X-RAY DEPARTMENT

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AUTHOR JB Guthrie	SUBJECT CLASSIFICATION 1. MC-890 SERIES 2. FINAL ASSEMBLY 3. OUTPUT TUBES	NO. R60XF21 DATE 4-13-60
TITLE EEN-307 Irradiation of Units at Low Temperature Test		
ABSTRACT (EWR - ESE-144.) Fifty MC-890 type final assemblies were subjected to irradiation at low temperature test in order to determine if irradiation would reduce the frequency of high voltage breakdowns. A control lot of a like number of units was subjected to low temperature test in the same manner except without irradiation.		
G.E. CLASS. 4	REPRODUCIBLE COPY FILED AT Technical Data Center P. O. Box 11508 St. Petersburg, Florida	NO. PAGES 11
GOV. CLASS. None CONCLUSIONS Irradiation of units during low temperature test did not reduce the frequency of high voltage breakdowns.		

By cutting out this rectangle and folding on the center line, the above information can be fitted into a standard card file.

For list of contents—drawings, photos, etc. and for distribution see next page.

INFORMATION PREPARED FOR Engineering

TESTS MADE BY Quality Control

COUNTERSIGNED Robert J. Bailey 4/7/60 sub-SECTION Electronic Systems Engineering

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F-1668

-1-

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I. INTRODUCTION

GEXM report No. GEX-251 (GEM-460) shows in a quantitative manner the build-up of electrical charge on the walls of the output tube as a number of successive operations is increased. It was also reported that the charge can be dissipated by irradiation of the tube with X-rays of 50 KVP, 2 milliamp seconds at a distance of 1 foot in air. The time constant of charge dissipation without irradiation was found to be approximately 7 minutes at room temperature.

High voltage breakdowns of final assemblies tested at low temperature also appear to be a time related effect. Data from Quality Control shows that the high voltage breakdown rate is approximately 0.2% on the first operation and increases to a rate of over 1% on the fifth operation, operating at a 3 minute interval between operations. The frequency of high voltage breakdowns is inversely proportional to the interval between operations. It was surmised that high voltage breakdown at low temperature was due in part to the accumulation of charges on the walls of the tube. It was expected that X-radiation between operations would eliminate this charge and in turn reduce the frequency of high voltage breakdowns on the second, third, fourth, and fifth operation. In order to test this hypothesis, arrangements were made to subject 50 MC-1140 (MC-890 type) units to X-radiation between operations at low temperature test. The lot was divided into 2 equal parts for control purposes.

II. TEST CONDITION

The 50 units selected for this test were MC-1140 type which previously had failed to qualify as MC-890 due to one high voltage breakdown at low temperature. MC-1140 units were used in preference to MC-890 type units because the latter were not available at the time. The 50 units were randomly divided into 2 groups of 25 each and labeled group A and group B respectively. Both groups were placed in temperature chambers and the temperature was reduced to -65°F for 8 hours minimum. Alternate units from groups A and B were removed from the chamber one at a time and subjected to 5 operations at 1 minute intervals, 24 volts input, 650 volts trigger and 4 second warm-up. Units from group A were subjected to X-radiation after each operation of the unit and units from group B were tested in an identical manner except they were not irradiated. The X-ray equipment used was General Electric type OX250 set at 250 KV, 10 milliamps for an exposure time of approximately 13 seconds. The X-ray target was set at a distance of 14 inches from the center of the product output tube to be irradiated. At the completion of this test, lots A and B were reversed and the tests were repeated except the other group was irradiated. This resulted in 250 operations on each group of 25 units, of which 125 operations were interposed by irradiation.

III. TEST RESULTS

Details of high voltage breakdowns according to unit serial numbers are shown on the attached Quality Control Engineering Analysis and the results may be summarized as follows:

Irradiated 250 operations
Non irradiated 250 operations

9 High Voltage Breakdowns.
11 High voltage breakdowns.

Test for significance by the Quality Control Engineer showed no significant difference between the irradiated and non-irradiated groups.

IV.

CONCLUSIONS

Based on the results of the above experiment involving a quantity of 50 units, irradiation between operations at cold test does not result in reduction of high voltage breakdowns on the second, third, fourth, and fifth operations.

QUALITY CONTROL ENGINEERING ANALYSIS

MARCH 11, 1960

EEN-307 - SPECIAL LOW TEMPERATURE TEST

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QUALITY CONTROL ENGINEERING ANALYSIS

MARCH 11, 1960

EEN-307 - SPECIAL LOW TEMPERATURE TEST

PURPOSE: To investigate the theory that x-ray radiation will reduce the incidence of high voltage breakdown.

SUMMARY: Results indicate that there is no significant difference between units x-ray radiated and those not x-ray radiated when subjected to radiation in the manner outlined in EEN-307.

QUALITY CONTROL ENGINEERING ANALYSIS

March 11, 1960

EEN-307 - SPECIAL LOW TEMPERATURE TEST

PURPOSE: To investigate the theory that x-ray radiation will reduce the incidence of high voltage breakdowns.

METHOD: 50 units were randomly divided into groups of 25 as follows:

<u>"A"</u>		<u>"B"</u>	
409022	535030	407015	535047
506020	545144	506006	535088
506027	545145	506077	535186
506028	545183	506114	535197
506040	555030	506119	545036
506073	555031	506137	545044
506134	555080	506152	545054
506181	555083	506156	545131
506192	555146	506163	545166
511053	555176	511021	545174
511064	555178	511051	555147
511096	555189	511059	555186
511098		511065	

Both groups were put into Conrad chambers and the temperature was reduced to -65° F. The units were held at this temperature a minimum of eight hours. Alternate units were removed from the chambers one at a time and subjected to five operations at one minute intervals, 24 volt input, 650 volt trigger, and four second warm up. Manual tester #146X131, less PT 502, was used. The five traces were recorded progressively on a film by a Dussont camera. The graticule was turned off to aid in the identification of HVB. Units from group "A" were subjected to x-ray radiation after each operation of the unit. The x-ray equipment was set at 250 K.V.P., 10 ma, for an exposure time of approximately 13 seconds. The distance of 14" from target to center of product tube was used after preliminary experiment indicated this was desirable. Production Engineer and Systems Engineer were in agreement with this. Group "B" was not radiated.

At the completion of the above sequence of 50 tests, the lots were reversed and the experiment performed as above except group "B" was irradiated under the above conditions after each operation. Group "A" was not irradiated.

RESULTS: Refer to Chart #1.

Group "A", x-ray irradiated: 125 operations, 5 HVB

Group "B", not irradiated: 125 operations, 7 HVB

Group "B", x-ray irradiated: 125 operations, 4 HVB

Group "A", not irradiated: 125 operations, 4 HVB

X-ray radiated, by operations

<u>Group "A"</u>	<u>Group "B"</u>
#1 - 0	#1 - 0
#2 - 0	#2 - 0
#3 - 1	#3 - 0
#4 - 3	#4 - 1
#5 - 1	#5 - 3

Not irradiated, by operations

<u>Group "A"</u>	<u>Group "B"</u>
#1 - 0	#1 - 1
#2 - 0	#2 - 1
#3 - 1	#3 - 0
#4 - 1	#4 - 5
#5 - 2	#5 - 0

<u>A</u>	<u>Irradiated</u>	<u>Not Irradiated</u>	<u>B</u>	<u>Irradiated</u>	<u>Not Irradiated</u>
409022	0/5	0/5	407015	0/5	0/5
506020	0/5	0/5	506006	0/5	0/5
506027	0/5	0/5	506077	0/5	0/5
506028	0/5	0/5	506114	0/5	0/5
506040	2/5, #3, #4	1/5, #4	506119	0/5	0/5
506073	0/5	0/5	506137	0/5	0/5
506134	1/5, #4	1/5, #5	506152	0/5	0/5
506181	0/5	0/5	506156	1/5, #5	1/5, #3
506192	0/5	0/5	506163	0/5	0/5
511053	1/5, #4	0/5	511021	0/5	0/5
511064	0/5	0/5	511051	0/5	0/5
511096	0/5	1/5, #5	511059	0/5	0/5
511098	0/5	0/5	511055	0/5	1/5, #1
535030	0/5	0/5	535047	0/5	0/5
545144	0/5	0/5	535088	0/5	0/5
545145	0/5	0/5	535186	0/5	0/5
545183	0/5	0/5	535197	1/5, #5	0/5
555030	0/5	0/5	545036	0/5	0/5
555031	0/5	0/5	545044	0/5	1/5, #4
555080	0/5	0/5	545054	0/5	0/5
555083	0/5	0/5	545131	0/5	0/5
555146	1/5, #5	0/5	545166	1/5, #4	1/5, #4
555176	0/5	0/5	545174	0/5	0/5
555178	0/5	0/5	555147	1/5, #4	1/5, #4
555189	0/5	1/5, #3	555186	0/5	2/5, #2, #4

There were no indications of abnormal operations.

CONCLUSIONS:

Test results were investigated for significance as follows:

"A" to "B" irradiated - no significant difference.

"A" to "B" not irradiated - no significant difference.

"A" irradiated to "B" not irradiated - no significant difference.

"B" irradiated to "A" not irradiated - no significant difference.

Each operation was compared as above, no significant difference.

It was noted that the HVB occurrence was much higher on the later operations which verifies previous results obtained from other experiments relating interval and HVB rate.

Therefore, the conclusion is that x-ray radiation performed as per this experiment makes no significant difference in the HVB rate.

J. D. Hardin
Quality Control Engineer

JDH:GW

TOP

CHART #1

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