
| 160° | 1.85960 |
| 165° | 1.87865 |
| 170° | 1.89770 |
| 175° | 1.91675 |
| 180° | 1.93580 |
| 185° | 1.95485 |
| 190° | 1.97390 |
| 195° | 1.99295 |
| 200° | 2.01200 |
| 205° | 2.03105 |
| 210° | 2.05010 |
| 215° | 2.06915 |
| 220° | 2.08820 |
| 225° | 2.10725 |

MIL-STD-1234
30 March 1967

TABLE 1 (Cont'd)

| <u>Rotation in Degrees</u> | <u>Torque Arm Length in Inches</u> |
|----------------------------|------------------------------------|
| 230° | 2.12630 |
| 235° | 2.14535 |
| 240° | 2.16440 |
| 245° | 2.18345 |
| 250° | 2.20250 |
| 255° | 2.22155 |
| 260° | 2.24060 |
| 265° | 2.25965 |
| 270° | 2.27870 |
| 275° | 2.29775 |
| 280° | 2.31680 |
| 285° | 2.33585 |
| 290° | 2.35490 |
| 295° | 2.37395 |
| 300° | 2.39300 |
| 305° | 2.41205 |
| 310° | 2.43110 |
| 315° | 2.45015 |
| 320° | 2.46920 |
| 325° | 2.48825 |
| 330° | 2.50730 |
| 335° | 2.52635 |
| 340° | 2.54540 |
| 345° | 2.56445 |
| 350° | 2.58350 |
| 355° | 2.60255 |
| 360° | 2.62160 |

Each degree rotation represents .00381" increase in the torque arm. The torque arm length in distance is equal to the degrees of rotation X .00981 inch plus 1.25 inches.

MIL-STD-1234
30 March 1967

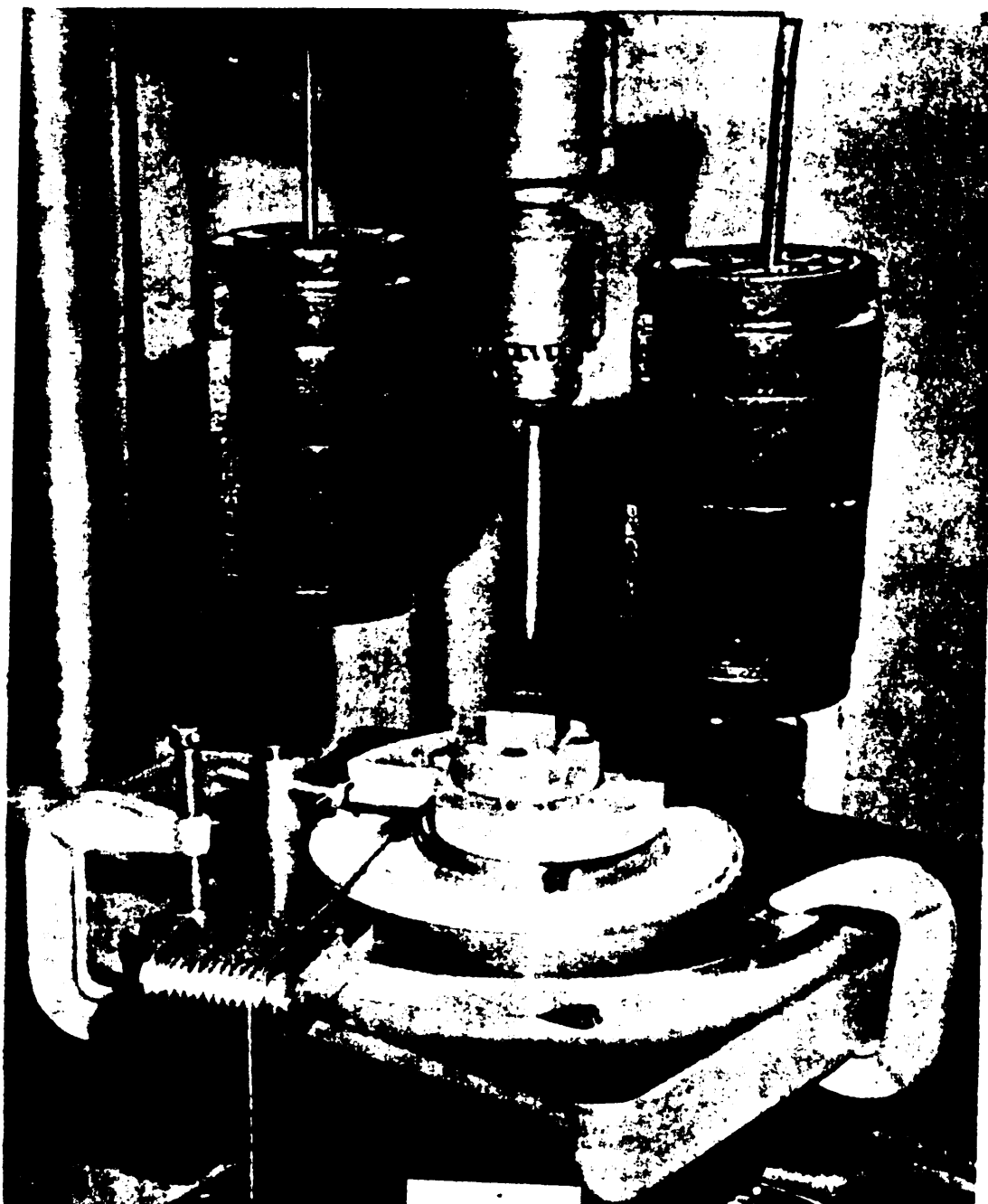
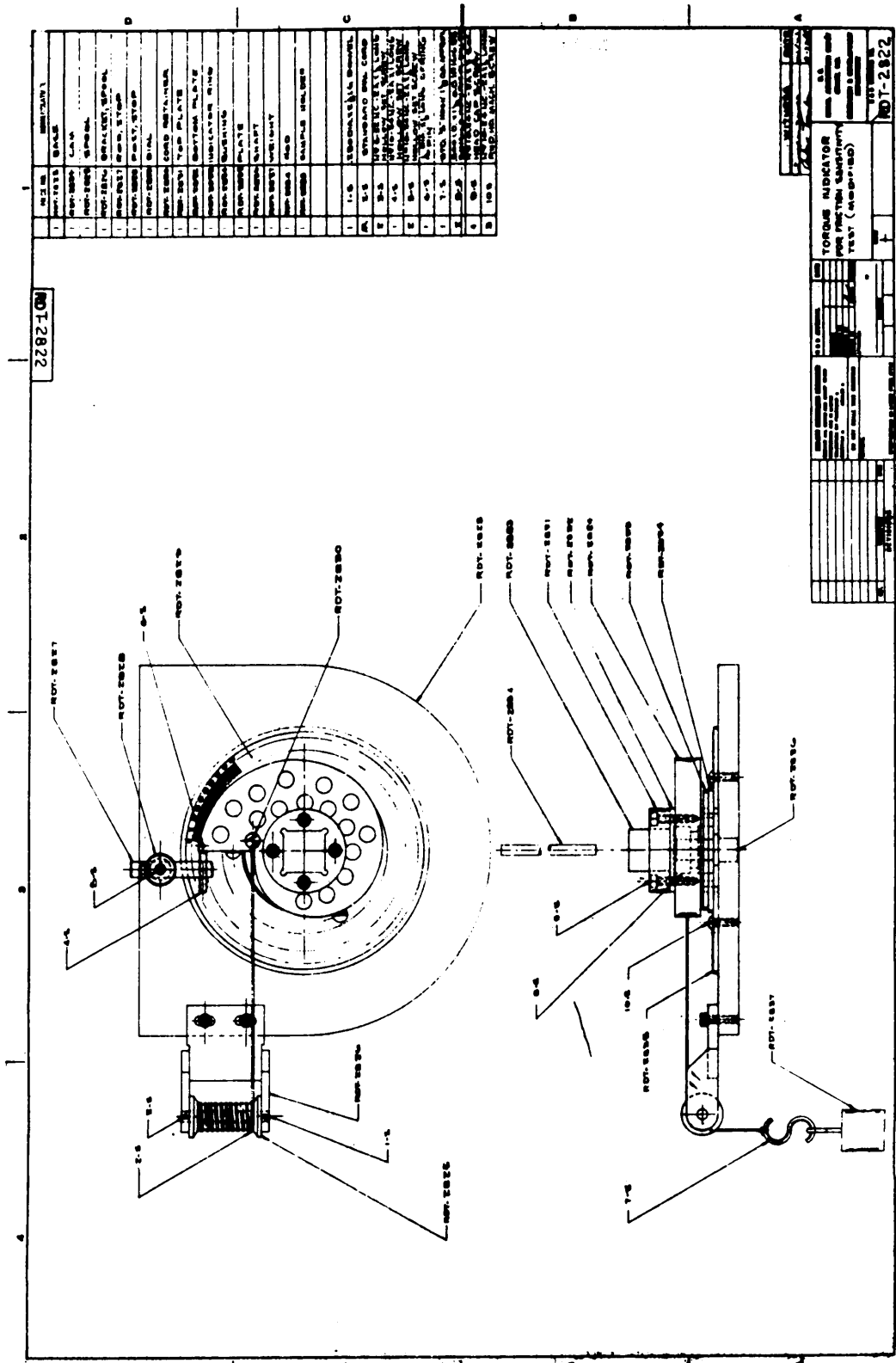


FIGURE 1

Method 506.1

MIL-STD-1234
30 March 1967



NOT 2822

| | |
|---|-------|
| TORQUE INDICATOR FOR TORQUE MEASUREMENT TEST (UNCALIBRATED) | |
| 1 | 1-1 |
| 1 | 1-2 |
| 1 | 1-3 |
| 1 | 1-4 |
| 1 | 1-5 |
| 1 | 1-6 |
| 1 | 1-7 |
| 1 | 1-8 |
| 1 | 1-9 |
| 1 | 1-10 |
| 1 | 1-11 |
| 1 | 1-12 |
| 1 | 1-13 |
| 1 | 1-14 |
| 1 | 1-15 |
| 1 | 1-16 |
| 1 | 1-17 |
| 1 | 1-18 |
| 1 | 1-19 |
| 1 | 1-20 |
| 1 | 1-21 |
| 1 | 1-22 |
| 1 | 1-23 |
| 1 | 1-24 |
| 1 | 1-25 |
| 1 | 1-26 |
| 1 | 1-27 |
| 1 | 1-28 |
| 1 | 1-29 |
| 1 | 1-30 |
| 1 | 1-31 |
| 1 | 1-32 |
| 1 | 1-33 |
| 1 | 1-34 |
| 1 | 1-35 |
| 1 | 1-36 |
| 1 | 1-37 |
| 1 | 1-38 |
| 1 | 1-39 |
| 1 | 1-40 |
| 1 | 1-41 |
| 1 | 1-42 |
| 1 | 1-43 |
| 1 | 1-44 |
| 1 | 1-45 |
| 1 | 1-46 |
| 1 | 1-47 |
| 1 | 1-48 |
| 1 | 1-49 |
| 1 | 1-50 |
| 1 | 1-51 |
| 1 | 1-52 |
| 1 | 1-53 |
| 1 | 1-54 |
| 1 | 1-55 |
| 1 | 1-56 |
| 1 | 1-57 |
| 1 | 1-58 |
| 1 | 1-59 |
| 1 | 1-60 |
| 1 | 1-61 |
| 1 | 1-62 |
| 1 | 1-63 |
| 1 | 1-64 |
| 1 | 1-65 |
| 1 | 1-66 |
| 1 | 1-67 |
| 1 | 1-68 |
| 1 | 1-69 |
| 1 | 1-70 |
| 1 | 1-71 |
| 1 | 1-72 |
| 1 | 1-73 |
| 1 | 1-74 |
| 1 | 1-75 |
| 1 | 1-76 |
| 1 | 1-77 |
| 1 | 1-78 |
| 1 | 1-79 |
| 1 | 1-80 |
| 1 | 1-81 |
| 1 | 1-82 |
| 1 | 1-83 |
| 1 | 1-84 |
| 1 | 1-85 |
| 1 | 1-86 |
| 1 | 1-87 |
| 1 | 1-88 |
| 1 | 1-89 |
| 1 | 1-90 |
| 1 | 1-91 |
| 1 | 1-92 |
| 1 | 1-93 |
| 1 | 1-94 |
| 1 | 1-95 |
| 1 | 1-96 |
| 1 | 1-97 |
| 1 | 1-98 |
| 1 | 1-99 |
| 1 | 1-100 |

