Mr. I. C. Eaton -

A Report on the Control Station in the Works Laboratory of the Bridgeport Works

Introduction;

The following report is based on the experience obtained during a two-month test assignment with the Control Station. The function performed was essentially that of an advisory Quality Control Engineer.

The subject is divided into three parts. Part one is concerned with the methods in use prior to May 1, 1949; the second part refers to the changes instituted as of May 1, 1949; and part three discusses various overall features of the picture together with a number of recommendations for future action.

I would like very much to thank Mr. E. J. Butler, Mr. T. A. Gilly, Mr. B. M. Fairbank, Mr. M. S. Greenhalgh, Mr. S. f. White, and Mr. A. J. D'Apice for the assistance which they have rendered me; and finally I would like to express my appreciation to the workers in the Control Station for their interest and cooperation.

PART I

The Control Station prior to May 1, 1949

The Control Station really performs three separate and distinct inspection functions. First is the Incoming Materials Inspection; second is the in-process Banbury Mix Inspection; and third is the finished Wire and Cable Inspection.

The changes which have been made have referred primarily to the In-process Inspection function. Here the discussion will center on this topic.

A sample of every batch of rubber, synthetic rubber, and Flamenol which is mixed is sent to the Control Station. No batch may be used in further operations until the Station has "released" it.

The station does not test every sample which it receives, but rather selects every second or third, etc. sample for actual testing purposes. If the samples tested are satisfactory, the other untested batches are assumed to be acceptable also.

Various tests are run in the station depending upon the compound. For rubbers and synthetic rubbers, the tensile strength and the elongation are alway tested and occasionally the modulus (tensile stress at 200% elongation), the specific gravity, the hardness, and the set. The way these tests have been run in the past has been to cut two dumbbells from each press cured sample and to run tests on both of these dumbbells. Later, the averages were taken for each sample and then these averages recopied on a separate sheet for each compound. These sheets covered a month's results on a given compound. The original sheet on which the calculations were made was sent to the chemists in 25E.

The possible causes for rejection of rubber or synthetic rubbers are numerous; they are: failure to meet any of the physical properties tested, lumpiness, failure to cure properly in the specified time, and poor dispersion.

As to the Flamenol compounds, the most important tests are the ones for specific resistivity, brittle point, and specific gravity. In addition, tests are made on all outgoing stock (to Lowell, Poughkeepsie, etc.) on every fourth batch as to tensile strength and elongation. The compounds are tested 100% for specific resistivity, brittle point, and specific gravity. A rejection occurs when any batch fails to meet the specifications for any of these properties. However, the chemist in charge of the compound may release it if he feels that it will "come in" after it is aged on wire.

The forms in use were unwieldy and caused a great deal of extra work. Form A was prepared initially for the testing of finished wire; yet it was being used for the testing of Banbury stocks. Form B, while being complete for its purpose, necessitated the file being kept by date rather than by compound.

The other changes which were made had to do with the calculation of a "K" value for Flamenol covered wire and burn-out percentages for Flamenol and Code covered wire. The actual tests are run in the test tank by the Inspection Department, but the results were averaged in the Control Station. While the results obtained were approximately correct, the method used was laborious and difficult to follow.

PART II

Changes instituted as of May 1, 1949.

After a study of various compounds for a number of months to see how well controlled the mixing process was, it was decided to concentrate on the development of new and simple forms, which could potentially be used in conjunction with a good sampling plan and a set of control charts.

Form C is the result for Physical Properties. It has the advantage of not only being applicable with a sampling plan but it can also be used without a change in the sampling procedure. This form is made out in duplicate at the testing machine, here is for reference, a table giving actual tensile strength for break/thickness for a die width of .133. It should be noted, however, that when a new die is obtained, a new table will have to be calculated for that value of width. In the course of two years, a complete set of tables for any value of die width will be built up.

TEST RECORD

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PHYSICALS

Tested By

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There are many other items which need correcting or improving. At the present time there is 100% inspection of Flamenol for specific resistivity. This can probably be avoided by a well thought out sampling plan based on the control charts. The testing of the brittle Point could be cut down by the maintenance of an average chart.

A sheet which lists the results of all the tests is sent along with each shipment of Flamenol. This can probably be entirely eliminated. Such action would result in a double saving: the expense of recopying all of the values, and the running of tensile tests on Flamenol, which is only done for material to be shipped.

On a number of compounds the specific gravity is tested and on Flamenol thisproperty is tested 100%. There appears to be no reason for continuing this procedure.

There are probably improvements which could be effected in the testing machinery. Reading the elongation is a very difficult job, as is the spotting of the tensile reading at 200% elongation for the calculation of the modulus. Possibly an attachment could be devised similar to the one used in the laboratory and developed by Mr. G. Harapas.

However, the greatest improvement which can be made is in the attitude of the testing personnel. This might be effected by giving them responsibility, respecting their judgment, and providing them with sufficient adequate tools.

As a point in question, the specifications given to the testers should be no higher than necessary. Since the testing is done directly after the Banbury mixing, most compounds have not developed full Physical Properties. If a compound shows low, the chemist concerned will release it, since he knows that after aging, the compound will reach the specifications. This procedure results in the tester losing respect for the specifications.

As a second point, each employee should be given a small plastic sliderule so that he need not wait to use the one in service now.

CONCLUSIONS

Another Test Engineer (preferably with some statistical background) should be assigned to the Control Station to carry on the work begun and to start some of the projects mentioned as it would provide good experience for the man; out above all it would more than repay Wire and Cable for its investment.

Burton Grad

cc: C. H. Black - 27E C. O. Hull - 24E E. J. Butler- 25E T. A. Gilly - 26D B. M. Fairbank -25E M. J. Greenhalgh - 25E S. T. White - 26D A. J. D'Apice - 26D 4

TEST RECORD ELECTRICALS

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Janne B

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GENERAL ELECTRIC - CONTROL STATION - WORKS LABORATORY

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This form should be changed by next month. A new form has been drawn up and should be sent to Duplicating by the 20th of May.

For the Electrical Properties, Form D seems to fill the bill, having the same advantages as Form C. Conversion tables have been set up for different values of the galvanometer constant. If at some time in the future the entire setting of the galvanometer were to be disturbed, then a new set of tables would have to be set up.

Here again, when new sheets are made up certain changes should be made. The corrected forms have been placed in a file and when the present supply of forms is exhausted, the new and correct forms can be made up. The third change was concerned with the Cable Test Record calculations. Having been informed that it was a necessary chore, new forms were drawn up. Form E is the result for calculating the "K" value, and Form F for the Burn-out Percentage calculations. Both of these forms need completing before being reprinted. These forms should standardize and make more readily available the Cable Test Record calculations.

The most important change to be undertaken is to set up and maintain control charts for each of the new forms introduced. As can be seen by inspection, these forms provide the figures which are to be plotted on the control charts, i.e. the average and the range. By the use of control charts the information will become readily intelligible to anyone who may be concerned. In addition, the charts will show up trends quickly and lead to better Banbury control.

The following forms, G and H, are two of the control chart forms developed for the plotting of averages. G is to be used for In-process testing results and H for the Burn-out Percentage control chart.

PART III

General discussion and recommendations.

There remain a great number of problems which could be solved by a Test Engineer. The whole question of incoming materials needs to be straightened out, not only in its relation to the Control Station, but also in its entirety.

The testing of finished wire could bear looking into --- as to what forms would be best and whether a regular system of testing might be introduced.

Of course, someone will have to set up all of the control charts. He will have to determine the control limits for different sample sizes from one to four for all of the different compounds. Someone must bring the charts to the attention of the chemists concerned, and attempt in the future to set up a sampling acceptance plan based on the control chart information. It is felt that each tester should have the responsibility for maintaining the control charts for the compounds which he tests.

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CONTROL CHART RECORD

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Rubber Compound Control Laboratory Report Pad No. - s



CONSTRUCTION MATERIALS DEPARTMENT

GENERAL

Report on Control Station by Mr. B. Grad, May 9, 1949

May 21, 1949

Mr. I. C. Eaton -

Before discussing the merits of the suggested or adopted changes, due credit should be given to Mr. Grad for his quick grasping of the general situation. Although I cannot agree with everyting in his report, it does show an appreciation of the numerous problems involved. Changes which have been suggested in the matter of test forms have been adopted on a temporary basis to prove their worth.

Any simplification which can be introduced will be so done, provided that it does not interfere with the maintenance of proper quality or result in requiring <u>more</u> manpower--the latter is always my fear when introducing more forms.

Now, let's discuss the report in greater detail.

Part I

The statements concerning Control Station activities are approximately correct, although the duties performed are not limited to the functions mentioned; for example, the following of experimental runs and the large scale testing of cables to meet involved specifications are increasingly among the duties.

Part II

Certain of the forms in question were drawn up with our advice, and are now in use on a temporary basis. Forms C and D would appear to be of value for an overall control of trends.

It must be borne in mind, however, that the primary function of the Control Station is to see that only approved materials pass its test point. At no time must this be lost sight of, and if the use of new forms or development of charts should threaten to interfere with this function-especially in the present period of reduced man power and low stock inventory--then such procedures will be halted.

Part III

I would like to discuss this section in detail, and in the sequence written.

GENERAL (B) ELECTRIC

Mr. I. C. Eaton

May 21, 1949

The paragraphs on Page 3 require no comment. They are self-evident but are directly related to amount of man power available.

On Page 4, a number of statements are misleading and require correction.

-2-

The 100% testing of Flamenol for electrical resistivity on electrical type stocks is a <u>must</u> and will be continued. We cannot countenance a possible return to conditions which prevailed some years back when we were flooded with wire of low electrical properties. This testing safeguard will be maintained. Brittle point is only done when trouble is encountered.

Elimination of test reports on Flamenol shipments to other plants was suggested <u>here</u> when the new CM setup took place, and will be pursued to the ultimate end.

For a new overall test setup on all types of Flamenol compounds, please see M. S. Greenhalgh's letter of May 19, 1949 to the Control Station. As noted therein, if this proves practical, it may be extended to thermosetting types of compounds.

As to test equipment, I must state that there is nothing difficult about reading either a 200% modulus or an elongation. Anyone who cannot do this with a ruler and a pair of eyes does not deserve a position in the Control Station.

The statements regarding personnel are rather surprising. All members of the Control Station staff have the responsibility of approving or rejecting the materials, compound batches, or wire that they test in their daily work. When a rejection is made, however, they are required to contact me or my assistants, or, more usually, the chemist or engineer who is particularly interested in the item in question. This chemist or engineer, in the light of his good judgment, will make a final disposition of the matter and will at once endeavor to find a cause and attempt a correction for the future. It is not an invariable rule that the cherist releases rejected stock, as intimated in the report, neither are test specifications set too high, since they are tied in with both the Underwriters' requirements and our knowledge of the <u>normal</u> behavior of the compounds.

Since it seems to be true that in most organizations some members are not as good as others, I can readily see how Mr. Grad became confused on the subject of responsibility and respect for judgment; unfortunately, the person or persons most to be questioned on these two points are always those who do the most complaining about the lack of reliance.

Mfaufa B. M. FAIRBANK

BMF:mv

CH Black CO Hull EJ Butler TA Gilly MS Greenhalgh ST White AJ D'Apice