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AUTHOR W. C. Brown	SUBJECT CLASSIFICATION Vacuum Tubes	NO. R60XF30 DATE 6/28/60
TITLE EEN-333 -- REVISED GETTER FLASH PROCEDURE		
ABSTRACT EWR #VTE-188 -- Tubes processed by flashing getters immediately prior to seal-off from vacuum systems are compared for total residual gas pressure to tubes processed by flashing getters after tubes were sealed off vacuum systems. Comparisons of residual pressures determined from current flows in the cold cathode ion gauge.		
G.E. CLASS. 2	REPRODUCIBLE COPY FILED AT Technical Data Center P. O. Box 11508 St. Petersburg, Florida	NO. PAGES 10
GOV. CLASS. NONE	CONCLUSIONS Residual gas pressures in tubes, in which the getters were flashed on the vacuum pump, were significantly lower than in tubes in which the getters were flashed after seal-off. Recommendation is that getters be flashed while tubes are on the vacuum pump.	

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 W. C. Brown
COUNTERSIGNED D. Weinberger *β* SUB-SECTION Vacuum Tube Engineering
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EEN-333 REVISED GETTER FLASH PROCEDURE

INTRODUCTION

Recent experiments dealing with getter flashing techniques have shown that flashing before tube seal-off results in lower residual pressures. EEN-333 was run to evaluate the application of this technique to the vacuum tubes being manufactured at GEXT.

PREVIOUS ENGINEERING LABORATORY WORK

Previous mass spectrometer analyses of residual tube gases revealed sizeable amounts of hydrogen, carbon monoxide and methane. Holding periods after seal-off varied from one hour to several months. Further studies illustrated the following points:

1. Gas is released from the previously degassed getter assemblies at a point during the getter flash cycle. This point immediately precedes the evaporation of barium getter material.
2. Degassing of incoming samples of getter material showed an evolution of hydrogen, carbon monoxide and methane. Up to 120 micron-liters of hydrogen was released during the complete outgassing of a typical 32mm length of getter material.

PROCEDURE AND TEST

Twenty type XIV tubes were processed during fiscal week 20 by flashing getters while the tubes were on the pumps. Periodic ion gauge measurements were made on these tubes. Ion gauge currents of twelve type XIV tubes processed during fiscal week 20 by flashing getters after seal-off are used as control values. The results of the comparative ion gauge currents appear in charts I and II. Plots of average ion gauge currents as a function of time for the two groups of tubes are shown in Chart III.

Ion gauge currents are measured on individual cold cathode gauges built into each tube.

In considering all parameters that would affect residual tube pressures, the expected ion gauge current at approximately 4 hours after getter flash is zero. This presumes that there is no in-leakage of argon during the hold period.

CHART I

RESULTS

Control Tubes

Ion gauge current readings (uA)

Tube #	#1	#2	#3	#4
B-0203098	2	3	8	9
B-0203093	0	5	10	9
B-0203096	0	0	4	5
B-0203097	0	0	5	6
B-0203069	0	2	4	5
B-0203091	0	3	5	6
B-0203113	0	3	5	6
B-0203101	1	4	14	14
B-0203100	0	3	7	6
B-0203064	2	4	8	12
B-0203071	0	3	5	12
B-0203090	0	0	5	11
	0.1	2.5	6.7	8.4
After system seal off		After Argon hold - 10 days after #1 reading	4 hours after getter flash - 6 hours after #2 reading	9 days after #3 reading

CHART II

REN-333 Tubes

Tube #	Instantaneous ion gauge current readings (nA)				
	5/23	5/31	6/6	6/9	6/13
0203072	0	2.5	3	3.5	4
0203073	0	0	4	4	4.5
0203076	2	2.5	4	4.5	5
0203077	3	3	3.5	3.5	4
0203078	0	0	0	3.5	4
0203079	3.5	3	3.5	0	4
0203080	0	0	0	0	0
0203083	0	0	0	0	0
0203084	0	0	0	2.5	3
0203085	0	0	0	0	0
0203086	0	0	0	0	0
0203087	0	0	0	0	0
0203088	0	0	0	0	0
0203089	0	0	0	2	2.5
0203106	2	2.5	3.5	3.5	4
0203107	0	2	2.5	2.5	3
0213001	0	2	2	2.5	3
0213002	0	2	2	2	2.5
0213004	0	0	2	2	2.5
0213003	0	0	0	0	0
Average	0.5	1.0	1.5	1.8	2.3

The above tubes were sealed off the exhaust system on 5/20.

AVERAGE LONGAUGE CURRENT (mA)

COMMENTS

1. The argon hold test will only be affected to the degree that virtual leaks (internal outgassing) cannot be measured when tubes are processed in accordance with this EEN.
2. The twenty EEN-333 tubes were tested electrically and outputs recorded. The output values were equal to those of control tubes. One tube (0203073) failed electrical test due to an open cathode condition.
3. In reviewing over 200 separate data recordings of GEXF produced tubes and comparing ion gauge currents after argon hold and 4 hours after getter flash, it was found that less than 1% of these tubes had a decrease in gauge current after getter flash. The average increase in gauge current for type IX and XIV tubes is as follows:

	After Argon Hold	4 hours after getter flash
Type IX	.09 μ A	6.61 μ A
Type XIV	3.53 μ A	7.69 μ A

GEXM data reviewed during the QEP 75 meeting at Sandia confirmed this finding.

4. Testing of EEN-333 tubes will continue and the data will be recorded.

CONCLUSIONS

1. Tubes manufactured by flashing the getters on the pumps contain significantly less residual gases than tubes with getters flashed after seal off.
2. Tube operation is not adversely affected by using the revised getter flash procedure.

RECOMMENDATIONS

1. That getter flashing procedures be changed specifying that tubes be processed by flashing getters on the pump.
2. That extensive getter studies be made toward an improved getter system.

I would like to acknowledge the cooperation and assistance of Mr. Cal Wyatt, (QC) in supplying data for this report.

W. C. Brown
Mass Spectrometer Engineer

APPENDIX

ENGINEERING NOTICE
PINELLAS PENINSULAR PLANT

Tube EEN-333
April 13, 1960

SUBJECT: Revised Getter Flash Procedure

REFERENCES: (1) 118A1345
(2) 802C355
(3) Letter dated 6-5-60 from W. C. Brown to L. C. Wimpee.
(4) EWR VTG-135

Purpose:

To evaluate relative performance and gas up rates of these tubes as compared to conventionally processed tubes.

Description:

Assemble and process normally twenty (20) type XIV C tubes with the following exception:

- A1 - Immediately prior to seal off at tube exhaust, flash the getter by passing 5 amperes of current through the getter for 10 seconds then increase the current to 6.2 amperes and maintain for one minute. Seal tube off system as soon as possible after performing the above.
- A2 - Deliver all tubes to VTE lab (W. C. Brown) upon the completion of A1.
- A3 - VTE to perform all electrical tests and make periodic peg current measurements. Tubes showing abnormal peg current increase will be analyzed for residual gases by mass spectrometer analysis.

Quantities & Identification:

Twenty (20) type XIV C tubes scribed EEN-333. Serial numbers to be tabulated and furnished to W. C. Brown, D. Grimm, and C. Wyatt.

Responsibilities:

- (1) C. Franek and C. Wing - Assemble tubes and scribe.
- (2) B. Barber and C. Ludwig - A1, A2.
- (3) W. C. Brown - A3.
- (4) W. Burrows - Schedule.
- (5) D. Grimm - Coordinate EEN.

Schedule:

Assemble tubes during fiscal week 16 or 17. Exhaust and supply tubes to VTE during fiscal week 17.

Hold Point:

All tubes to be scrap upon completion of test.

D. S. Grimm - Tube Area
Production Engineering

DSG:ec

Approved:

H. R. Sine, Manager
Production Engineering