MEMORANDUM ON VISIT TO TUBE LABORATORIES OF THE I.B.M. COMPANY, POUGHKEEPSIE, NEW YORK

April 8, 1952

On March 24, 1952, Messrs. Charl Cillié, L. E. Record, F. W. Tietsworth, and the writer visited the Tube Laboratories of the I.B.M. Company in Poughkeepsie, New York. Mr. Jack Goetz met us at the Reception Building and introduced us to Dr. Samuels who is in charge of their advanced development work on tubes, diodes, and transistors.

The morning was spent discussing the storage tube and inspecting the testing set up. Mr. W. Mutter explained the testing of the I.B.M. Storage Tube, Type IBM-79, and the RCA-CR3551. They are performing three (3) types of tests on these tubes. The first test we discussed was blemish location. This test was performed by scanning the face of the storage tube at a horizontal frequency of 1,000 cycles and a vertical frequency of 3 cycles. The output signal is amplified by a video amplifier with a frequency response between 100KC and 8MC, and the resultant output signal used to modulate the grid of a DuMont type 294A scope with P7 screen and the vertical plates of a tektronix scope. The blemish pattern is then visible on the face of the P7 screen due to the change of output at a blemish site. The magnitude of the blemish signal is read on the tektronix scope. Tubes are rejected if any blemishes appear within a 1.9" x 1.9" area which have a signal output greater than .1 millivolt. They reported that from a total of 180 tubes they had been able to obtain 60 blemish free samples after they had discovered the sparking technique. The sparking operation consists of vigorously sparking the face and screen of the storage tube for several minutes. Care must be taken during this operation to discharge the screen with the spark coil, otherwise, a pattern cannot be obtained on the face of the storage tube for two or three days.

The second test made is spill-over which requires a considerable amount of equipment. This test is performed by writing a 1 microsecond dot then writing 4 microsecond dashes n times adjacent to the 1 microsecond dot and reading out the signal originally stored by the 1 microsecond pulse. The tube is rejected if the read-out signal is lower than 50% of its original amplitude for a given spacing of storage areas. Normally their tests consist in setting the binary counter to apply 900 pulses to the 4 microsecond dash. We did not obtain their test limit for this test but it appeared that a spot spacing of approximately .030 inches was about the rejection limit. The output from the storage area is read on a P7 scope. This test is performed in the center and at the corners of a 1.6" square.

The final test being made was a check for the "mudhole" effect. This phenomena is described in the March 21, 1952 report. Test equipment required to perform this test includes another binary counter and a balanced direct coupled sweep amplifier which permits the writing of any number of signals with a predetermined waiting time and a read out signal. Satisfactory tubes must not show a reversal in signal output on the first pulse following 900 write-ins and a waiting period of 16 milliseconds. A tektronix scope is used to record signal polarity and intensity. Dr. Samuels believed that the "mudhole" effect was either due to bombardment induced conductivity or the malter effect. Blemishes could not be located by an optical examination of the screen surface. As a rule pinholes do not show up as screen blemishes.

The afternoon was spent in the Tube Laboratory which is under the supervision of Mr. J. Goetz. Mr. John B. Little is in charge of storage tube manufacture. Approximately 1,800 square feet was devoted to the various operations with the exception of exhaust and test. They are presently buying most of their gun parts from R.C.A., with the exception of the deflection plates which they fabricate in the Laboratory. The grid cathode assembly is purchased from R.C.A. and assembled to the gun structure in the mount room which is about 18 x 20 feet in size and is temperature and humidity controlled. The temperature is held within 74° and 78°F and the humidity at approximately 50%. The completed mounts which use the ceramic rod construction are inserted into polyethylene bags until ready for gun sealing. The operators use rubber finger cots during the assembly work after the gun parts have been hydrogen fired.

The storage screen is applied by liquid settling in a solution of potassium sulfate and lithium hydroxide, the formula for which was not disclosed. However, this is an old process familiar to workers in the cathode ray tube field and information on it is available in Syracuse. Willemite is used for the storage surface because of its greater brightness, however calcium tungstate gives a signal about two times as great but the storage pattern is very weak in visual intensity, making it more difficult for the computer operator to set up the tubes.

The phosphor weight is about 1 1/2 milligrams per square centimeter and the settling cushion about 120 cc. A minimum settling time of about two hours is required. After screening, the mouth of the bulb is always kept covered or pointed in a downward direction. The screen is baked out at 450°C for a period of about two hours. Special techniques were used during gun seal-in to minimize loosening of the graphite coating and the introduction of foreign particles. After exhaust the outside of the bulb is coated with a very low resistance silver coating, Hanovia Cold Setting Silver Paste #2, which is baked at 150°C to further increase its abrasion resistance.

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CATHODE RAY TUBES

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