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U. S. NAVAL AIR DEVELOPMENT CENTER

JOHNSVILLE, PENNSYLVANIA

Aeronautical Electronic and Electrical Laboratory

REPORT NO. NADC-EL-6285

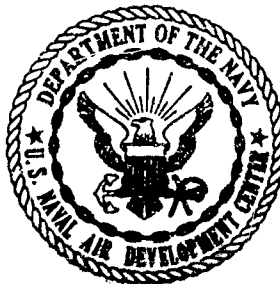
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EVALUATION OF ELAPSED TIME INDICATORS
AND DEVELOPMENT OF AN APPLICABLE SPECIFICATION

FINAL REPORT
WEPTASK NO. RAVOJ001/2021/RO08-01-01
Problem No. 8

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S U M M A R Y

The evaluation results of elapsed time indicators indicated that electro-mechanical types are better suited to the environment of service use than electro-chemical or electronic types at present. The electro-chemical types failed to meet the rigors of temperature cycling as required by the governing specification. Electronic types lacked the accuracy for reliable time totalizing.

EVALUATION OF ELAPSED TIME INDICATORS
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Ref: (a) BUAER ltr Aer-AV-4422/7 of 20 Jan 1959
(b) Report No. NADC-EL-6068, "Phase Report No. 2, Evaluation of Elapsed Time Indicators and Development of an Applicable Specification," of 17 Oct 1960

INTRODUCTION

WEPTASK No. RAV03J001/2021/R008-01-01, Problem No. 8 (formerly TED Project No. ADC AV-44014) was established by reference (a) for the evaluation of available elapsed time indicators and the development of new specifications to cover those best suited for service use.

The evaluation of a variety of elapsed time indicators, including electro-mechanical, electro-chemical and electronic types was covered in reference (b). Also, a proposed revision to Specification MIL-M-7793B was included.

This report presents the results of tests conducted on mercury-coulometer types of elapsed time indicators and discusses the final form of the revised specification.

DESCRIPTION

Mercury-coulometer indicators operate on exact electro-chemical principles. The measuring element consists of a capillary tube filled with two columns of mercury separated by an indicating gap of electrolyte. A precise constant current plates mercury across the gap at an exact rate. The movement of the gap is directly proportional to the passage of time.

EVALUATION

Samples from two manufacturers were evaluated according to applicable portions of Specification MIL-M-7793. Both a-c and d-c models were represented. (See figure 1.)

RESULTS

A summary of the test results is shown in table I. In each case, the first number indicates those that met the requirements of the test specification; the second number denotes the total of each type tested.

T A B L E I

TEST RESULTS

	Type "K"		Type "L"		
	<u>A-C</u>	<u>D-C</u>	<u>A-C</u>	<u>D-C</u>	
Examination of Product	6/6	3/3	3/3	3/3	per mfr's spec
Operational Check*	6/6	3/3	3/3	3/3	per MIL-M-7793
Power Supply Tolerance*	6/6	3/3	3/3	3/3	per MIL-M-7793
Altitude	2/2	2/2	2/2	2/2	per MIL-M-7793
Salt Spray	2/2	2/2	2/2	2/2	per MIL-M-7793
Vibration	2/2	2/2	2/2	2/2	per MIL-M-7793
Life Test**	2/2	2/2	2/2	2/2	per MIL-M-7793
Temperature Cycling***	0/3	3/3	2/2	1/2	per MIL-M-7793

* Samples will record accurately only at one specific current flow for each type.

** During life test, both types recorded 1000 hours within +3 percent.

*** Type "K" - the d-c samples passed; the a-c samples warped when subjected to +85° C which is required as part of the test. (See figure 2.) Type "L" - one of the d-c units cracked during the +85° C portion of the test, and the mercury and electrolyte seeped out.

SPECIFICATION

A conference was held in Washington, D. C. in February 1961 by the interested personnel of the Army, Navy and Air Force to determine the services' requirements regarding elapsed time indicators. As a result, the Department of Defense appointed NAVAIRDEVCON as the cognizant activity in matters concerning these components and requested a Specification and Military Standards to cover the best units available for use in all services.

Further revisions were made to Specification MIL-M-7793 to encompass all a-c and d-c units found to meet service requirements. The new specification published as MIL-M-7793C supersedes and replaces MIL-M-7793B, MIL-I-26550A(USAF), MIL-I-9367(USAF) and MIL-M-3971. The term "elapsed time indicators" has been deleted and the term "time totalizing meters" has been substituted.

Additional Military Standards were drafted to cover newer types of time totalizing meters and published under numbers MS17321 to MS17325 inclusive. These, together with MS28053, will govern detail requirements for future service needs.

Due to the large number of vendors of time totalizing meters, it was decided to expedite qualification testing by having each manufacturer evaluate his own product. Necessary visits were made to the manufacturers'

own and/or affiliated test laboratories to appraise their facilities and determine their capability to perform evaluation per Specification MIL-M-7793C. Local government inspectors were contacted in each case, and arrangements were made to have evaluation tests witnessed and the results certified. Final reports were submitted by the manufacturers concerned to NAVAIRDEVCON for final determination of acceptance for placement on the Qualified Products List. As a result, the following types qualified under Specification MIL-M-7793C:

Types A and C	- digital only	} See reference (b)
Type E	- dial and digital	
Types M, N, and O	- digital only	} (See figure 3)

CONCLUSIONS

Conclusions reached as a result of the additional tests performed on electro-chemical types "K" and "L" and as a result of final reports submitted by manufacturers of electro-mechanical types, are essentially the same as in reference (b).

RECOMMENDATION

It is recommended that paragraph 4.5.12 of Specification MIL-M-7793C be expanded to include the following sentence: "Smaller shock testing machines may be utilized so long as they produce the required G-force and pulse duration."

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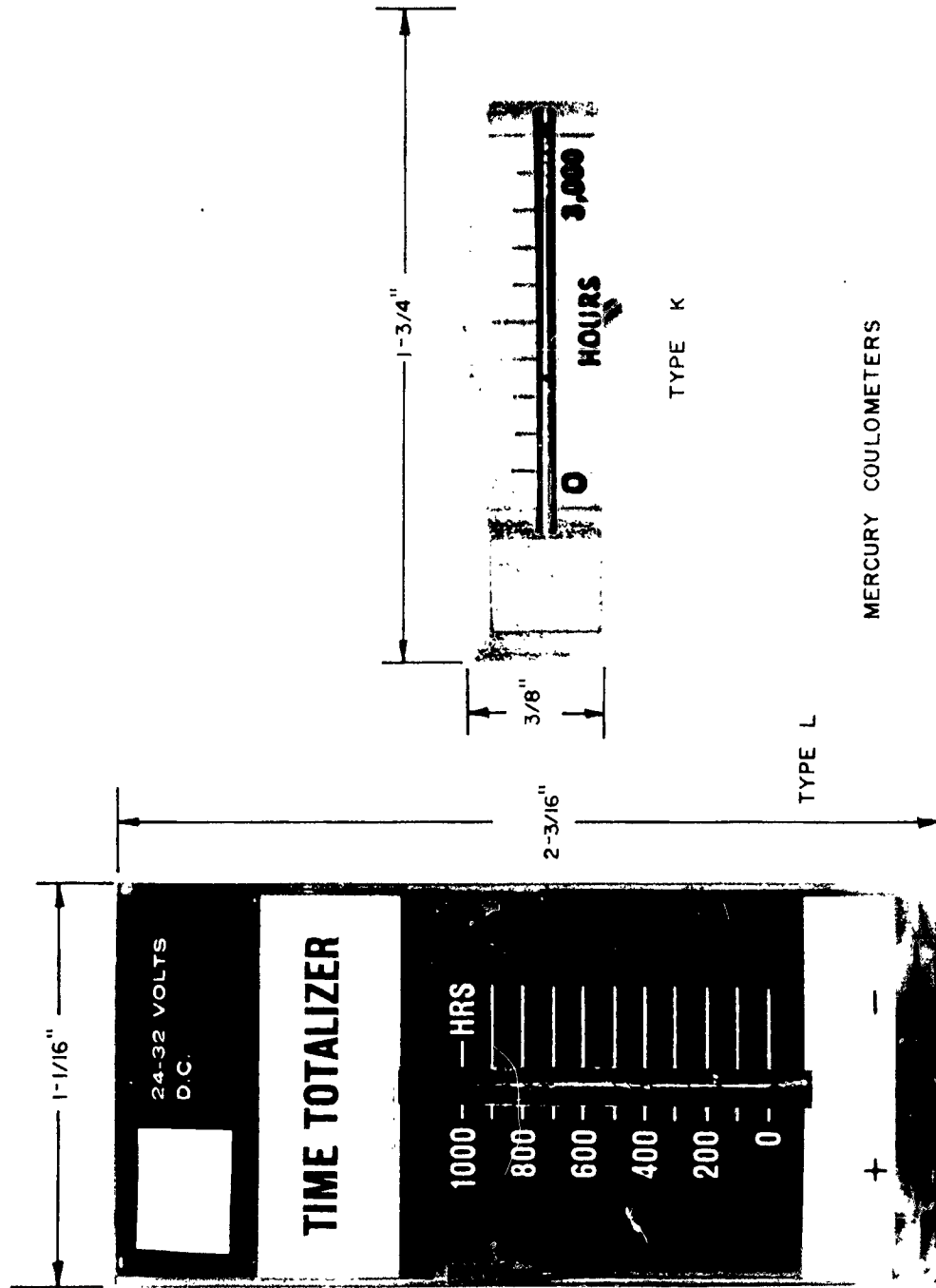
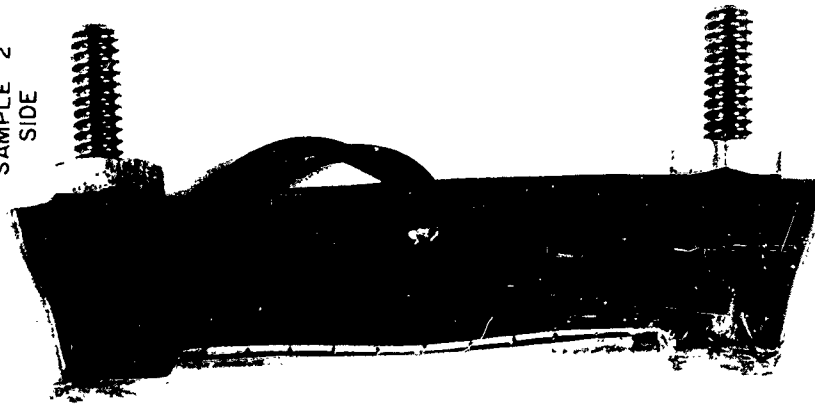


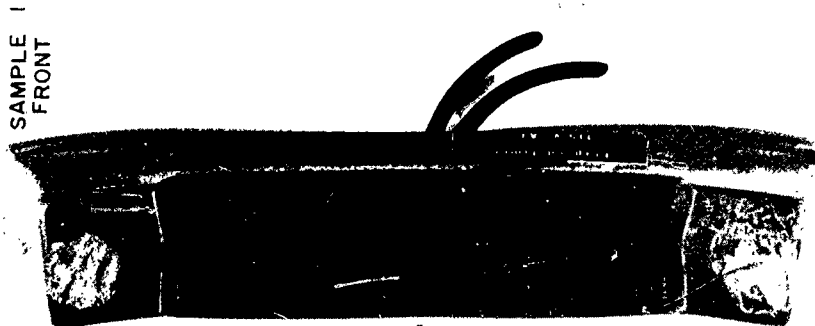
FIGURE 1 - Electro-Chemical Types



SAMPLE 3
BACK



SAMPLE 2
SIDE



SAMPLE 1
FRONT

DAMAGE SAME ON ALL THREE A-C SAMPLES

FIGURE 2 - Results of Temperature Cycling on Type "K"

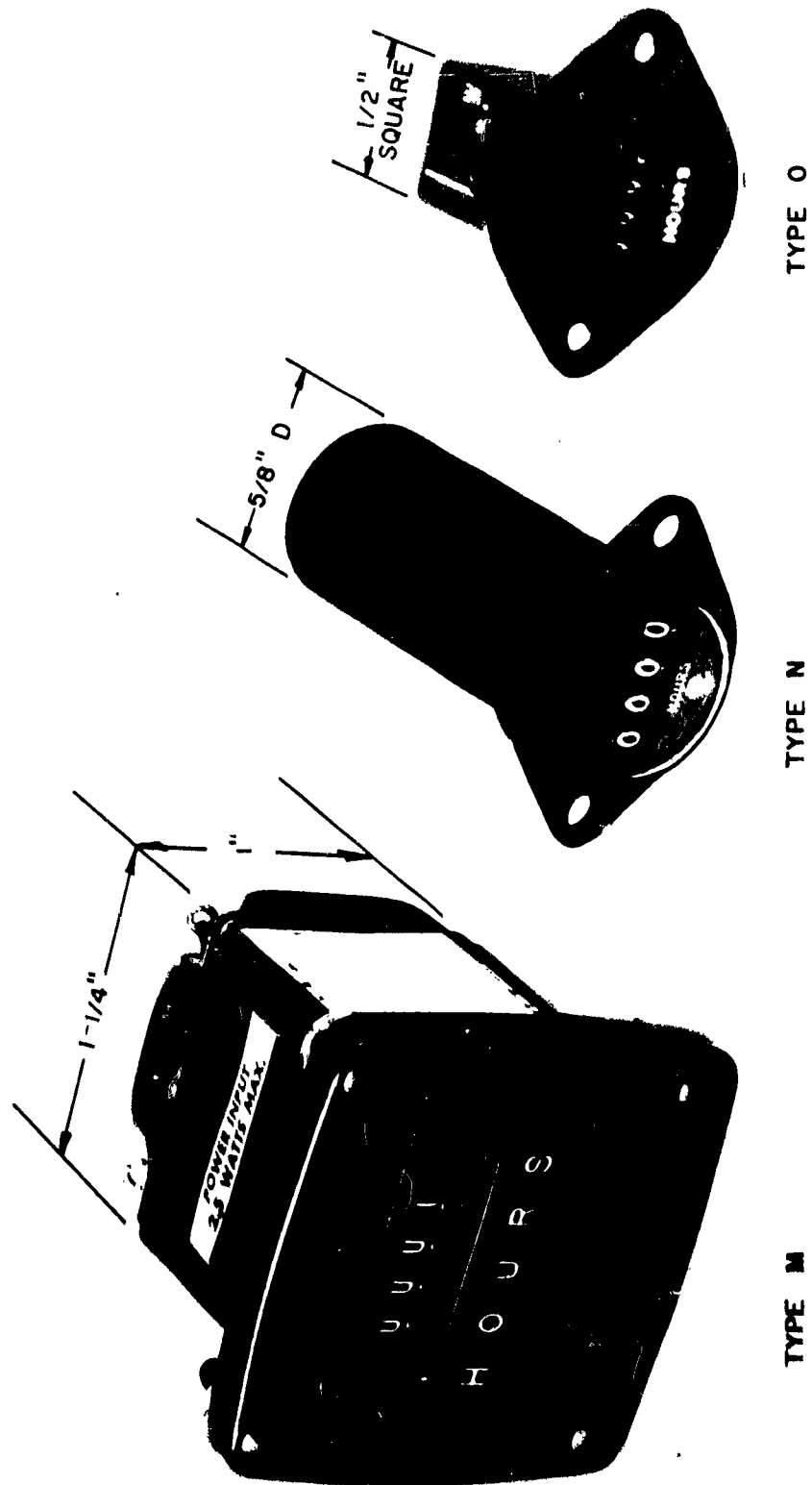


FIGURE 3 - Electro-Mechanical Types

C O D I N G O F S A M P L E S

- A - Haydon, Division of General Time Corporation, Model 7010-004
- C - A. W. Haydon Company, Models K23205 and K25205
- E - Elgin Micronics Division, Models 95A, 95B [REDACTED]
- K - Curtis Instrument Company, Models 515 and 528
- L - Leland Airborne Products, Models 5265 and 5266
- M - Cramer Controls Corporation, Model 620
- N - Bowmar Instrument Corporation, Model X2703
- O - A. W. Haydon Company, Models K19202 and K19203