TRIP REPORT

Plant Visited - CBS-Hytron
Newburyport, Mass.

Date - May 7, 1953

Persons making visit - G. L. Case
W. T. Posey
C. E. Buchwald
W. L. Jones

Persons contacted -

L. A. Freeman - Plant Manager
A. J. Harcher - Chief Engineer
Robert Paine - Factory Control Engineer

FACTORY, PERSONNEL AND PRODUCTION

The picture tube plant contains about 50,000 sq. ft. with an additional 20,000 sq. ft. in a two-story wing which is nearing completion. They have a separate warehouse of about 100,000 sq. ft. in which they do outside painting, finished tube polishing, pre-ship testing, branding, etc. We did not visit this building.

Direct labor totals 538 people on 3 shifts. Operating on a 5-day basis, their estimated daily capacity is 3,500 to 4,000 17" and smaller or 2,500 21" sizes with 120 to 130 27" size. They stated that their average pay rate was $1.21 to $1.23 per hour which they compared with $1.24 to $1.26 for Sylvania at Seneca Falls, $1.25 for RCA at Marion and $1.31 for Westinghouse. Factory supervision consisted of foremen over the screen room, mounting, finishing and a unit foreman (gun seal to exhaust). On the 2nd and 3rd shift, unit foremen have plant responsibility. The engineering staff consists of one factory control engineer, a chemical engineer, one glass engineer and one senior engineer assigned to long range planning.

The new plant under construction at Kalamazoo, Michigan, will have a manufacturing space of 80,000 sq. ft. and warehousing space of 150,000 sq.ft. It is being set-up to produce 24" and 27" aluminized tubes at a rate of 4500 to 5000 per day.

MOUNTING

Hytron is using two Federal automatic pin welders which have been rebuilt to improve the indexing and parts holders. The machines give 90 to 95% good parts and operate about 75% of the time. Some pin welding was also being done by hand. The Hytron people were not convinced that automatic welding saved too much in view of the maintenance and downtime. Most of the production was electrostatic types.

ETC heaters, RCA 623A cathodes and Baker R 500 emission mix were being used. The heaters and cathodes were coated by the receiving tube plant from whom they also obtained stems whose outside diameter, they felt, was especially critical.

Mount capacity was stated as 4,000 per day.

BULB WASH

Bulbs were washed with 5% hydrofluoric acid on a machine of their own design which also served as a transfer conveyor into the screen room. The machine indexed 5 positions every minute requiring about 8 seconds for the transfer. An Entwhistle washer had recently been obtained and was being used on rework bulbs with 3 acid, 2 water and 2 detergent tanks (in order).

For removal of outside paint hot Oakite M-3 was used. To remove films from rework bulbs, a small quantity of sand was agitated in the bulbs before washing. Aluminum was removed with a caustic. Rework bulbs were washed with 14% hydrofluoric acid in a barrel prior to regular wash.

SCREENING

The screening conveyors were Hytron's own design with small wheels at the loading end and large ones at the unloading end and an overall of 55'. The present facilities include two belts for 17" and 21" and one new unit under construction for 27" size. Dispensing is 100% automatic by means of a carriage which rides above the bulbs. In first position of the carriage, cushion water and electrolyte is dispensed by controlling the time of flow. In the second position, Kasil and phosphor suspension is added by means of a two-stage arrangement. In the first stage, the phosphor and Kasil are metered into a mixing chamber. From this the mix is fed into the dispensing funnel. Settling time is 15 to 20 minutes with a 3 to 4 minute pour-off.

For 17" rectangulars ten liters of cushion water and 690 cc. of a "Secret" electrolyte are used. Surgle tubes are required because of this deep cushion. Kasil #1 is diluted with 1½ parts of water. DuPont 2629 or Sylvania 1530 phosphors are suspended to give .022 grams per cc. of water. For 17" size screen density is 5.2 mg. per square cm. The amount of phosphor dispensed is checked once per day by centrifuging. Accuracy of dispensing was claimed to ± 3%. The Kasil for 17" was 190 cc. @ 2.5/1 dilution, along with 600 cc. rinse.

Screening cont'd

The phosphor suspension is prepared every other shift and stored in continuous stirred tanks. The suspension is circulated through a piping system to the dispensing mechanism and returned to the storage tank. Pressure at the draw off points is about 10 P.S.I. Solutions are kept at room temperature, about 70°F.

The capacity of the present facilities is 180 an hour for 17" or 160 an hour for 21". Capacity for 24" and 27" is now 12 an hour, using tilt tables. When the new conveyor is in operation, the output will be 90 an hour screened and filmed 24" or 27" bulbs. The new conveyor will have two lines for screening and two for filming.

When Freeman was asked if automatic dispensing reduced yellow centers, he answered no, that it was the deep cushion that brought the problem under control.

The screens are dried on a conveyor with dried air at 80° to 90° F in about nine minutes. This air was pre-dried through alumma gel.

Screening yield was stated as 90%.

Kasil and electrolyte were prepared in mix tanks in a 70°F room and pumped to level-controlled head tanks, from whence they were dispensed without further filtration.

FILMING AND ALUMINIZING

Filming and aluminizing is still in an experimental stage at Hytron. They pre-saturate the 10 l. of cushion water 1½ minutes before dispensing of the lacquer. In the case of 27" bulbs they use 2.3 cc. of an amyl acetate solution of Raffie-Swanson 120 sec. nitro-cellulose. The film dries in three minutes. Pour-off is accomplished in 3 to 5 minutes. The yield is 85 to 90%, using ultra violet side lighting. Present capacity is 24 per hour on tilt tables. The lacquer formulation was 35 gm. 125 cc. nitrocellulose, 1000 cc. amylacetate, 200 cc. ethyl acetate, 250 cc. Butanol, 25 cc. B 400.

Aluminizing is carried out on two 5 position National Research aluminizers with valved backing. The capacity of the set-up is 40 per hour. A filament similar to G.E.'s is used to evaporate 450 mg. of aluminum for the 27" bulb. Hytron claims they are getting 15 to 18 flashes per filament. The flash cycle is 1½ - 2 minutes.

INSIDE PAINTING AND BULB BAKE

Dag is applied by hand at individual positions followed by a bulb bake cycle of 1½ hours on 27", 55 minutes on 21", with a peak oven temperature of 420°C. 21" bulbs are in hot region for eight minutes; 27" for 22 minutes. Heating rate 22°/minute maximum. No air flush is used. Breakage was quoted at 2 to 3%. Exit temperature is 265°C.

GUN SEALING

The facilities consisted of two 8 head 16 position machines operating at approximately 15 seconds per position. For 17" and 19", the output was 120 per hour. For 21" to 27", every other head was used and the output was 60 per hour.

All bulb necks are pre-heated for 2 minutes by 4 2500 watt calrod units located on the transfer conveyor and so positioned as to heat the gun seal area of the neck. Stems are not pre-heated. The first five index positions on the sealer used 3 cannon burners each and a pin fire on the stem cup. The next position had a pin fire on cup and a heavy bushy flame on the neck. The three sealing positions had 4 or more pin fires each. Annealing was done in 4 positions with a single cannon burner each. Within 15 seconds after removal from the sealing machine, the tubes were loaded face down on a conveyor belt which had an enclosed heated area giving the necks a 9 minute slow cool down. The tunnel temperature was held at 420°C for the first 5 or 6 minutes. Their seals were tapered in much more than ours. However, their stem leads were on a smaller diameter. The holders at sealing had a spring loaded holder around the cone, an open U at the reference line, and a narrow neck clamp high on the neck away from seal. There was plenty of room to anneal the seal strain and eliminate cracked necks. Sealing machines had hoods and draft shields around them. A third 8 head gun sealer to operate at 60 per hour was on order to go with the new exhaust machine under construction.

EXHAUST

Hytron's exhaust facilities included two inline machines of their own design and construction which were quite similar to DPI machines and a third unit under construction. Each machine was equipped with 63 buggies operating on a continuous index. The capacity of each machine was 30 per hour for 27" tubes, 57 per hour for 21" or 70 to 80 per hour for 17". The new unit under construction will clear 27" tubes on each head and will thus have a capacity of 60 per hour. The bulb holders are spring loaded. In addition, when 27" tubes are loaded on the exhaust buggies, the tubulations are softened with a hand torch before and after the port compression nuts are tightened.

The oven temperatures were such that tubes reached a maximum temperature of 385°C with 15 minutes above 350°C. Tip-off temperature was 160 - 175°C for 21" and slightly lower for 27". Tubes, after hand tip-off with a lifting aid are immediately placed face down in regular shipping cartons that had been ventilated by cutting holes in the side. Small carts were used that held 4 boxes each.

Exhaust (cont'd)

At one time the tubes were placed directly onto a transfer conveyor after tip-off. Chain implosions, however, became serious. During a visit by the CBS Directors, a chain of 20 implosions occurred while the Directors were observing exhaust operations. Present rate of implosions was stated as 1 to 3% (seemed low).

No cathode current is drawn during exhaust. Maximum heater voltage applied is 12 volts. R.F. heating is used at 7 positions. The coils are made of heavy aluminum bar with 6 turns, the top one being shorted. Only air cooling is used. For oven checking a heat curve buggy similar to ours is used.

In addition to the inlines there were 16 positions of bench exhaust plus a few in the receiving tube plant. These units were operated on an hour schedule. The capacity of the trolleys was given as 120 to 130 per day.

The new inline will be unloaded directly onto the basing conveyor. This will be accomplished by having a hinged curve in the conveyor that can dip down over the tip-off position and lift the bulb. They were extremely proud of this device and indicated that they had patented it.

BASING AND AGING

While tubes were cooling in the carton in which they had been placed after tip-off, the bases were threaded. After cooling, tubes were placed face down on a belt conveyor and given a base bake of 5 minutes. The tubes were then removed and lead wires dip soldered at the same time the getters were flashed. Solder pots were temperature controlled.

For sparking and aging, the tubes were returned to the same belt conveyor and connected to seckets and lead wires which were supported from another belt spaced above the tube belt. All tubes were pulsed AC sparked for 5 minutes with the anode grounded and all other elements tied together using 40 KV. After sparking, another socket is applied to the base, sparked by hand with a Tesla coil and then short tested, the aging belt being set up to stop if a shorted tube appears on aging. The aging schedule totals 30 minutes consisting of 3 minutes at an Ef of 12 volts and the remainder at

$$E_f = 10 \text{ volts}$$

$$G_1 = +12 \text{ V.D.C.}$$

$$G_2 = +500 \text{ V.D.C.}$$

TESTING

Two double ended test sets operated by two testers handled 17" to 21". A third conventional single position set was available for 27" tubes. For the double ended units the output was 80 per hour each. The 1st tester loaded, unloaded and performed gas, emission, heater-cathode leakage and shorts tests. The 2nd operator performed I_b, G-1, G-2 leakage, heater current, focus and screen tests. Tubes requiring rework were returned on the underside of the basing-aging belt to a rework and analysis bench. All gas and low emission rejects were recorded by exhaust buggy number. This information was examined by exhaust personnel at least every 30 minutes and used for buggy control.

After initial test, tubes are held for a couple of hours and then given a heating time test just prior to shipment to the warehouse where all finishing operations (i.e., mechanical inspection, outside painting, polishing, branding, etc.) are performed. We did not visit the warehouse. On the heating test, each tube must reach at least 740 microamperes emission in 30 seconds from a cold start.

REWORK

The following facilities were available for rework:

4 reneck lathes
1 belt type wet grinder

MISCELLANEOUS

Hytron has a Baird Associates grating spectrograph which they use to analyze such materials as phosphors, cathode blanks and emission mix.

R. R. Law has been hired to direct their color program, reporting directly to a vice-president. From remarks made by L. A. Freeman, it seems that Hytron does not intend to make the RCA type color tube but plans to try some version of the grid type. About 10,000 sq. ft. of the new addition has been set aside for a development shop for color.

Elwood Schaeffer, from National Union, had recently been hired.

The following seal to stock scrap figures were given:

Feb. and March	12%
April	18%
May	13% (gun seal 1%-Exhaust electrical 3%)

*NOTE: This report contains information from the notes of W. T. Posey and G. L. Case.

C. E. Buchwald
W. L. Jones, Jr.
9/9/53

CEB/WLJ:rn

cc: CE Buchwald
GL Case
RW Bryant - BTP
VC Campbell
CH Dichter
HR Hemmings - BTP (2)
WL Jones, Jr.
RE Lee
RA Norman (2)
AN Reagan
LE Record
PE Sullivan - BTP
WT Posey - BTP