Addendum I

# Experiment Utilizing AC Magnetic Field Pick-up Coil to Probe Short Faulted DCO302

TS-SSC90-100
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After yoking coil DCO302, a short appeared between the upper and lower coil sections. Based on the hypothesis that any shorts in the total coil assembly could distort the vertically oriented B Field so that it would have some horizontal B Field components, an experimental probe coil was designed to search for the short locations.

The first attempt was made with a 50 turn coil wound on a 1 3/16" diameter wooden bobbin. The coil was approximately 7/8 inch in diameter and approximately 1/2 inch wide. The ends of the coil were attached to a standard BNC female connector which was screwed into the center hole of the wooden bobbin. A 50 ohm cable which was marked every foot was used to pull the bobbin from the "return end" of the coil toward the lead end. A signal generator set to 1 kHz was connected to DSC302 with the coil connected in the normal manner to produce a vertical field. Approximately 13 volts rms thru 50 ohms was applied to the leads.

The output of the probe coil was connected to a Tektronix 7603 oscilloscope with a 7A22 vertical amplifier section. As the probe coil was pulled through the DCO302 coil, several peaks and valleys were noted on the oscilloscope; however, it was also noted that rotating the probe by twisting the cable also produced large variations in pick-up voltage. This was thought to be caused by the loop formed by the start and finish leads of the probe coil as they were routed to the BNC connector.

A new probe was built which was only 3/16 inch wide and the start and finish leads were routed with very short leads to the BNC connector.

This 50 turn coil was again pulled through DCO302 while attached to the same oscilloscope set-up. Although the effect was reduced, the probe was still very sensitive to rotation inside the coil. The scan of the coil was performed despite the rotational sensitivity but every effort was made to pull the probe through without twisting or rotating the probe cable. The results are shown in Figure 1. Note the "W" shaped dip between 27 feet and 39 feet as measured from the mouth of the lead-end beam tube.

The 303 coil was probed using the same probe coil and equipment; however, since 303 was not yoked at the time of this test, there was a much larger output with large (50 to 200 microvolt) swings in amplitude (see Figure 2). The periodicity of this waveform is 6 to 8 feet and is unexplained at this time.

Conclusions:

It was later found that coil 302 was heavily shorted at a single small spot between upper and lower inner coils and upper and lower outer coils at a location very close to the lead end (approximately 18" from turn-around). The difference between the 302 scan and the 303 scan shows 302 decreasing rapidly in the first foot of measurement and 303 increasing rapidly in the same area. Because there were only two sample coils and 303 was not yoked at the time, no conclusions are drawn. A future scan of 303 is planned after it is yoked to better compare a known shorted coil to a known good coil (303), while both are in the yoked stage.

The "W" pattern in 302 may be from the slightly magnetic stainless steel shim material that was used in the strain gauge pack at 36 feet. The same is probably true of the smaller dip at 18 feet.

In the future, it may be possible to improve the probe coil by placing the coil bobbin inside a high permeability metal tube about 3" long so that only horizontal magnetic lines are picked up by the coil. Grounding this tube would also reduce electrostatic pick-up.

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HORIZONTAL MAGNETIC FIELD INSIDE BEAM
TUBE OF LONG COIL WITH 1KHZ APPLIED
TO TOTAL COIL

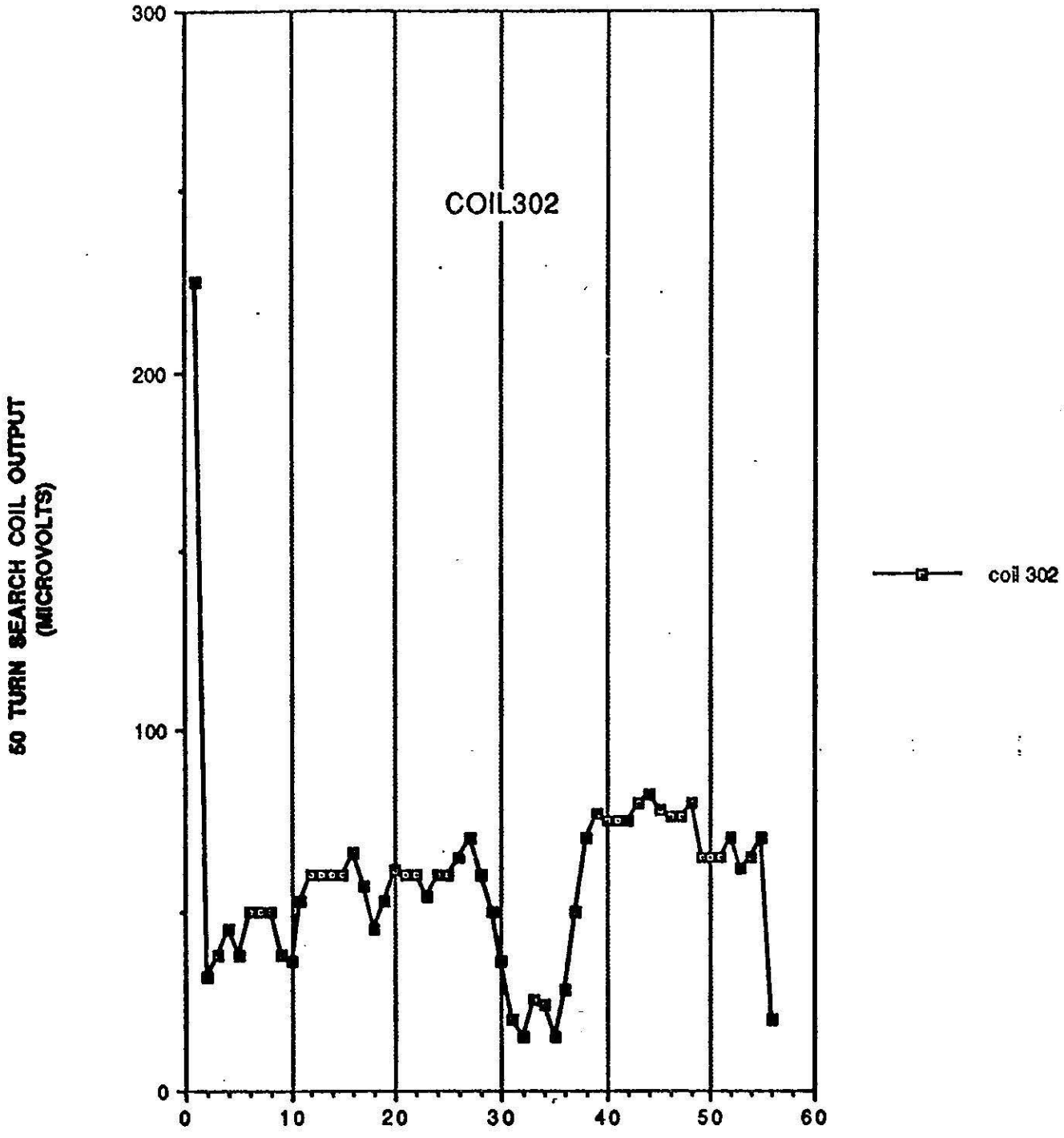



FIGURE 1

HORIZONTAL MAGNETIC FIELD INSIDE BEAM TUBE OF LONG COIL WITH 1KHZ APPLIED TO TOTAL COIL

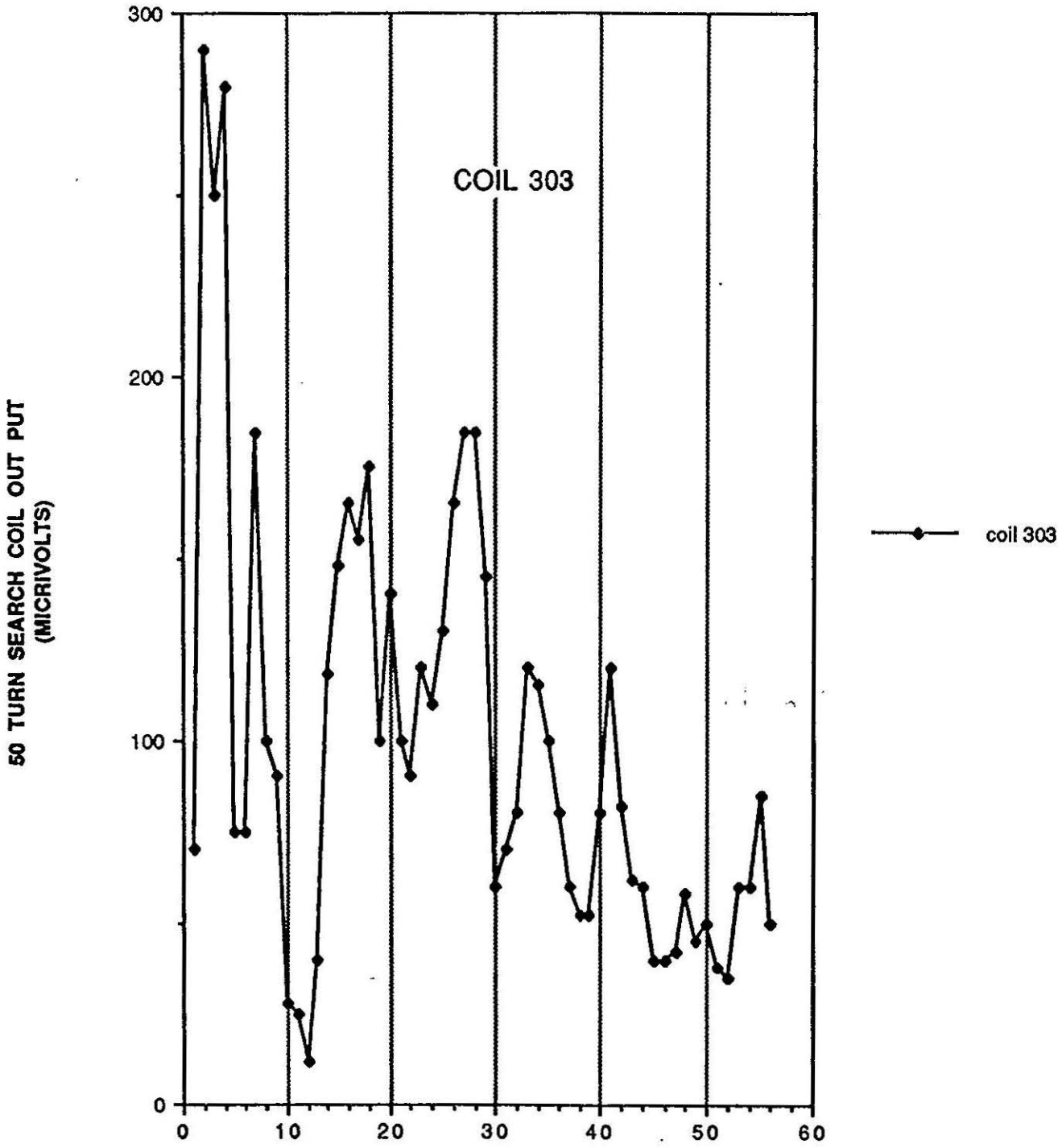
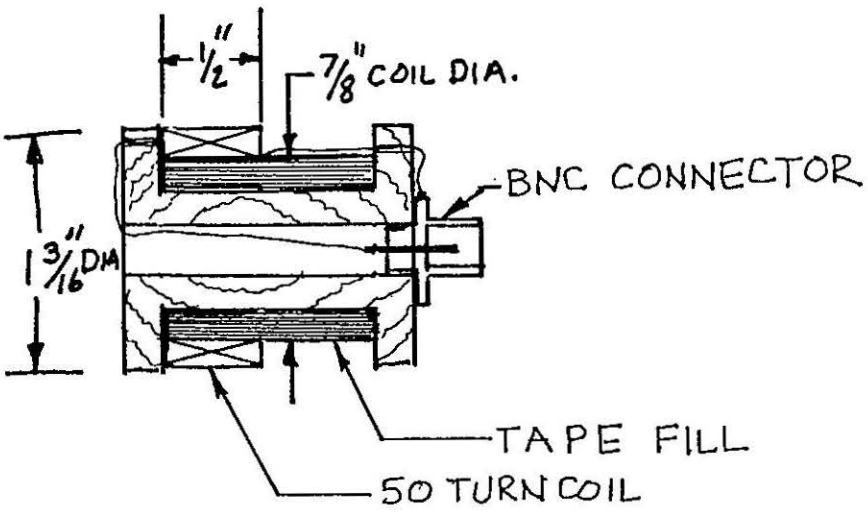
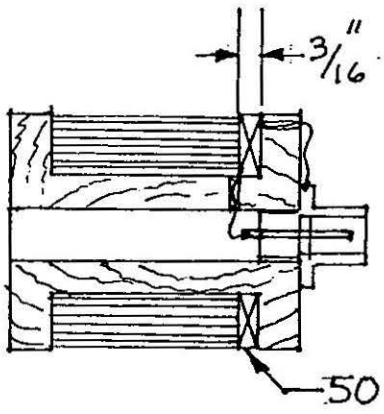



FIGURE 2




FIRST COIL CROSS SECTION




SECOND COIL CROSS SECTION