The EN was run to establish a second source for toroidal core, 118A1217 P3, and to establish the effect of saturation flux density on oscillation frequency. This report summarizes the results of the pilot run, and of laboratory tests performed on the core characteristics.

Conclusions

Magnetics, Incorporated core part #50026-ID is an acceptable source for 118A1217 P3. (Incorporated as second source on CN 3752).
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I. INTRODUCTION

This pilot run was initiated to evaluate a second source for part number 118A1217 P3 which is the power supply transformer core. This core has been a single source item purchased from Arnold Engineering Inc. of Marengo, Illinois. The source being evaluated is Magnetics Inc. who make essentially the same line of toroidal cores as Arnold Engineering.

II. PREVIOUS LABORATORY WORK

Much work has been done with the present transformer core to establish the effect of core parameters on oscillation frequency. Twenty (20) cores from each of six (6) transformer core lots were tested in the Engineering Laboratory to establish core characteristics, and lot to lot variations. In performing this work, fifteen (15) cores from Magnetics Inc. were also tested to compare this product with that of Arnold Engineering. X - R charts were plotted by Q. C. data center and are included in the appendix as figures 2 and 3. The characteristic plotted is the peak flux density obtained at a 2000 cycle test frequency with a peak magnetizing force of 1/2 oersted.

Figure 2 shows a comparison of values obtained with both Arnold and Magnetics Inc. cores. Peak flux densities of these Magnetics Inc. cores are seen to be more similar to those from lot 50 of the Arnold Engineering group than to other lots. The Magnetics Inc. cores are within the manufacturer's specifications, while the total spread of the Arnold Engineering cores is greater than claimed by the manufacturer.

The effect of peak flux density on oscillation frequency is seen in Figure 3. In this X - R chart, peak flux density for each of the lot numbers shown is plotted from samples of N = 2. To the right of this plot is shown the average frequency (plotted as the inverse) obtained from fifty (50) transformers made from cores of the same lot numbers.

It can be seen that the oscillation frequency follows the general trend of the curves for peak flux density. However, flux density is not the only variable affecting oscillation frequency. Transformer frequency may be expressed as follows:

\[ f = \frac{V_{cc}}{4N_p \Phi_m 10^{-8} + 2V_{cc}T_1} \]  

\[ V_{cc} = \text{Primary voltage.} \]  
\[ N_p = \text{Number of primary turns.} \]  
\[ \Phi = \text{Maximum flux (Maxwells).} \]  
\[ T_1 = \text{Time in seconds for} \]  
\[ \text{switching each half cycle.} \]

(1) GE-164 April 7, 1958 P. O. 54-4025
As can be seen from this equation, primary voltage, primary turns and peak magnetic flux are the three (3) important variables controlling oscillation frequency. Since primary turns are very closely controlled, little variation from transformer to transformer should exist here. As the same transistors are used for all tests, the switching time of the transistors will not affect the results. However, the method of test involves adjusting the primary voltage until a specified output voltage level is reached. The primary voltage must then fall within specified limits for the transformer to be acceptable. Therefore, the frequency data plotted includes not only the effect of core parameters but the actual voltage variations occurring in power transformer test.

It was apparent that the spread in oscillation frequency could be reduced by reducing the spread in peak flux density. This reduction was agreed to by the vendor and was put into effect after lot 50. The narrower spread of frequencies for lot 53 - 59 is the result.

These tests showed that the Magnetics Inc., cores have essentially the same shape and dynamic characteristics as Arnold Engineering cores. A pilot run was, therefore, initiated to verify whether the Magnetics Inc. cores would act as well as Arnold Engineering cores in complete transformers.

III. PILOT RUN

Ten (10) power transformers were constructed using Magnetics Inc., cores. Their performance was compared to a control group using Arnold Engineering cores.

Each of the transformers was tested per 118A1322 and the following data was recorded:

<table>
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<tr>
<th>Input Voltage</th>
<th>Tap Voltage</th>
<th>Compensating Voltage</th>
<th>Actual Oscillation Frequency</th>
</tr>
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Control charts plotted from this data are included in the appendix as Figures 4, 5, 6, and 7.

IV. RESULTS

The only significant difference in characteristics measured occurred in oscillation frequencies, which was expected as no attempt was made to match the characteristics of Magnetics Inc. and Arnold cores. It is noted that both groups were within the engineering limits.

It is concluded, therefore, that no significance difference in power transformer performance is to be expected when using cores from either of these vendors.

V. CONCLUSION

Magnetics Inc., core part number 50026-1D is an acceptable source for 118A1217 P3.
VI. RECOMMENDATIONS

1. Incorporate Magnetics Inc., as a second source for 118A1217 P3. (Incorporated as second source on CN 3752).

2. Further investigation should be made of the effect of other core parameters on power supply performance to establish definitive specifications.

A. Dounoucos
Transformer Engineer

AD:mmm
APPENDIX
CONTROL CHART

PRODUCT: MAGNETIC CORES (ARNOLD)

CHARACTERISTIC: PEAK FLUX DENSITY ($B_p$), OSCILLATION FREQUENCY ($f$) (INVERSE)

LOT NUMBERS:
- Lot 43: 50, 52, 59
- Lot 46: 48
- Lot 47
- Lot 50
- Lot 51
- Lot 52
- Lot 53
- Lot 54
- Lot 55
- Lot 56
- Lot 57
- Lot 58
- Lot 59

CL 53-59

FIG. 3