

AD-A062 244

ROCK ISLAND ARSENAL IL ENGINEERING DIRECTORATE
NDT MEASUREMENTS OF CHROMIUM PLATE THICKNESS ON SMALL CALIBER G--ETC(U)
MAY 78 J M BISH

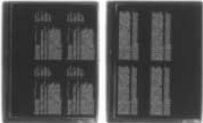
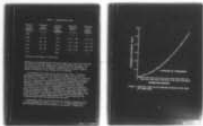
F/G 11/6

UNCLASSIFIED

CARRI-TR-FN-7A-05

NI

1 of 1
AD
A062244



END
DATE
FILMED
3--79
DDC

ADA062244

DDC FILE COPY



12 SC

AD

TR-EN-78-05

LEVEL II

6

NDT MEASUREMENTS OF CHROMIUM PLATE THICKNESS ON SMALL CALIBER GUN BARREL BORES.

9 Technical rept., by

10 JOSEPH M. BISH

11 MAY 1978

12 28 p.

DDC RECEIVED
DEC 18 1978
A

ENGINEERING DIRECTORATE

DISTRIBUTION STATEMENT

Approved for public release; distribution unlimited.

14 SARRI-TR-EN-78-05

78 12 11 136

ROCK ISLAND ARSENAL
ROCK ISLAND, ILLINOIS 61299

410 569

JOB

DISTRIBUTION INSTRUCTIONS:

Destroy this report when it is no longer needed. Do not return it to the originator.

DISCLAIMER:

The findings of this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|--|---|---|
| 1. REPORT NUMBER TR-EN-78-05 ✓ | 2. GOVT ACCESSION NO. | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle) NDT MEASUREMENTS OF CHROMIUM PLATE THICKNESS ON SMALL CALIBER GUN BARREL BORES | 5. TYPE OF REPORT & PERIOD COVERED Technical Report | |
| | 6. PERFORMING ORG. REPORT NUMBER | |
| 7. AUTHOR(s) Joseph M. Bish | 8. CONTRACT OR GRANT NUMBER(s) | |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS CDR Rock Island Arsenal Rock Island, IL 61299 | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS PRON A1-5-P6350-02-AW-M5 AMS Code 5397-OM-6350 | |
| 11. CONTROLLING OFFICE NAME AND ADDRESS CDR, Rock Island Arsenal ATTN: SARRI-ENM Rock Island, IL 61299 | 12. REPORT DATE May 1978 | |
| | 13. NUMBER OF PAGES 18 | |
| 14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) | 15. SECURITY CLASS. (of this report) UNCLASSIFIED | |
| | 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE | |
| 16. DISTRIBUTION STATEMENT (of this Report) Approved for public release, distribution unlimited. | | |
| 17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report) | | |
| 18. SUPPLEMENTARY NOTES | | |
| 19. KEY WORDS (Continue on reverse side if necessary and identify by block number) 1. Small Caliber Gun Tubes 2. Chromium Plate Thickness 3. Non-Destructive Testing (NDT) 4. Eddy Current Testing | | |
| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Chromium-plate thicknesses of gun barrel bores are necessarily assumed since the air gauges used simply provide differences in bore-size readings before and after plating. The only means available to accurately determine plating thickness, including concentricity, is to use destructive methods to examine micro-specimens representing cross sections of the gun barrel. The objective of this project was to make use of improved nondestructive testing methods to measure chromium plate thicknesses in small caliber gun barrels. | | |

(Cont.)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

20. ABSTRACT (cont)

Evaluation of improved NDT inspection methods resulted in the selection of two instruments using eddy current testing technology. The instruments, selected for comparative evaluation, were the Nortec NDT-10 and the Dermatron Thickness Tester. The Nortec NDT-10 Eddy Current Tester, used to measure 5.56mm gun tubes, could not be calibrated due to repeated malfunctions of the instrument; consequently, no meaningful data could be recorded. The Dermatron Thickness Tester, used to measure 7.62mm gun tubes, was calibrated and chromium thickness measurements were taken of an M-60 gun barrel. These measurements showed good correlation with actual thickness measurements of metallographic specimens taken of the gun barrel.

The accuracy and usefulness of the Dermatron would be improved by more frequent calibration and reduction of calibration time by using automated recording/printout methods. Recommendations to expand the use of eddy current testing methods for the determination of chromium plate thicknesses in small caliber gun barrels have been made.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

CONTENTS

| | <u>Page</u> |
|------------------------------|-------------|
| DD FORM 1473 | i |
| TABLE OF CONTENTS | iii |
| ILLUSTRATIONS | iv |
| | |
| INTRODUCTION | 1 |
| EQUIPMENT | 1 |
| PROCEDURE | 3 |
| RESULTS AND DISCUSSION | 6 |
| CONCLUSIONS | 11 |
| RECOMMENDATIONS | 11 |
| DISTRIBUTION | 13 |

| | |
|-----------------------------------|---|
| FORM 1473-64 | |
| ATTN | Diff. Section <input checked="" type="checkbox"/> |
| PLC | Diff. Section <input type="checkbox"/> |
| SEARCHED | <input type="checkbox"/> |
| INDEXED | <input type="checkbox"/> |
| BY | |
| DISTRIBUTION / AVAILABILITY CODES | |
| DISL | AVAIL. AND/OR SPECIAL |
| A | |

ILLUSTRATIONS

| <u>Figure</u> | | <u>Page</u> |
|---------------|---|-------------|
| 1 | a. Nortec NDT-10 Eddy Current Tester Inserted in 5.56mm Gun Barrel | 2 |
| | b. Probe for the Nortec NDT-10 Eddy Current Tester | 2 |
| 2 | Dermatron Thickness Tester with Probe for 7.62mm Gun Barrel | 4 |
| 3 | Close-Up of Probe for Dermatron Thickness Tester | 4 |
| 4 | Dermatron Thickness Tester with Probe Inserted in a 7.62mm Gun Barrel | 5 |
| 5 | Analytical Curve for the Dermatron Thickness Tester Using the 7.62mm Probe | 8 |
| 6 | Measurement of Chromium Plate Thickness in 7.62mm, M60 Gun Barrel by Two Operators | 10 |

INTRODUCTION

The bores of small arms gun barrels are chromium plated when it is necessary to withstand the erosive effects of severe firing schedules. Since the accuracy of a gun barrel is somewhat degraded by the electro-polishing and electroplating operations, it is imperative that the plating be deposited as uniformly as possible.

When chromium-plate thicknesses are measured during electroplating operations, the uniformity of the chromium layer (including the concentricity of the deposit) is necessarily assumed. This is attributed to the air gauges used which are not able to measure specific chromium thicknesses but simply provide differences in bore-size readings before and after plating. Thus, for lack of a more accurate thickness measuring technique, this procedure is used for in-process control when gun barrels are chromium plated. The only means available to accurately determine plating thickness, including concentricity, is to use destructive methods to examine microspecimens representing cross sections of the gun barrel.

The objective of this project was to make use of improved nondestructive testing (NDT) methods to measure chromium plate thicknesses in small caliber, e.g. 5.56mm and 7.62mm, steel gun barrels. The NDT method to be used must enable a quality assurance inspector to measure the chromium plate thickness at any point in a gun barrel approximately 24 - 30 ins. long. Instrumentation should be sufficiently rugged for rapid inspection of gun barrels in a production environment and accurate enough to determine chromium thickness with one to a maximum of three measurements at any point. Evaluation of improved NDT inspection methods resulted in the selection of instrumentation using eddy current testing technology.

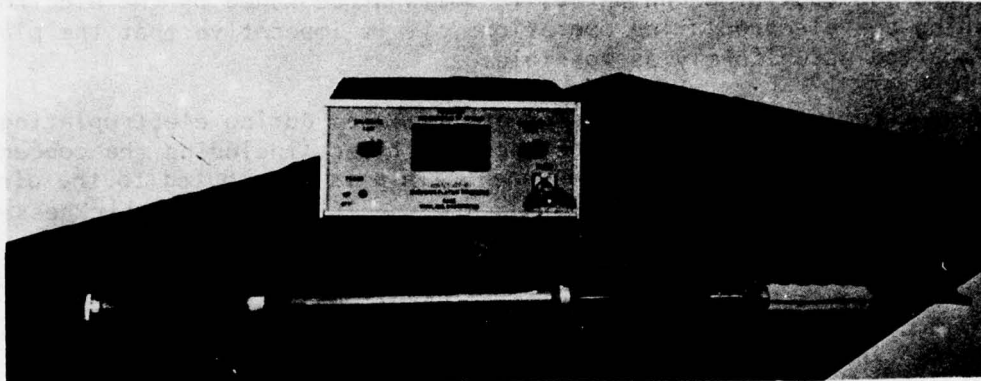
Two instruments were selected for comparative evaluations. One was developed by the Nortec Corporation to measure 5.56mm gun tubes and the other was manufactured by Unit Process Assemblies, Inc. to measure 7.62mm gun tubes.

Equipment

A. Nortec Eddy Current Tester, NDT-10*

The NDT-10 (Fig. 1a) is a direct reading, phase sensitive instrument using 2 easily-adjusted front panel controls to calibrate digital readout in mils of plating thickness. The instrument, 117 v AC, has solid state circuitry, weighs 15-lbs and its dimensions are 6'h x 16'w x 12'd. It was designed to measure chromium thicknesses from 0.0 to 5.0 mils. The probe used with the NDT-10 is a 500 KC eddy-current probe mounted on a 27-in. wand, and its sensing coil enables the operator to measure plating thickness of one specific land as the probe is passed over the land. The probe body (Fig. 1b) is made of an epoxy with the sensing coil

*Developed under Contract No. DAAF03-72-C-0085 by the Nortec Corporation, Richland, WA 99352



a.



b.

Figure 1. a. Nortec NDT-10 Eddy Current Tester with Probe Inserted in 5.56mm Gun Barrel.

b. Probe for the Nortec NDT-10 Eddy Current Tester

embedded in the epoxy. A felt pad inserted under the probe body (opposite the sensing coil) is used to facilitate a smooth even travel throughout the length of the gun barrel. A 2-in. flex section is inserted between the probe body and the wand to minimize pressure changes on the coil and stress on the probe body should misalignment of the wand occur.

B. Dermitron Thickness Tester*

This apparatus consists of a standard Dermitron Basic Unit, Model D-2, eddy-current thickness gauge equipped with a probe-system designed to measure 7.62mm gun tubes having chromium thicknesses from 0.0 to 5.44 mils. The basic unit is 11" h x 17" w x 9" d. The instrument, 115 v AC, is equipped with a carrying handle and weighs 26 lbs. The probe is connected to the "C" receptacle on the front panel of the basic unit (Fig. 2).

The measuring probe consists of a stainless steel tube linked to a measuring-head by means of a short teflon section (Fig. 3). The measuring-head contains the sensing-element which is held with a spring loaded element-holder. The face of the element-holder which rides along the land is a hard flame-sprayed surface. The guide and other bearing surfaces are similarly hardened. The sensing-element is fixed in its holder to prevent contact with the land, thereby preventing any wear on the sensing-element.

Although the element-holder is spring-loaded, it is recessed to eliminate interference during entry of the probe-head into the gun barrel. After entry, the probe-head can be moved continuously throughout the barrel so that the sensing-element can measure the chromium thickness at any point on the surface of any particular land.

Wire leads from the probe coil pass through the teflon section to a shielded twin-lead cable which runs through the tube. This cable is fastened within the handle of the probe and extends to the connector.

The purpose of the teflon section is to allow a floating action for the measuring-head, so that the head will remain properly oriented within the bore without being adversely affected by excessive lateral pressures exerted by the operator.

The wand is graduated at 1-in. intervals, enabling the operator to easily determine the position of the sensing-element along the land-surface. Figure 4 shows the probe being passed through a gun barrel.

Procedure

A. Nortec NDT-10 Measurements of 5.56mm Gun Barrels

* Manufactured by Unit Process Assemblies, Inc., P.O. Box 1011, 53-15 37th Avenue, Woodside, NY 11377

78 12 11 136

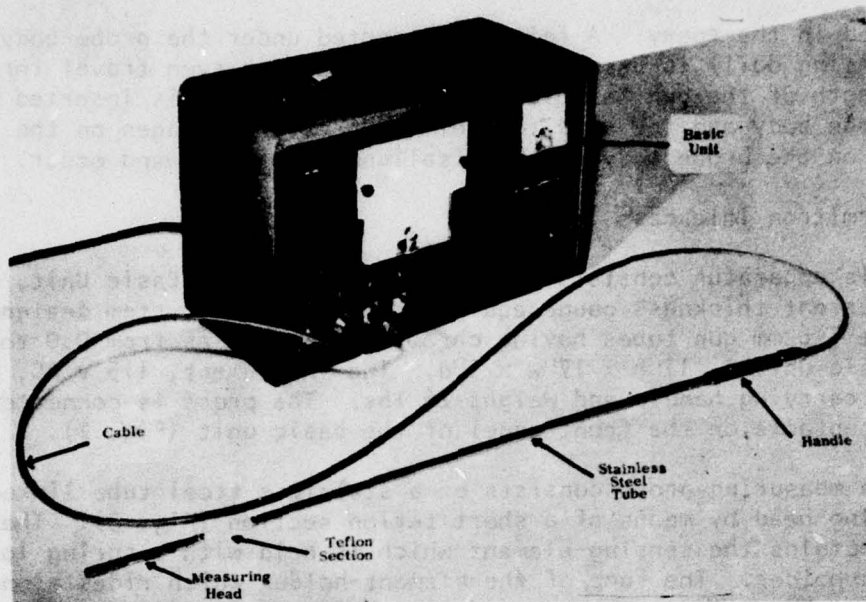


Figure 2. Dermatron Thickness Tester with Probe for 7.62mm Gun Barrel.

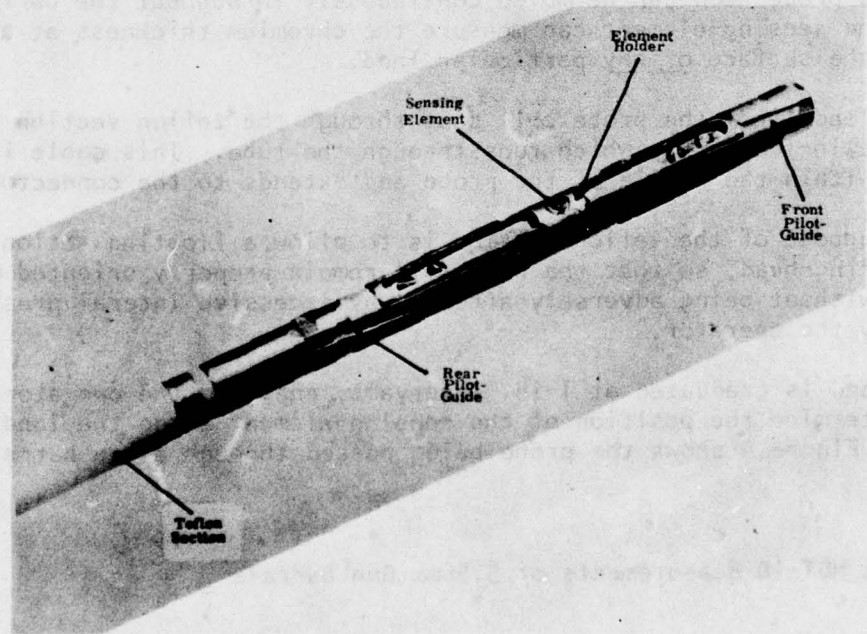


Figure 3. Close-Up of Probe for Dermatron Thickness Tester

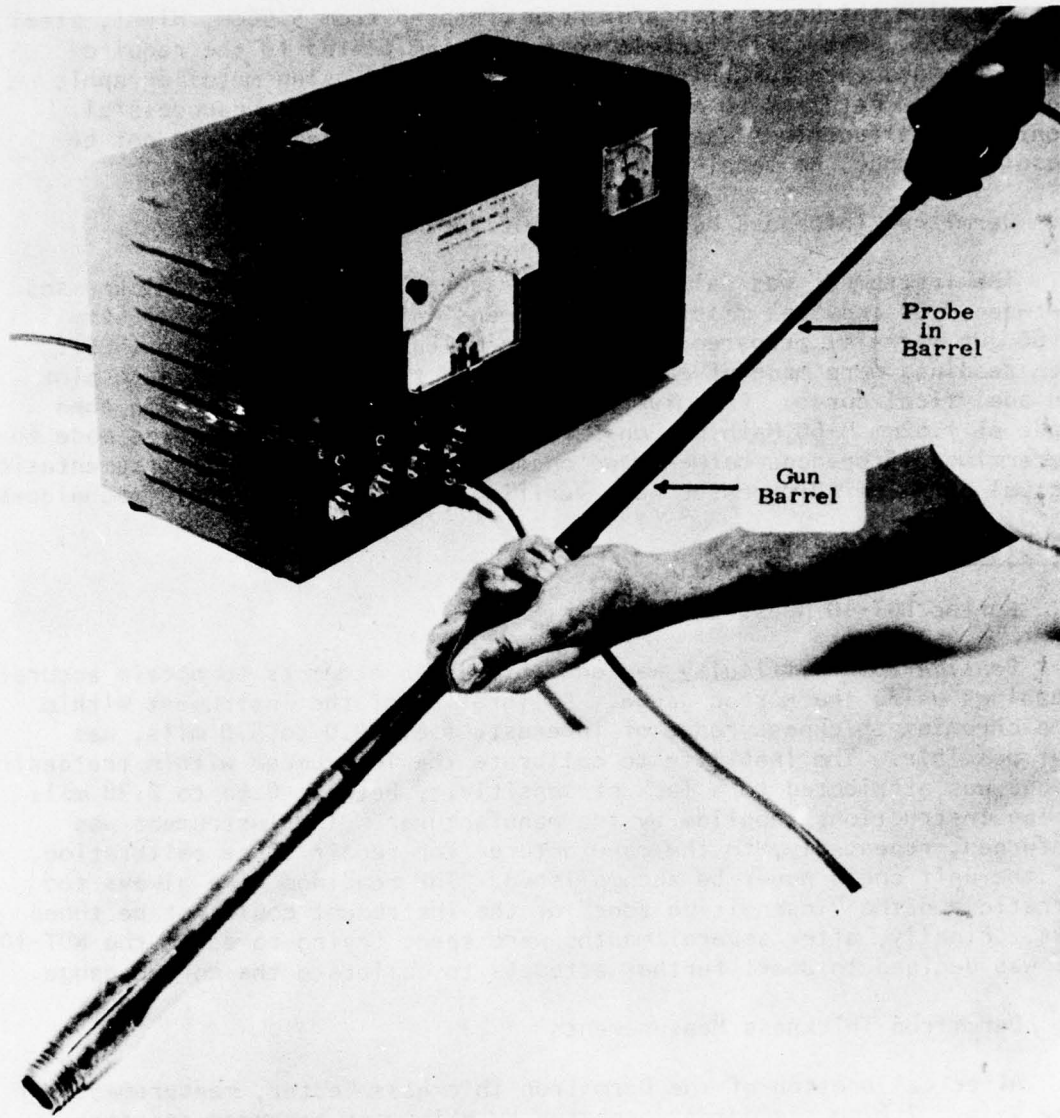


Figure 4. Dermitron Thickness Tester with Probe Inserted in a 7.62mm Gun Barrel.

Chromium thickness standards were prepared from 5.56mm, M16A1, steel gun barrels. The rifle barrels were chromium plated to the required thickness and chromium thicknesses were measured using metallographic techniques. Attempts to calibrate the instrument were unsuccessful. Continued malfunctions associated with the NDT-10 gauge could not be resolved, hence, no meaningful data could be recorded.

B. Dermitron Thickness Measurements of 7.62mm Gun Barrels

The instrument was calibrated to measure chromium plate thicknesses between 0.00 and 5.44 mils using specimens (4-in. sections of 7.62mm M-60 gun barrels) prepared by the National Bureau of Standards (NBS). Ten readings were made of each specimen and the data were used to plot an analytical curve. Chromium plate thickness measurements were then made of 7.62mm M-60 Machine Gun barrels. Measurements were also made to determine differences between two operators using the same instrumentation. Actual chromium thicknesses were verified using metallographic techniques.

Results and Discussion

A. Nortec NDT-10 Measurements

Considerable difficulty was encountered in attempts to obtain accurate readings using the Nortec gauge. Calibration of the instrument within the chromium thickness range of interest, i.e., 0.0 to 5.0 mils, was not possible. The inability to calibrate the instrument within the desired range was attributed to a lack of sensitivity between 0.98 to 2.38 mils using instructions supplied by the manufacturer. The instrument was returned, repeatedly, to the manufacturer for repair since calibration of the unit could never be accomplished. The readings were always too erratic and the "insensitive zone" of the instrument could not be tuned out. Finally, after several months were spent trying to debug the NDT-10, it was decided to abort further attempts to calibrate the Nortec gauge.

B. Dermitron Thickness Measurements

After calibration of the Dermitron Thickness Tester, measurements of the 4-in., 7.62mm standards, prepared by NBS, were recorded and are presented in Table 1. It is observed that the accuracy of the measurements ranged from -0.22 to +0.35 mils. These inaccuracies were scattered, i.e., the measurement errors were as large, in mils, for smaller plating thicknesses as they were for larger thicknesses. This is unusual since the sensitivity or accuracy of such an instrument is generally constant or varies in a consistent manner. When an instrument performs in the manner displayed by the Dermitron, either the circuitry is inadequate or manipulation of the probe by the operator causes the erroneous or highly-scattered recordings. Great care was taken to prevent the latter occurrence. The probe was designed to minimize extraneous sensitivity and the

TABLE 1. DERMITRON TEST DATA

| <u>Chromium Plate Standards (mils)</u> | <u>Dermatron Meter Readings</u> | <u>Average Dermatron Meter Readings*</u> | <u>Dermatron Readings (mils)</u> | <u>Deviation from Standard (mils)</u> |
|--|---|--|--|---|
| 0.00 | 0 | 0 | ----- | ----- |
| 0.80 | 26 - 34 | 29.2 | 0.70 - 1.02 | -.10, +.22 |
| 1.25 | 36 - 42 | 39.1 | 1.10 - 1.40 | -.15, +.15 |
| 2.30 | 54 - 63 | 58.0 | 2.08 - 2.65 | -.22, +.35 |
| 4.30 | 82 - 87 | 84.9 | 4.10 - 4.45 | -.20, +.15 |
| 5.44 | 0 | 100.0 | ----- | ----- |

*Average values based on 10 recordings

operator of the equipment exercised great caution to insure that the probe was handled in the same manner each time a measurement was taken. However, the circuitry was checked and it appears that the instrument is somewhat hypersensitive to operator handling when the probe is used to measure thicknesses of short-length (4-in.) standards.

An analytical curve (Fig. 5) was derived from Table 1. Chromium thickness measurements were then taken of a 7.62mm, M-60 gun barrel. Measurements were started 1-in. from the muzzle end and at 2-in. intervals for the first 11 inches. It was planned to limit the number of measurements to 2 readings at each location since this procedure would be more amenable to production. However, the recordings were too scattered. Two recordings of one chromium plate thickness point would indicate variances of 0.2 to 0.5 mils. Consequently, the number of readings at each location was increased to insure accuracy. Data from these measurements are presented in Table 2. Although the errors appear large, the recordings show good correlation with actual thickness measurements taken of the gun barrel. The chromium plate thicknesses are consistently larger than those measured metallographically. Recalibration of the instrument would make the recordings more accurate.

Measurements taken to observe differences between 2 operators using the same equipment are shown in Figure 6. It is observed that fairly good agreement between the two operators was achieved. Comparative

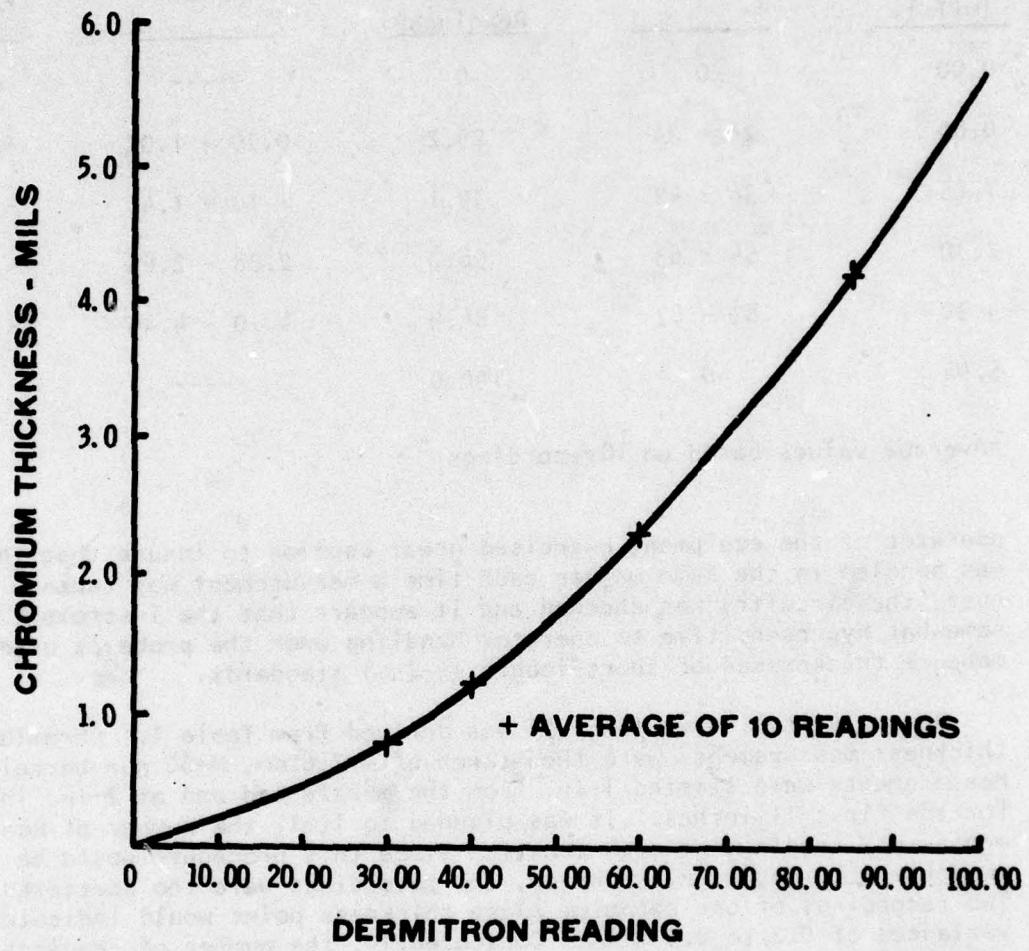


FIGURE 5. ANALYTICAL CURVE FOR THE DERMATRON THICKNESS TESTER USING THE 7.62MM PROBE.

TABLE 2. CHROMIUM THICKNESS MEASUREMENTS OF 7.62MM, M60 GUN BARREL

| Distance from Muzzle End (ins) | Reference Metallographic Measurements (mils) | Dermatron Meter Readings | Dermatron Readings (mils) | Average Dermatron Readings (mils) | Deviation from Reference (mils) |
|--------------------------------|--|--------------------------|---------------------------|-----------------------------------|---------------------------------|
| 1 | 2.45 | 61 - 66 | 2.52-2.90 | 2.75 | +0.30 |
| 3 | 2.38 | 57 - 64 | 2.25-2.75 | 2.55 | +0.17 |
| 5 | 2.20 | 52 - 62 | 1.95-2.60 | 2.41 | +0.21 |
| 7 | 2.05 | 54 - 58 | 2.10-2.30 | 2.19 | +0.14 |
| 9 | 1.90 | 52 - 58 | 1.95-2.30 | 2.12 | +0.22 |
| 11 | 2.02 | 57 - 60 | 2.25-2.45 | 2.40 | +0.38 |

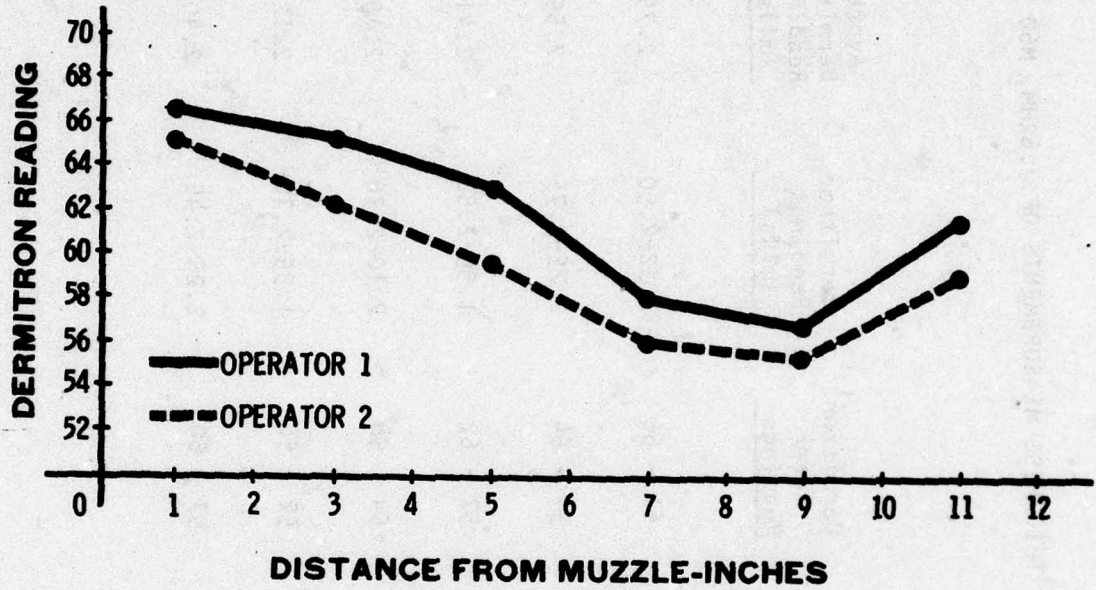


FIGURE 6. MEASUREMENT OF CHROMIUM PLATE THICKNESS IN 7.62MM, M60 GUN BARREL BY TWO OPERATORS.

recordings between operators varied from 0.08 to 0.19 mils.

Evaluation of the Dermatron Thickness Tester to determine chromium plate thicknesses in 7.62mm gun barrels resulted in the following observations.

a. The instrument recordings appear hypersensitive to manipulation of the probe within the gun tube by the operator. Consequently, a mechanical support/guide must be designed to keep the gun tube and the probe in perfect alignment. This should reduce the number of readings required for accurate data to 2 - 3 recordings at each point.

b. The tester reads the chromium thickness of only 1 land at a time. It is important, as stated previously, that the uniformity of the chromium deposit along the periphery of the bore be constant, consequently, at least 2 lands (approx. 180° apart) of the gun bore must be measured. This dictates that 2 readings at 6 points (12 recordings, min.) would be required to insure reliable data during NDT inspections of production gun barrels. This would not be unreasonable should the Dermatron Thickness Tester be implemented as an inspection tool. The primary objection would be directed to the calibration requirements of the instrument. The instrument must be calibrated at least 2 - 3 times during an 8-hour work shift. At the present time, approximately 1 hour is required for each calibration. However, with the use of automated recording/printout methods, the calibration time could be reduced to less than 15 minutes. Actual measurements of a production gun barrel could then be accomplished within 5 - 10 minutes after derivation of an analytical curve.

CONCLUSIONS

It is concluded that:

a. The chromium plate thicknesses of small caliber gun barrels can be determined nondestructively using Eddy Current testing methods.

b. The Nortec NDT-10 Eddy Current Tester is not sufficiently developed for use in the determination of chromium plate thicknesses on steel.

c. The Dermatron Thickness Tester is sufficiently accurate for the measurement of chromium plate thicknesses in 7.62mm gun barrels.

RECOMMENDATIONS

It is recommended that:

a. A mechanical support/guide to align gun tube and probe be designed to minimize erratic recordings caused by manual manipulation of the probe

as it passes through the standards and the gun barrels.

b. An automated recording/printout system be used in conjunction with the Dermatron Tester to make it a more useful and more easily calibrated production tool.

c. A swivel handle be designed to facilitate movement of the probe as it is passed through the gun tube.

d. Other probes (including different sizes and/or rifling configurations) be acquired and evaluated to expand the use of the Dermatron Thickness Tester.

DISTRIBUTION

Copies

A. Department of Defense

Defense Documentation Center
ATTN: TIPDR 12
Cameron Station
Alexandria, VA 22314

B. Department of the Army

Commander
US Army Materiel Development and Readiness Command
ATTN: DRCMT 1
5001 Eisenhower Avenue
Alexandria, VA 22333

Commander
US Army Materiel Development and Readiness Command
Scientific and Technical Information Team - Europe
ATTN: DRXST-STL, Dr. Richard B. Griffin 1
APO New York 09710

Commander
US Army Armament Materiel Readiness Command
ATTN: DRSAR-RDP 1
DRSAR-SC 1
DRSAR-QAE 1
DRSAR-IRW 1
Rock Island, IL 61299

Commander
US Army Armament Research & Development Command
ATTN: DRDAR-PMP, Mr. Donald J. Fischer 1
Dover, NJ 07801

Director
US Army Materials and Mechanics Research Center
ATTN: DRXMR-M 2
Watertown, MA 02172

Commander
US Army Maintenance Management Center
ATTN: DRXMD-A 1
Lexington, KY 40507

Commander
US Army Electronics Research and Development Command
ATTN: DRSEL-PA-E 1
Fort Monmouth, NJ 07703

DISTRIBUTION

Copies

Commander
US Army Missile Research and Development Command
ATTN: DRDMI 1
Redstone Arsenal, AL 35809

Commander
US Army Tank-Automotive Materiel Readiness Command
ATTN: DRSTA-Q 1
Warren, MI 48090

Commander
US Army Tank-Automotive Research and Development Command
ATTN: DRDAR-UL 1
DRDTA-RKA 1
Warren, MI 48090

Commander
US Army Aviation Research and Development Command
ATTN: DRDAV-EXT 1
P.O. Box 209
St. Louis, MO 63166

Commander
US Army Troop Support and Aviation Materiel Readiness Command
ATTN: DRSTS-PLE 1
4300 Goodfellow Blvd.
St. Louis, MO 63120

Commander
Army Ballistic Research Labs
ATTN: DRXBR-X 1
Huntsville, AL 35804

Commander
Harry Diamond Laboratories
ATTN: DRXDO-RCD 1
2800 Powder Mill Road
Adelphi, MD 20783

Commander
New Cumberland Army Depot
ATTN: SDSNC-QA 1
New Cumberland, PA 17070

Commander
Pueblo Army Depot Activity
ATTN: DRXPU 1
Pueblo, CO 81001

DISTRIBUTION

Copies

Commander
Red River Army Depot
ATTN: SDSRR-QA
Texarkana, TX 75501

Commander
Sacramento Army Depot
ATTN: SDSSA-QA
Sacramento, CA 95813

Commander
Seneca Army Depot
ATTN: SDSSE-R
Romulus, NY 14541

Commander
Sharpe Army Depot
ATTN: SDSSH-QE
Lathrop, CA 95330

Commander
Sierra Army Depot
ATTN: SDSSI-DQA
Herlong, CA 96113

Commander
Tobyhanna Army Depot
ATTN: SDSTO-Q
Tobyhanna, PA 18466

Director
US Army Industrial Base Engineering Activity
ATTN: DRXIB-MT
Rock Island Arsenal
Rock Island, IL 61299

Director
USDARCOM Intern Training Center
ATTN: SDSRR-QA
Red River Army Depot
Texarkana, TX 75501

Commander
US Army Tropic Test Center
ATTN: STETC-TD
Drawer 942
Fort Clayton, Canal Zone

DISTRIBUTION

Copies

Commander
Anniston Army Depot
ATTN: SDSAN-QA
Anniston, AL 36202

Commander
Corpus Christi Army Depot
ATTN: SDSCC-MEE
Mail Stop 55
Corpus Christi, TX 78419

Commander
Fort Wingate Army Depot Activity
ATTN: DRXFW
Gallup, NM 87301

Commander
Letterkenny Army Depot
ATTN: SDSLE
Chambersburg, PA 17201

Commander
Lexington-Blue Grass Army Depot Activity
ATTN: SDSLX
Lexington, KY 40507

Commander
Tooele Army Depot
ATTN: SDSTE-QA
Tooele, UT 84074

Commander
Holston Army Ammunition Plant
ATTN: SARHO
Kingsport, TN 37660

Commander
Indiana Army Ammunition Plant
ATTN: SARIN
Charleston, IN 47111

Commander
Iowa Army Ammunition Plant
ATTN: SARIO
Middletown, IA 52601

DISTRIBUTION

| | <u>Copies</u> |
|---|---------------|
| Commander Joliet Army Ammunition Plant ATTN: SARJO Joliet, IL 60434 | 1 |
| Commander Lone Star Army Ammunition Plant ATTN: SARLS Texarkana, TX 75501 | 1 |
| Commander Louisiana Army Ammunition Plant ATTN: SARLA P.O. Box 30058 Shreveport, LA 71161 | 1 |
| Commander Milan Army Ammunition Plant ATTN: SARMI Milan, TN 38358 | 1 |
| Commander Radford Army Ammunition Plant ATTN: SARRA Radford, VI 24141 | 1 |
| Commander Riverbank Army Ammunition Plant ATTN: SARRB Riverbank, CA 95367 | 1 |
| Commander Scranton Army Ammunition Plant ATTN: SARSC Scranton, PA 18501 | 1 |
| Commander Twin Cities Army Ammunition Plant ATTN: SARTC New Brighton, MN 55112 | 1 |
| Commander Volunteer Army Ammunition Plant ATTN: SARVO-T P.O. Box 6008 Chattanooga, TN 37401 | 1 |

DISTRIBUTION

Copies

C. Department of the Navy

Commander

US Navy Materiel Industrial Resources Office

ATTN: Code 044, CPT L. C. Dictmar

Code 227

Philadelphia, PA 19112

1

1

D. Department of the Air Force

Commander

Air Force Materials Laboratory

ATTN: LTM

Wright-Patterson AFB, OH 45433

1

DISTRIBUTION LIST UPDATE

- - - FOR YOUR CONVENIENCE - - -

Government regulations require the maintenance of up-to-date distribution lists for technical reports. This form is provided for your convenience to indicate necessary changes or corrections.

If a change in our mailing lists should be made, please check the appropriate boxes below. For changes or corrections, show old address *exactly* as it appeared on the mailing label. Fold on dotted lines, tape or staple the lower edge together, and mail.

Remove Name From List

Change or Correct Address

Old Address:

Corrected or New Address:

COMMENTS

Date: _____ Signature: _____

Technical Report #

DISTRICT OFFICE

FOR YOUR CONVICTION

Government regulations require the maintenance of up-to-date distribution lists for official records. This form is provided for your convenience to indicate necessary changes or corrections. If a change in our mailing list should be made, please check the appropriate boxes below. For changes of correction, check off the correct box. If a change in the mailing list is indicated, check the appropriate box. This form is provided for your convenience to indicate necessary changes or corrections.

FOLD HERE

Return Address:

Return address box with dashed lines for text entry.

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD 314



OFFICIAL BUSINESS
Penalty for Private Use \$300

Commander
Rock Island Arsenal
Attn: SARRI-ENM
Rock Island, Illinois 61299

FOLD HERE

Large rectangular area with horizontal dashed lines for additional text or markings.

| AD | Accession No. | UNCLASSIFIED | Accession No. | UNCLASSIFIED |
|--|---------------|----------------------------------|--|----------------------------------|
| CDR, Rock Island Arsenal Engineering Directorate Rock Island, IL 61299 | | 1. Small Caliber Gun Tubes | CDR, Rock Island Arsenal Engineering Directorate Rock Island, IL 61299 | 1. Small Caliber Gun Tubes |
| NDT MEASUREMENTS OF CHROMIUM PLATE THICKNESS ON SMALL CALIBER GUN BARREL BORES, by Joseph M. Bish | | 2. Chromium Plate Thickness | NDT MEASUREMENTS OF CHROMIUM PLATE THICKNESS ON SMALL CALIBER GUN BARREL BORES, by Joseph M. Bish | 2. Chromium Plate Thickness |
| Report TR-EN-78-05, May 78, 18 p. incl. illus. tables, (AMS Code 5397-0M-6350) Unclassified report. | | 3. Non-Destructive Testing (NDT) | Report TR-EN-78-05, May 78, 18 p. incl. illus. tables, (AMS Code 5397-0M-6350) Unclassified report. | 3. Non-Destructive Testing (NDT) |
| Chromium-plate thicknesses of gun barrel bores are unjustifiably assumed since the air gauges used simply provide differences in bore-size readings before and after plating. The only means available to accurately determine plating thickness, including concentricity, is to use destructive methods to examine microspecimens representing cross sections of the gun barrel. The objective of this project was to make use of improved nondestructive testing methods to measure chromium plate thicknesses in small caliber gun barrels. | | 4. Eddy Current Testing | Chromium-plate thicknesses of gun barrel bores are unjustifiably assumed since the air gauges used simply provide differences in bore-size readings before and after plating. The only means available to accurately determine plating thickness, including concentricity, is to use destructive methods to examine microspecimens representing cross sections of the gun barrel. The objective of this project was to make use of improved nondestructive testing methods to measure chromium plate thicknesses in small caliber gun barrels. | 4. Eddy Current Testing |
| CDR, Rock Island Arsenal Engineering Directorate Rock Island, IL 61299 | | 1. Small Caliber Gun Tubes | CDR, Rock Island Arsenal Engineering Directorate Rock Island, IL 61299 | 1. Small Caliber Gun Tubes |
| NDT MEASUREMENTS OF CHROMIUM PLATE THICKNESS ON SMALL CALIBER GUN BARREL BORES, by Joseph M. Bish | | 2. Chromium Plate Thickness | NDT MEASUREMENTS OF CHROMIUM PLATE THICKNESS ON SMALL CALIBER GUN BARREL BORES, by Joseph M. Bish | 2. Chromium Plate Thickness |
| Report TR-EN-78-05, May 78, 18 p. incl. illus. tables, (AMS Code 5397-0M-6350) Unclassified report. | | 3. Non-Destructive Testing (NDT) | Report TR-EN-78-05, May 78, 18 p. incl. illus. tables, (AMS Code 5397-0M-6350) Unclassified report. | 3. Non-Destructive Testing (NDT) |
| Chromium-plate thicknesses of gun barrel bores are unjustifiably assumed since the air gauges used simply provide differences in bore-size readings before and after plating. The only means available to accurately determine plating thickness, including concentricity, is to use destructive methods to examine microspecimens representing cross sections of the gun barrel. The objective of this project was to make use of improved nondestructive testing methods to measure chromium plate thicknesses in small caliber gun barrels. | | 4. Eddy Current Testing | Chromium-plate thicknesses of gun barrel bores are unjustifiably assumed since the air gauges used simply provide differences in bore-size readings before and after plating. The only means available to accurately determine plating thickness, including concentricity, is to use destructive methods to examine microspecimens representing cross sections of the gun barrel. The objective of this project was to make use of improved nondestructive testing methods to measure chromium plate thicknesses in small caliber gun barrels. | 4. Eddy Current Testing |

Evaluation of improved NDT inspection methods resulted in the selection of two instruments using eddy current testing technology. The instruments, selected for comparative evaluation, were the Nortec NDT-10 and the Dermitron Thickness Tester. The Nortec NDT-10 Eddy Current Tester, used to measure 5.56mm gun tubes, could not be calibrated due to repeated malfunctions of the instrument; consequently, no meaningful data could be recorded. The Dermitron Thickness Tester, used to measure 7.62mm gun tubes, was calibrated and chromium thickness measurements were taken of an M-60 gun barrel. These measurements showed good correlation with actual thickness measurements of metallographic specimens taken of the gun barrel.

The accuracy and usefulness of the Dermitron would be improved by more frequent calibration and reduction of calibration time by using automated recording/printout methods. Recommendations to expand the use of eddy current testing methods for the determination of chromium plate thicknesses in small caliber gun barrels have been made.

Evaluation of improved NDT inspection methods resulted in the selection of two instruments using eddy current testing technology. The instruments, selected for comparative evaluation, were the Nortec NDT-10 and the Dermitron Thickness Tester. The Nortec NDT-10 Eddy Current Tester, used to measure 5.56mm gun tubes, could not be calibrated due to repeated malfunctions of the instrument; consequently, no meaningful data could be recorded. The Dermitron Thickness Tester, used to measure 7.62mm gun tubes, was calibrated and chromium thickness measurements were taken of an M-60 gun barrel. These measurements showed good correlation with actual thickness measurements of metallographic specimens taken of the gun barrel.

The accuracy and usefulness of the Dermitron would be improved by more frequent calibration and reduction of calibration time by using automated recording/printout methods. Recommendations to expand the use of eddy current testing methods for the determination of chromium plate thicknesses in small caliber gun barrels have been made.

Evaluation of improved NDT inspection methods resulted in the selection of two instruments using eddy current testing technology. The instruments, selected for comparative evaluation, were the Nortec NDT-10 and the Dermitron Thickness Tester. The Nortec NDT-10 Eddy Current Tester, used to measure 5.56mm gun tubes, could not be calibrated due to repeated malfunctions of the instrument; consequently, no meaningful data could be recorded. The Dermitron Thickness Tester, used to measure 7.62mm gun tubes, was calibrated and chromium thickness measurements were taken of an M-60 gun barrel. These measurements showed good correlation with actual thickness measurements of metallographic specimens taken of the gun barrel.

The accuracy and usefulness of the Dermitron would be improved by more frequent calibration and reduction of calibration time by using automated recording/printout methods. Recommendations to expand the use of eddy current testing methods for the determination of chromium plate thicknesses in small caliber gun barrels have been made.

Evaluation of improved NDT inspection methods resulted in the selection of two instruments using eddy current testing technology. The instruments, selected for comparative evaluation, were the Nortec NDT-10 and the Dermitron Thickness Tester. The Nortec NDT-10 Eddy Current Tester, used to measure 5.56mm gun tubes, could not be calibrated due to repeated malfunctions of the instrument; consequently, no meaningful data could be recorded. The Dermitron Thickness Tester, used to measure 7.62mm gun tubes, was calibrated and chromium thickness measurements were taken of an M-60 gun barrel. These measurements showed good correlation with actual thickness measurements of metallographic specimens taken of the gun barrel.

The accuracy and usefulness of the Dermitron would be improved by more frequent calibration and reduction of calibration time by using automated recording/printout methods. Recommendations to expand the use of eddy current testing methods for the determination of chromium plate thicknesses in small caliber gun barrels have been made.

| | | | |
|---|---|---|---|
| <p>AD <u>CDR, Rock Island Arsenal</u> Engineering Directorate Rock Island, IL 61299</p> <p>NDT MEASUREMENTS OF CHROMIUM PLATE THICKNESS ON SMALL CALIBER GUN BARREL BORES, by Joseph M. Bish</p> <p>Report TR-EN-78-05, May 78, 18 p. incl. illus. tables, (AMS Code 5397-0M-6350) Unclassified report.</p> <p>Chromium-plate thicknesses of gun barrel bores are unjustifiably assumed since the air gauges used simply provide differences in bore-size readings before and after plating. The only means available to accurately determine plating thickness, including concentricity, is to use destructive methods to examine microspecimens representing cross sections of the gun barrel. The objective of this project was to make use of improved nondestructive testing methods to measure chromium plate thicknesses in small caliber gun barrels.</p> | <p>Accession No. _____</p> <p>UNCLASSIFIED</p> <ol style="list-style-type: none"> 1. Small Caliber Gun Tubes 2. Chromium Plate Thickness 3. Non-Destructive Testing (NDT) 4. Eddy Current Testing | <p>Accession No. _____</p> <p>UNCLASSIFIED</p> <ol style="list-style-type: none"> 1. Small Caliber Gun Tubes 2. Chromium Plate Thickness 3. Non-Destructive Testing (NDT) 4. Eddy Current Testing | <p>Accession No. _____</p> <p>UNCLASSIFIED</p> <ol style="list-style-type: none"> 1. Small Caliber Gun Tubes 2. Chromium Plate Thickness 3. Non-Destructive Testing (NDT) 4. Eddy Current Testing |
| <p>AD <u>CDR, Rock Island Arsenal</u> Engineering Directorate Rock Island, IL 61299</p> <p>NDT MEASUREMENTS OF CHROMIUM PLATE THICKNESS ON SMALL CALIBER GUN BARREL BORES, by Joseph M. Bish</p> <p>Report TR-EN-78-05, May 78, 18 p. incl. illus. tables, (AMS Code 5397-0M-6350) Unclassified report.</p> <p>Chromium-plate thicknesses of gun barrel bores are unjustifiably assumed since the air gauges used simply provide differences in bore-size readings before and after plating. The only means available to accurately determine plating thickness, including concentricity, is to use destructive methods to examine microspecimens representing cross sections of the gun barrel. The objective of this project was to make use of improved nondestructive testing methods to measure chromium plate thicknesses in small caliber gun barrels.</p> | <p>Accession No. _____</p> <p>UNCLASSIFIED</p> <ol style="list-style-type: none"> 1. Small Caliber Gun Tubes 2. Chromium Plate Thickness 3. Non-Destructive Testing (NDT) 4. Eddy Current Testing | <p>Accession No. _____</p> <p>UNCLASSIFIED</p> <ol style="list-style-type: none"> 1. Small Caliber Gun Tubes 2. Chromium Plate Thickness 3. Non-Destructive Testing (NDT) 4. Eddy Current Testing | <p>Accession No. _____</p> <p>UNCLASSIFIED</p> <ol style="list-style-type: none"> 1. Small Caliber Gun Tubes 2. Chromium Plate Thickness 3. Non-Destructive Testing (NDT) 4. Eddy Current Testing |

Evaluation of improved NDT inspection methods resulted in the selection of two instruments using eddy current testing technology. The instruments, selected for comparative evaluation, were the Nortec NDT-10 and the Dermitron Thickness Tester. The Nortec NDT-10 Eddy Current Tester, used to measure 5.56mm gun tubes, could not be calibrated due to repeated malfunctions of the instrument; consequently, no meaningful data could be recorded. The Dermitron Thickness Tester, used to measure 7.62mm gun tubes, was calibrated and chromium thickness measurements were taken of an M-60 gun barrel. These measurements showed good correlation with actual thickness measurements of metallographic specimens taken of the gun barrel.

The accuracy and usefulness of the Dermitron would be improved by more frequent calibration and reduction of calibration time by using automated recording/printout methods. Recommendations to expand the use of eddy current testing methods for the determination of chromium plate thicknesses in small caliber gun barrels have been made.

Evaluation of improved NDT inspection methods resulted in the selection of two instruments using eddy current testing technology. The instruments, selected for comparative evaluation, were the Nortec NDT-10 and the Dermitron Thickness Tester. The Nortec NDT-10 Eddy Current Tester, used to measure 5.56mm gun tubes, could not be calibrated due to repeated malfunctions of the instrument; consequently, no meaningful data could be recorded. The Dermitron Thickness Tester, used to measure 7.62mm gun tubes, was calibrated and chromium thickness measurements were taken of an M-60 gun barrel. These measurements showed good correlation with actual thickness measurements of metallographic specimens taken of the gun barrel.

The accuracy and usefulness of the Dermitron would be improved by more frequent calibration and reduction of calibration time by using automated recording/printout methods. Recommendations to expand the use of eddy current testing methods for the determination of chromium plate thicknesses in small caliber gun barrels have been made.

Evaluation of improved NDT inspection methods resulted in the selection of two instruments using eddy current testing technology. The instruments, selected for comparative evaluation, were the Nortec NDT-10 and the Dermitron Thickness Tester. The Nortec NDT-10 Eddy Current Tester, used to measure 5.56mm gun tubes, could not be calibrated due to repeated malfunctions of the instrument; consequently, no meaningful data could be recorded. The Dermitron Thickness Tester, used to measure 7.62mm gun tubes, was calibrated and chromium thickness measurements were taken of an M-60 gun barrel. These measurements showed good correlation with actual thickness measurements of metallographic specimens taken of the gun barrel.

The accuracy and usefulness of the Dermitron would be improved by more frequent calibration and reduction of calibration time by using automated recording/printout methods. Recommendations to expand the use of eddy current testing methods for the determination of chromium plate thicknesses in small caliber gun barrels have been made.

Evaluation of improved NDT inspection methods resulted in the selection of two instruments using eddy current testing technology. The instruments, selected for comparative evaluation, were the Nortec NDT-10 and the Dermitron Thickness Tester. The Nortec NDT-10 Eddy Current Tester, used to measure 5.56mm gun tubes, could not be calibrated due to repeated malfunctions of the instrument; consequently, no meaningful data could be recorded. The Dermitron Thickness Tester, used to measure 7.62mm gun tubes, was calibrated and chromium thickness measurements were taken of an M-60 gun barrel. These measurements showed good correlation with actual thickness measurements of metallographic specimens taken of the gun barrel.

The accuracy and usefulness of the Dermitron would be improved by more frequent calibration and reduction of calibration time by using automated recording/printout methods. Recommendations to expand the use of eddy current testing methods for the determination of chromium plate thicknesses in small caliber gun barrels have been made.