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MANUFACTURING METHODS AND TECHNOLOGY (MM&T)  
SPECIFICATIONS FOR MINIATURE CATHODE RAY TUBE(U) THOMAS  
ELECTRONICS INC WAYNE NJ F M BRUNO 31 JAN 83

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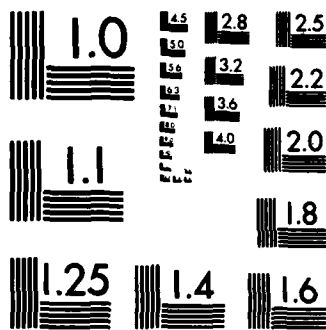
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31 January 1983

Thomas Electronics, Inc.  
100 Riverview Drive  
Wayne, NJ 07470

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**NINTH QUARTERLY REPORT**

for period

1 October 1982 - 31 December 1982

Approved for public release; distribution unlimited

**Manufacturing Methods and Technology (MM&T) Specifications for  
Miniature Cathode Ray Tube**

prepared by

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31 JAN 1983  
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#### **ACKNOWLEDGEMENT**

This project has been accomplished as part of the US Army Manufacturing Methods and Technology (MM&T) Program which has as its objective the timely establishment of manufacturing processes, techniques, or equipment to insure the efficient production of current or future defense programs.

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Manufacturing Methods and Technology (MM&T) Specifications for  
Miniature Cathode Ray Tube

NINTH QUARTERLY REPORT


for period

1 October 1982 - 31 December 1982

The object of this study is to develop design, performance, and test specifications for the Miniature Cathode Ray Tube (CRT) assembly suitable for use in the Integrated Helmet and Display Sight System (IHADSS) of the Army Advanced Attack Helicopter (AAH).

Contract Number: DAAK70-80-C-0168

Approved by:



M. L. Beasty  
Vice President - Engineering

Approved by:



F. M. Bruno  
Program Manager

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## ABSTRACT/SUMMARY

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Improvements in vibration-testing techniques led to the satisfactory performance of CRTs in continuing pre-vibration tests. Pending final approval of its ATP and QTP, TEI was fabricating CRT components preparatory to manufacture and test of Phase II - Confirmatory Samples. Life testing of the P43 phosphor was successfully concluded.

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## 1.0 PURPOSE

The purpose of this Manufacturing Methods and Technology (MM&T) contract is to establish production methods and facilities required to produce the Miniature Cathode Ray Tube Assembly required for the Integrated Helmet and Display Sight System (IHADSS) of the Army Advanced Attack Helicopter (AAH).

The primary objectives are to develop vendor sources for the required individual components and establish viable production techniques to meet the necessary monthly production rate.

The product produced will be required to meet the mechanical, electrical, performance, and environmental parameters of MM&T H799838.

## 2.0 GLOSSARY

AAH.....	Advanced Attack Helicopter
ATP.....	Acceptance Test Procedure
CDRL.....	Contract Data Requirements List
COR.....	Contracting Officer's Representative
CRT.....	Cathode Ray Tube
EM.....	Equipment Manufacturer
IHADSS.....	Integrated Helmet and Display Sight System
MERADCOM.....	Mobility Equipment Research and Development Command
MM&T.....	Manufacturing Methods and Technology
MOD.....	Modification (to Contract)
NV&EOL.....	Night Vision & Electro-Optics Laboratory
PCO.....	Procuring Contracting Officer
PERT.....	Program Evaluation and Review Techniques
QTP.....	Qualification Test Procedure
TEI.....	Thomas Electronics, Inc.
TIR.....	Total Indicated Range

### 3.0 NARRATIVE AND DATA

Improvements in vibration-testing techniques led to the satisfactory performance of CRT assemblies in continuing pre-vibration tests.

Drafts of the ATP (Acceptance Test Procedure) and the QTP (Qualification Test Procedure) were submitted to the COR for review and approval. Pending final approval of these documents, TEI is continuing to fabricate CRT components preparatory to manufacture and test of Phase II - Confirmatory Samples.

Life testing of the P43 phosphor was successfully concluded. TEI's final report on this testing is attached to this Ninth Quarterly Report in the Appendix.

Major test parameters and data for the 3rd Submission of Phase I - Engineering Samples are contained in the following table.

Test Results on Major Parameters for  
3rd Submission of Phase I - Engineering  
Samples - Serial Numbers 004 & 005

Customer Spec. Para. Ref.	MIL-STD 1311 Method	Test Parameter	Limits		Units	Test Readings	
			Min.	Max.		SN004	SN005
3.2.1.2	5241	Cutoff Voltage	-40	-70	VDC	70	57
3.2.1.2	1301	Heater Current at Eh=11.0V	73.8	90.2	uA	80	85
3.2.3.7	5231	Spot Position	---	.060	R Inch	.056	.053
3.2.3.2		Contrast at High Brightness	0.60		Ratio	.70	.71
3.2.3.3		Brightness Contrast Ratio	23:1		Ratio	30:1	23.5:1
3.2.3.4		Sine-Wave Modu- lation Response Spatial Fre- quency			S/US	S	S
		10	.92			.98	.95
		100	.89			.94	.94
		200	.84			.92	.92
		400	.64			.84	.84
		600	.40			.63	.52
3.2.1.4		Deflection Sensitivity					
		+H at 0.8A	.299	.336	A	.385	.357
		-H at 0.8A	.299	.336	A	.336	.357
		+V at 0.8A	.299	.336	A	.358	.331
		-V at 0.8A	.299	.336	A	.354	.334
3.2.2.2		Total Weight	---	170	Gram	159	159

#### 4.0 CONCLUSIONS

Improvements in vibration-testing techniques led to the satisfactory performance of CRTs in continuing pre-vibration tests. Pending final approval of its ATP and QTP, TEI was fabricating CRT components preparatory to manufacture and test of Phase II - Confirmatory Samples. Life testing of the P43 phosphor was successfully concluded.

## 5.0 PROGRAM FOR NEXT INTERVAL

For the next quarter, TEI's plans are as follows:

1. Fabricate and test CRT assemblies for Phase II - Confirmatory Samples.
2. Maintain detailed test records for compiling into technical data items required by the contract.
3. Prepare and submit monthly status reports and also the draft and final quarterly reports.

## 6.0 DISTRIBUTION LIST

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A P P E N D I X

Final Report

on

P43 Phosphor Life Test

TEI Supplementary  
Report

DAAK70-80-C-0168

27 January 1983

Thomas Electronics, Inc.  
100 Riverview Drive  
Wayne, NJ 07470

FINAL REPORT

on

P43 Phosphor Life Test

**Purpose:** Determination of Phosphor Aging Effect on the 1" Manufacturing Methods and Technology Reliability Test Specification Paragraph 3.2.3.12 Which States "CRT Assemblies Shall Remain Within the Limits of This Specification for Statistical Mean of 5000 Hours of Operation."

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## FINAL REPORT

### P43 Phosphor Life Test

In the December 1981 Monthly Report, TEI stated that by calculation and experience, the specified P43 phosphor will have an appreciable drop in efficiency and some MM&T requirements would not be met during Reliability Testing.

TEI provided two CRT assemblies for life testing of the P43 phosphor. One CRT featured the specified fiber optic faceplate and the other had a clear glass (S8003N) faceplate. The clear faceplate was tested to determine the degree of transmission loss in comparison with a fiber optic faceplate during life testing.

The life testing of the P43 phosphor has now been completed and the conclusions and data are as follows:

#### CONCLUSIONS

1. The usual assumption is that the end of phosphor life is 50% of the initial intensity and the life constant of P43 is 100 Coulombs/cm<sup>2</sup>. The base data was projected to a 50% drop in brightness. Since the two samples represent typical products, it can be concluded from the data that neither screen should deteriorate to a 50% drop in brightness when operated at normal beam current.
2. That aging of the phosphor from normal usage should not contribute to any major premature phosphor failures but some MM&T test parameters might not be maintained during

the life testing. The drop in brightness could result in CRTs not meeting the High Brightness, Modulation, Contrast at High Brightness and Sine Wave Modulation test limits. The life testing is with D.C. video operation (@ 100% duty cycle). In service, the duty cycle will be much less, probably well under 25%. Therefore, the actual degradation in service should be negligible and the MM&T requirements which were not met on life testing would be met in actual service.

3. There is no apparent transmission loss in the faceplates. The raster area had browned during life testing and to determine which materials had browned, the faceplates were removed from the CRT assembly and washed. Neither faceplate showed any sign of glass browning, meaning all visual browning was in the P43 phosphor. Transmission of the fiber optic faceplate is 63 % and the clear faceplate is 92 %.

#### TEST DATA AND CONDITIONS

The test specimens consisted of one (1) fiber optic and one (1) clear non-browning (S8003N) glass faceplate coated with P43 phosphor. The faceplates were sealed to a 1M40 design cathode ray tube. Voltages and yoke driving signals were applied throughout the test as follows:

Anode:	7.5 KV DC
Focus:	Adjusted

Grid 2:	300 V DC
Heater:	6.3 V DC
Cathode:	Ground
Grid 1:	Adjusted for specific screen current as noted.
Raster:	525 lines per frame, no blanking, Sync., 60 HZ vertical; 15,750 HZ horizontal, one-half of raster blanked to eliminate DC positioning.
Raster Size:	0.567cm <sup>2</sup> (active area)
Writing Rate:	9,259.3"/sec

Brightness measurements were taken of the scanned and unscanned portions of the individual faceplates at random times during the test, percentage drop in brightness was calculated for both.

The test data is tabulated on sheet 4 and a plot is provided of Coulombs per square centimeter versus percentage drop in brightness for both specimens, sheet 5. Phosphor life is an exponential decaying function and plotted on Log-Log paper.

During the course of the test, some calculation errors were made in the periodic data. This report contains all revised periodic data, preceding data is superseded.

P43 LIFE TEST DATA

I. GLASS FACEPLATE

HOURS (Ib2)	CUMULATIVE HOURS	COULOMBS	COULOMBS/cm <sup>2</sup>
2719 at 2.2uA	2719	21.5	37.9
1340.5 at 5.4uA	4059.5	47.56	83.88
1319.5 at 5.4uA	5379	73.21	129.12

Graph Parameters: COULOMBS/cm <sup>2</sup>	Log10	PERCENTAGE DROP	Log10
37.9	1.58	11	1.04
83.88	1.92	28	1.45
129.12	2.11	30	1.48

Life of phosphor is an exponential function (best fit line).

y-intercept: anti-log (-0.312) = 0.487 % drop

slope: 0.875 % drop/Coulombs/cm<sup>2</sup>

correlation coefficient: 0.955 (a 1.0 would be a perfect match for all data points in line)

To 50% drop in brightness (extrapolated): 199 C/cm<sup>2</sup>  
(5804 hours at 5.4uA Ib2)

II. FIBER OPTIC FACEPLATE

HOURS (Ib2)	CUMULATIVE HOURS	COULOMBS	COULOMBS/cm <sup>2</sup>
2719 at 2.7uA	2719	26.4	46.56
1296 at 5.4uA	4015	51.59	90.99
1319.5 at 5.4uA	5334.5	77.24	136.22

Graph Parameters: COULOMBS/cm <sup>2</sup>	Log10	PERCENTAGE DROP	Log10
46.56	1.67	9	0.954
90.99	1.96	15	1.18
136.22	2.13	20.1	1.30

Life of phosphor is an exponential function (best fit line).

y-intercept: anti-log (-0.305) = 0.495 % drop

slope: 0.755 % drop/Coulombs/cm<sup>2</sup>

correlation coefficient: 0.999

To 50% drop in brightness (extrapolated): 447 C/cm<sup>2</sup>  
(13,037 hours at 5.4uA Ib2)

NOTES:

-scanned area: 0.567 cm<sup>2</sup>

-5.4uA Ib2 will provide an area brightness of 375 footlamberts on the fiber optic faceplate CRT, somewhat higher brightness for the glass faceplate.

**END**

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