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V-52 KLYSTRON OSCILLATOR
REFINEMENT AND PRODUCTION PROGRAM

Progress Report for
December 1953



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Engineering Report
No. 132-18

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V-52 KLYSTRON OSCILLATOR
REFINEMENT AND PRODUCTION PROGRAM

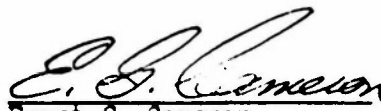
Progress Report for
December 1953

Prepared for: Bureau of Ships
Navy Department

On: BuShips Contract No. NObs-5358

By: Claude Conner and David Clifford

Approved:


Emmet G. Cameron
Chief Product Engineer

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PURPOSE

The purpose of the program covered by BuShips Contract No. N0bs-5358 is to refine and produce one thousand (1000) rugged X-band local oscillator V-52 klystrons. This tube is to comply with the specifications of SHIPS E-720, which were subsequently modified at a conference held at the Bureau of Ordnance, Washington, D.C. on 20-21 May 1952 and later at a conference held at Varian Associates on 29-30 September 1952.

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PROGRESS

In the month of December two tubes incorporating the short moly drift tube mentioned in last month's report¹ were completed and tested. The results were almost duplications of those for the tube made last month, having excellent power, bandwidth, modulation sensitivity and drift characteristics.

In addition to the tubes mentioned above (which utilized short drift tubes machined from molybdenum rod), two other tubes were completed and tested in which the drift tubes were of the same configuration but drawn from sheet moly. These tubes compared favorably in all respects with the standard tube. A total of approximately ten tubes are to be made with this construction in order to evaluate the distribution of the various test results.

Reference was made last month to the possibility that the flared end of the standard V-52 drift tube may contribute to the overall drift compensation within the tube. Further investigation revealed information which seems to support this hypothesis. Part of the evidence is that over the past several months a decreasing percentage of tubes have fallen within ± 3 mc drift even though there has been no change in reflector header "fit" or pretuning. It has been determined, however, that due to die wear the radius at the transition to the flared portion of the drift tube has been

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¹ Varian Engineering Report No. 132-17

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increasing and the effective included flare angle has been decreasing, thus allowing this part to "degenerate" toward a straight tube. Following the reasoning employed for the design of the short, flared drift tube¹, it can be seen that a straight tube can offer no additional compensation (other than that due to differential linear expansions relative to the cavity wall).

Toward the end of the month a group of tubes was started in which the radius and flare angle of the drift tubes was controlled by an additional drawing operation. Steps are also being taken to rework all partially completed drift tubes currently fabricated in order to conform with dimensions previously obtained.

Leaks in the mica window seal have represented the major cause of rejection of the present V-52 tubes. Different types of glass used for sealing have been investigated, but no satisfactory results have been obtained. Now a synthetic mica, which was developed by the Naval Research Laboratory, is being investigated as a replacement for the present mica window. The synthetic mica is to be brazed into position rather than sealed with glass. This material - and the process involved - will be investigated further.

Emission troubles have been experienced of late in the V-52 tubes. Studies of this problem will continue next month.

Oxidation of the tube body during life test was experienced during this program which resulted in the practice of gold plating the finished tube. Unfortunately, this necessitates a considerable amount of time and care in

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order to protect the mica window and glass-metal seals. If the tubes are plated before assembly metal diffusion takes place during exhaust bake-out, which produces a surface that oxidizes quite readily. Rhodium plating was investigated this month, but with no better results. Other techniques are to be investigated.

One tube was constructed this month in which the tube flange, tube body, reflector shell, exhaust tubulation, drift tube assembly, and reflector header were all brazed together at the same time. The tube produced was highly satisfactory, and more tubes of this construction will be made in January.

The short focus electrode mentioned in previous reports^{2,3} has been standardized. Further tests conducted this month indicate that an optimum design has been established.

The modified reflector header, which was discussed in the September report², was incorporated in a number of tubes and these tubes were tested. No significant change in the performance of these tubes over standard tubes was noted.

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2 Varian Engineering Report No. 132-15

3 Varian Engineering Report No. 132-16

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Performance data of tubes tested in December are given in Table I.

TABLE I

Average Performance Data of Tubes Tested in December

	<u>Beam Voltage = 350 v</u>		<u>Beam Voltage = 300 v</u>	
Frequency (mc)	8800	9600	8800	9600
Beam Current (ma)	50.05 (64)	49.81 (63)	40.34 (140)	40.15 (136)
Reflector Voltage (v)	-113.13 (64)	-156.20 (63)	-67.10 (140)	-98.25 (136)
Power Output (mw)	120.30 (64)	146.35 (63)	52.35 (140)	66.56 (136)
Bandwidth (mc)	67.73 (64)	46.23 (63)	75.79 (140)	48.93 (136)
Mod. Sens. (mc/v)	2.67 (61)	1.64 (60)	4.19 (140)	2.47 (134)
Drift, 10 minutes (mc)	----	----	-0.56 (28)	-3.13 (125)

The number in parenthesis indicates the number of tubes tested.

Additional facilities were received for the plating shop in December.

The items are as follows:

<u>Quantity</u>	<u>Description</u>	<u>Equipment No.</u>
1	Spare tank for filtering	93326-000125
2	Methanol Dip Tanks	93326-000123
		93326-000124
1	250 Amp. Nickel Plating Rectifier	93326-000122
1	100 Amp. Electropolishing Rectifier	93326-000117
1	Copper Strike Tank	93326-000111

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The above items, with the inclusion of the Duct Boards that were also received, and items previously reported complete the equipment ordered under Item No. 14 of the facilities contract (NObs-3227). Installation of all items is scheduled to be completed during January 1954.

Also received were Items No. 133 and No. 134 of the Environmental Test Equipment. These items included an M.B. Model C31 Vibration Tester and Exciter Power Supply No. 1320134.

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PROGRAM FOR NEXT INTERVAL

Additional tubes incorporating the drawn, short moly drift tube will be built and tested.

Tubes utilizing the drift tubes with the controlled flare angle will be completed and tested.

The synthetic mica material for the window will be investigated thoroughly during the next month.

Studies of the cause of emission troubles will continue.

Plating metals and techniques which might eliminate the oxidation problem will be studied.

Additional tubes with all subassemblies brazed together simultaneously will be built in the next interval.

Estimated expenditures during December 1953: \$30,560.00

Estimated man-hours during December 1953: 3636

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