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TRIP REPORT

-Corning Glass Company-

December 10, 1954

Purpose of Visit: To discuss various methods of bulb closure, with particular attention to electrical sealing.

Date of Contact: December 7, 1954

Report by: M. J. Ozeroff

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Persons Contacted: J. Allen, Color Plant Manager
M. Hunt, Design Engineering
W. Lynn, Sales Representative
Dr. McCartney, Development Engineering
P. Orr, Field Engineering
J. Sheldon, Development
F. Shork, Sales

Mr. M. Hunt started the meeting off with a description of four methods of sealing bulbs. The first three of these are experimental.

I. Double X-Band Method

The first method described is called the double x-band method. A single flange of 430 stainless steel is welded to the faceplate and one to the funnel. The material is .080 inches thick. After welding, the face of each flange is ground flat to within .002 inches. A glass frit, suspended in a binder for example, is applied to one flange. The frit may or may not be fired. The two parts of the bulb are then placed together properly located. Registration can be done accurately - e.g. by locating pins in the flange. The temperature is raised to 430°C for about 15 minutes (or possibly 440° or 450° for 5 minutes). It is then lowered to 400°, pumping is started since the seal is now made, and the bulb passes subsequently through the remainder of the usual exhaust cycle. Corning feels that this is a very good closure, vacuum-wise. To open such a tube, a wedge is inserted between the two flanges and rapped sharply. If this is done at several points around the periphery, the frit seal splits open. In the sealed condition the frit layer between the flanges is approximately .002 inches thick. No work has been done as yet on attaching some kind of flexible mounting structure to the flange on the funnel side. Hunt assured us this can be done. Corning claims that this construction is very much stronger than the existing one because of the glass being in direct compression at the seal. The flat surfaces and thin frit layer presumably make this possible. Four advantages were claimed for this bulb: 1. Cost-wise it would be about \$4.00 cheaper than the existing color bulb, because of the reduction in the flange and in some glass. 2. It is approximately 20 per cent lighter in weight, but would approximate the weight of the present 21-inch monochrome bulb. 3. It is claimed that handling shrinkage will be less. 4. The salvageability of this bulb is greater. Presumably, the bulb can be opened and resealed many times.

Although Corning claims that the vacuum properties are satisfactory, they did not state specifically that there would be no vacuum problem with this kind of closure. Further questioning elicited the fact that some customers have run gas pressure measurements on such bulbs, and so far no adverse results have been reported by them. We were assured that this construction would adequately support a 10-pound sandwich.

II. Single X-Band Method

A variation of the double x-band, in which a single flange is sealed to both the panel and funnel with frit, was briefly described. It appears that little work has been done on this, since there was very little information available. This construction is somewhat weaker than the double x-band - it will support a six-pound sandwich.

III. Frit-Frit

In this kind of closure a direct seal is made from funnel to panel using a frit between the two glass surfaces. The skirt edge of the panel must be made rather broad to take into account manufacturing tolerances ($\pm .050$ inches) in the funnel dimensions. Thus, here one eliminates the flanges but adds more glass to the bulb. In order to salvage the bulb, it must be opened in an oven at high temperature. If air is let into a cold bulb, a crack occurs at the seal. This occurs because of unloading of the funnel which is a relatively flexible member. Hunt indicated that this tube could be resealed satisfactorily if properly opened, but it was apparent that Corning had not fully investigated this. Again, this bulb would be about \$4.00 cheaper than the existing one, eliminating flange costs, but adding glass.

IV. Electro-sealing

Some confusion existed in the writer's mind over this method, as it was not apparent at first what the new concept was here. Mr. Allen clarified this. It was news to the writer that the new concept here is simply a transfer of Corning's existing sealing method to the tube manufacturer. This, of course, brings in other related factors, such as different screening, filming, and other processes. In electro-sealing, the panel and funnel are first pre-heated to about 175°C, chucked up in a horizontal lathe where the edges receive further heating (oxygen flame), then two so-called conductive flames are applied to the areas to be sealed. A potential of some 3000 volts (60 c. A.C.) is applied via the flames, and the resistance is such that about three amperes of current are drawn. The seal is completed in this way, and the bulb will subsequently be annealed. The production rate is determined principally by the capacity of the Lehr. It is found that four lathes are adequate to supply a Lehr running at 100 bulbs per hour. The writer has some further details on this process, but they are not pertinent for this report.

The question was asked as to whether or not Corning had other sealing methods in development. The answer was no. Did they think the flange brazing method was a probability? Sheldon insisted that flange brazing was definitely out because of the difficulties encountered in finding a brazing material which would wet the flange surfaces. It is the writer's opinion that Sheldon and the others were concealing some information, possibly involving this very method. No other concrete possibilities were suggested by the Corning group.

Some inconclusive discussions took place on the matter of glass failure in the PA bulbs. Corning wants to examine all the glass from such failures.

The writer asked if Corning could assist in finding a high resistance coating which could be used to alleviate the fringe field difficulty (in the POF tube). Here again, no encouragement whatsoever was offered by them.

A tour was made of part of the Pressware factory, where the electro-sealing method was observed in operation. We were shown also the panel- and funnel-forming operation. It's a hot place.

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