

Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: TESTING OF METALLIC CORES

To: David R. Brown
From: Arthur D. Hughes
Date: January 7, 1953

Abstract: Of 668 metallic cores tested, 38.8 percent were selected as good cores. The specifications for a good core were: (1) an absence of disturb sensitivity,* (2) a switching time of 7.6 to 9.3 microseconds and (3) a disturbed-one voltage of 30 to 38 millivolts. Recommendations for future tests are made as follows: (1) obtain continuous calibration of oscilloscope and pre-amp with a standard known waveform superimposed on test scope screen; (2) obtain continuous calibration of driving current with a Small current calibrator; (3) test cores in batches of approximately 24, tagging each batch and numbering cores in a predefined manner, eliminating color coding.

The cores tested were fabricated by Magnetics, Inc., for MTC. They contained 10 wraps of 1/8-mil molybdenum-permolloy ribbon, 1/8 in. wide, wound on an 1/8 in. diameter ceramic bobbin.

Results of testing a total of 668 cores yielded 259 good cores, 38.8 percent. Driving current was 175 milliamps. Tested cores were divided into two groups. The first group of 342 was tested and good cores selected on a basis of a \pm 10 percent deviation from average, limits being 7.6 to 9.3 microseconds switching time, and 31 to 37 millivolts for the amplitude of the disturbed one at 4 microseconds. Results are as follows:

- 48 percent good
- 10 percent disturb sensitive
 - 5 percent switching time less than 7.6 microseconds (2 percent of these were OK otherwise; 3 percent had a voltage output greater than 37 millivolts)
- 11 percent switching time greater than 9.3 microseconds (4 percent of these were OK otherwise; 7 percent had a voltage output less than 31 millivolts.)
- 12 percent had a voltage output greater than 37 millivolts, otherwise OK.
- 2 percent were bad for miscellaneous reasons. (metallic foil loose, bobbin chipped, no output, etc.)

A second group of 276 cores, rejects from the first group and approximately 100 cores that had been previously tested under different current

* The cores are tested with four non-selecting read impulses. A core is considered disturbed sensitive if there is a reduction in disturbed-one output when 30 instead of four non-selecting read impulses are used.

conditions, was tested. The voltage range was increased to 30 to 38 millivolts in order to produce the required number of good cores for a 16 x 16 array. The results briefly are as follows:

- 35 percent good
- 36 percent disturb sensitive
- 4 percent switching time less than 7.6 microseconds
- 15 percent switching time greater than 9.3 microseconds
- 4 percent output voltage greater than 38 millivolts
- 4 percent output less than 30 millivolts

Since this group of cores was selected partly from a group of previous rejects, the percentage acceptance should be relatively poor. The first group gives a better indication of how many cores are good and why the others were rejected.

The chief difficulty in maintaining a uniform test over a period of time was to keep the driving current constant. The tests were set up by adjusting the current to give the same output results on six standard cores as they were read at the beginning of the test with a known current. This was done since a small variation in driving current will produce a large variation in output voltage and switching time. Also, drift of the calibration of oscilloscopes and pre-amp could cause erroneous results. Apparently results were reasonably accurate since 48 cores when rechecked gave results within the acceptable limits.

Another cause of possible error arose in the method of handling the cores. At first, color coding was used, but given up because of the difficulty in distinguishing certain colors. The method then used was to keep the cores in tagged batches of 20 or 30, numbered left to right and kept that way until final separation into good or bad groups.

Recommendations

These recommendations are a combination of ideas from various sources.

1. To insure proper calibration of the scope and pre-amp, it is recommended that a known voltage (30 millivolts) be displayed as a waveform on the oscilloscope screen continuously while testing, and in so doing the pre-amp can be set so that the horizontal division lines on the scope face will always represent the same voltage. Also, the voltage waveform could be of known duration so that the sweep time can be continuously checked, and thus an accurate value of switching time read.

2. To insure a proper value of driving current, a continuous calibration with a Small calibrator should be used.

Memorandum M-1785

Page 3 of 3

3. It is recommended that cores be tested in batches of 24 and numbered as 1 through 24, left to right, with a batch number, and kept in those batches until separated.

Signed Arthur D. Hughes
Arthur D. Hughes

Approved DRB
David R. Brown

ADH/jk

cc: Group 63 Staff
W. Ogden
W. Papian