13-980714-CLN-01

TO: DISTRIBUTION
FROM: C NEUMEYER
SUBJECT: OH GROUND PLANE REWORK AND GROUNDING CONNECTIONS

Reference:

13-980704-CLN-01, "OH Ground Plane Behavior"

The reference memo provided an analysis of the OH ground plane behavior based on the ground plane provided by the coil manufacturer, which was judged therein to be too resistive.

This memo provides instructions for reworking the ground plane of the OH coil and providing connections to ground.

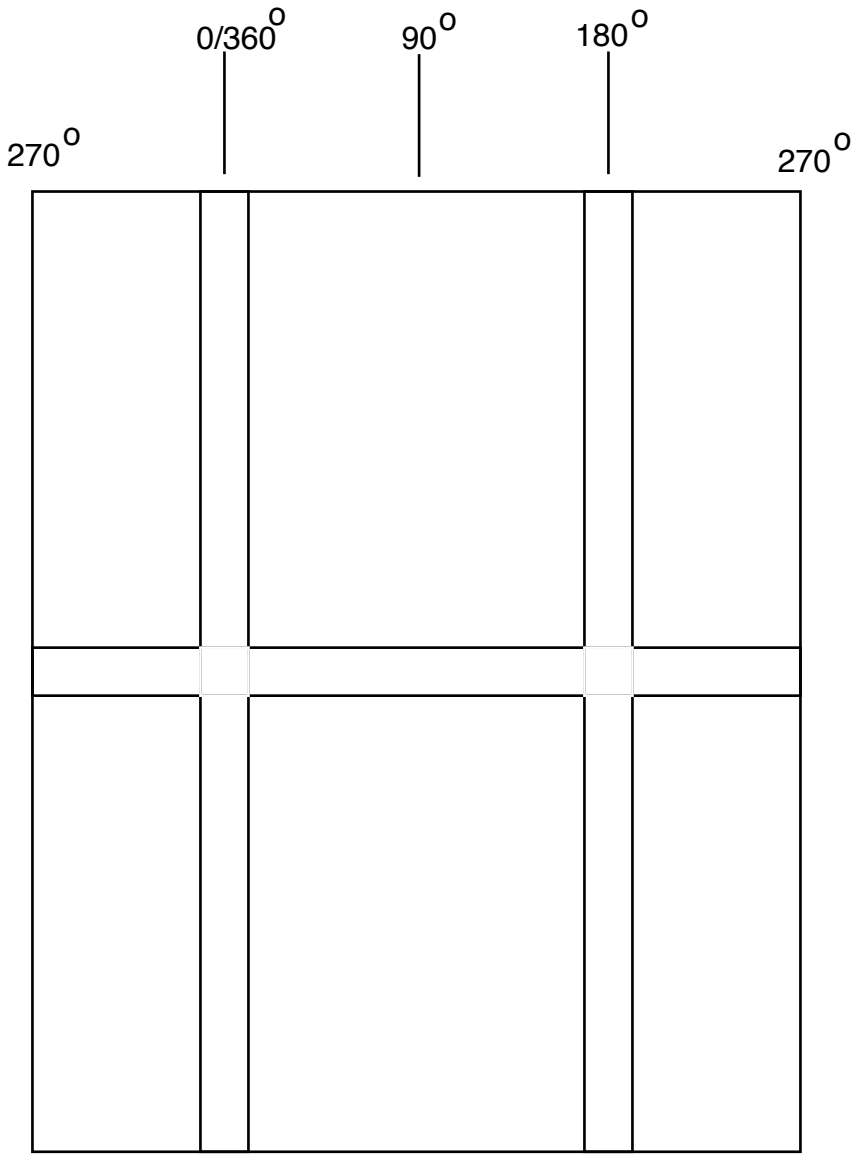
Existing Condition of Coil

The condition of the coil assumed to exist at the time of issue of this memo is based on the following prior sequence of steps:

• Groundwall of coil covered by Ranbar B-2-135 type semi-conductive paint (2000-5500 ohms/square, data sheet attached) by the manufacturer, Everson Electric;

• Semi-conductive paint covered by polycrylic sealer (data sheet attached) by PPPL;

• Three 1.25" wide stripes (two azimuthal, one circumferential) of semi-conductive paint and sealer were removed by PPPL, down to the original ground plane surface, as depicted in the following figure (developed view, outer surface of OH coil). Azimuthal stripes located at 0^o and 180^o positions.

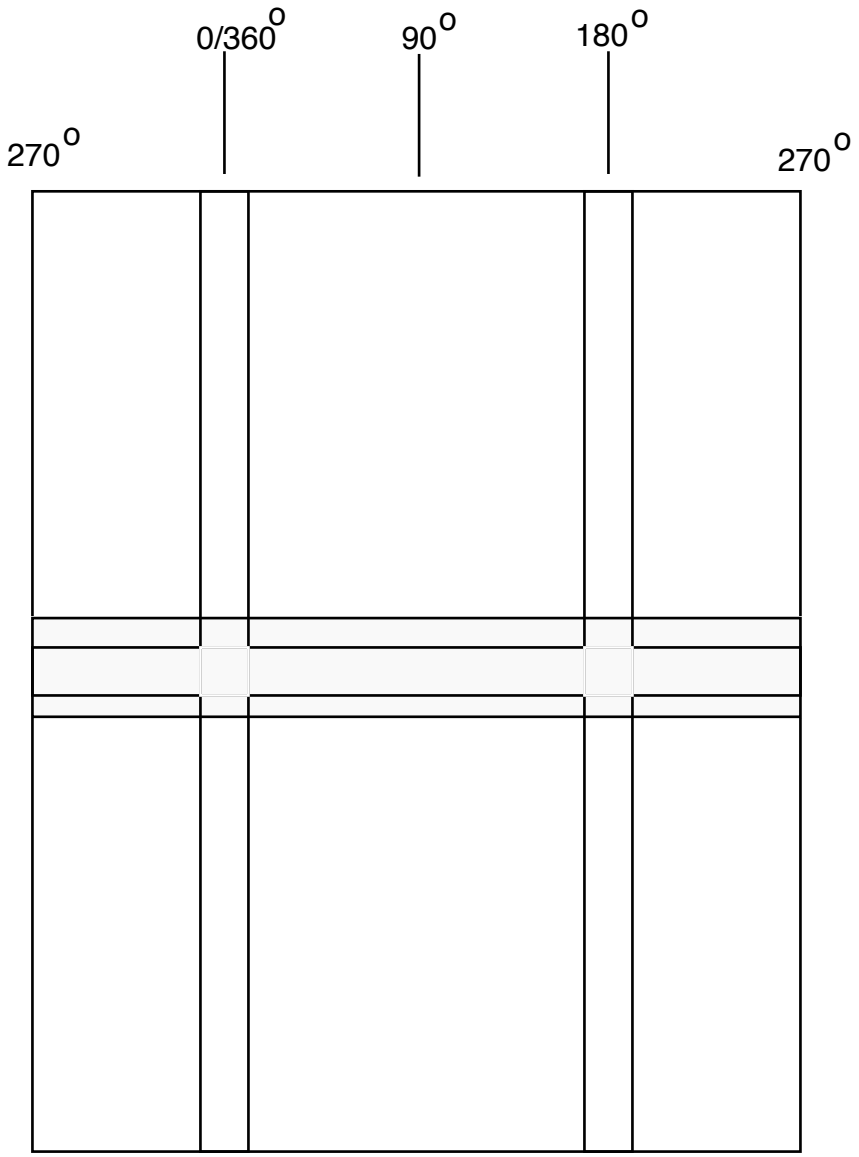


• Three 1.25" wide stripes of Glyptal insulating paint applied by PPPL over the stripes made in the previous step.

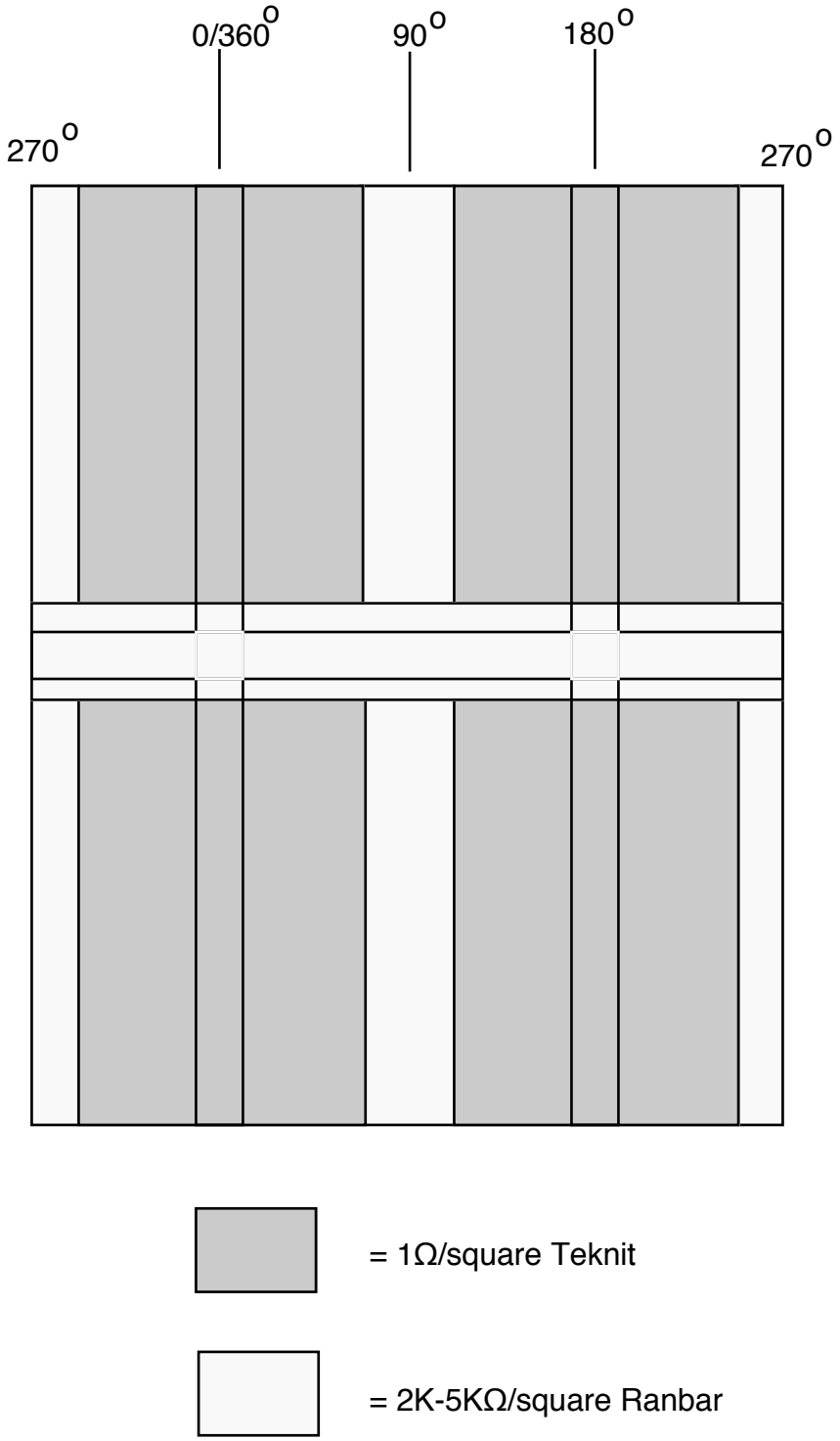
Rework Instructions

• Prepare the regions of the coil surface still covered by sealer to accept additional coats of paint by very light sanding.

• Apply a 4" wide circumferential stripe of Ranbar B-2-135 type semi-conductive paint (2000-5500 ohms/square) over the midplane stripe of Glyptal insulating paint as depicted in the following figure.

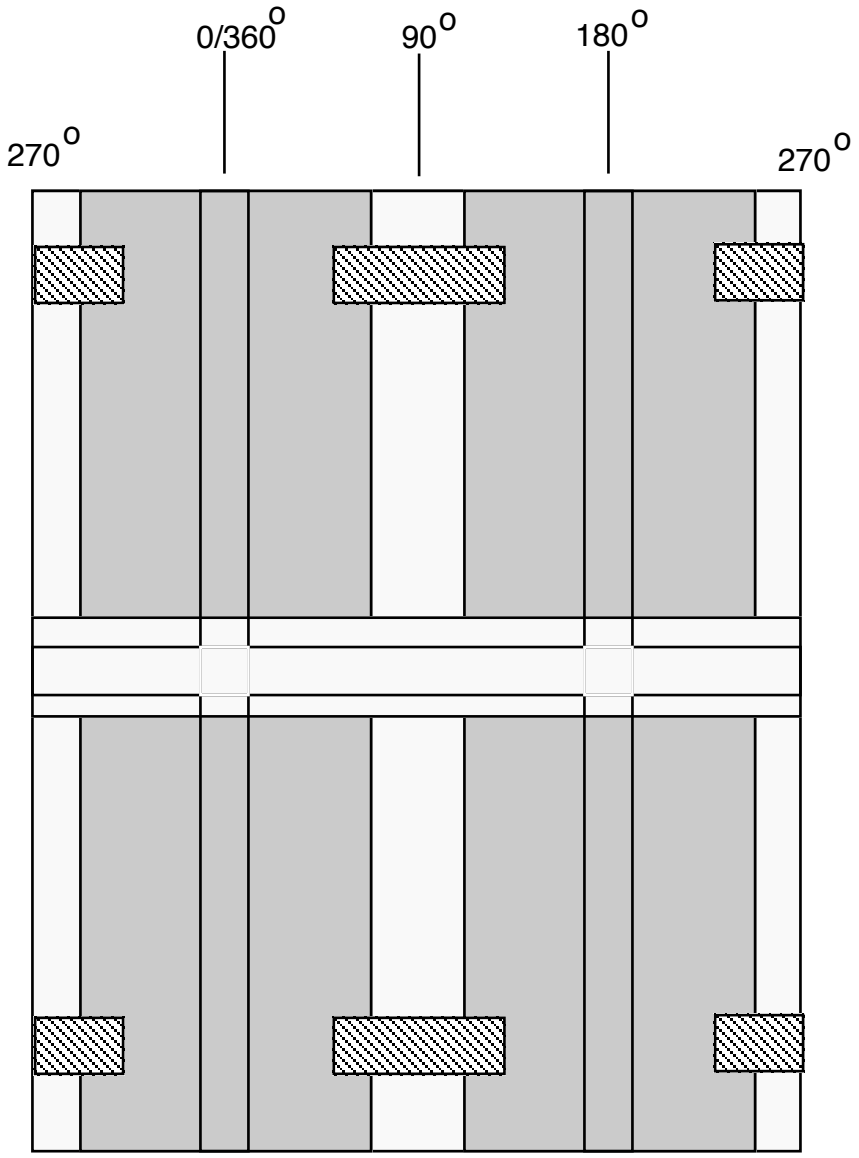


• Mask off three 2" wide stripes, two azimuthal and one circumferential, with azimuthal stripes located at 90º and 270º positions (180º apart). Then overcoat the entire unmasked area with Tecknit type 73-0025 conducting paint (1 Ω/square) as depicted in the following figure.

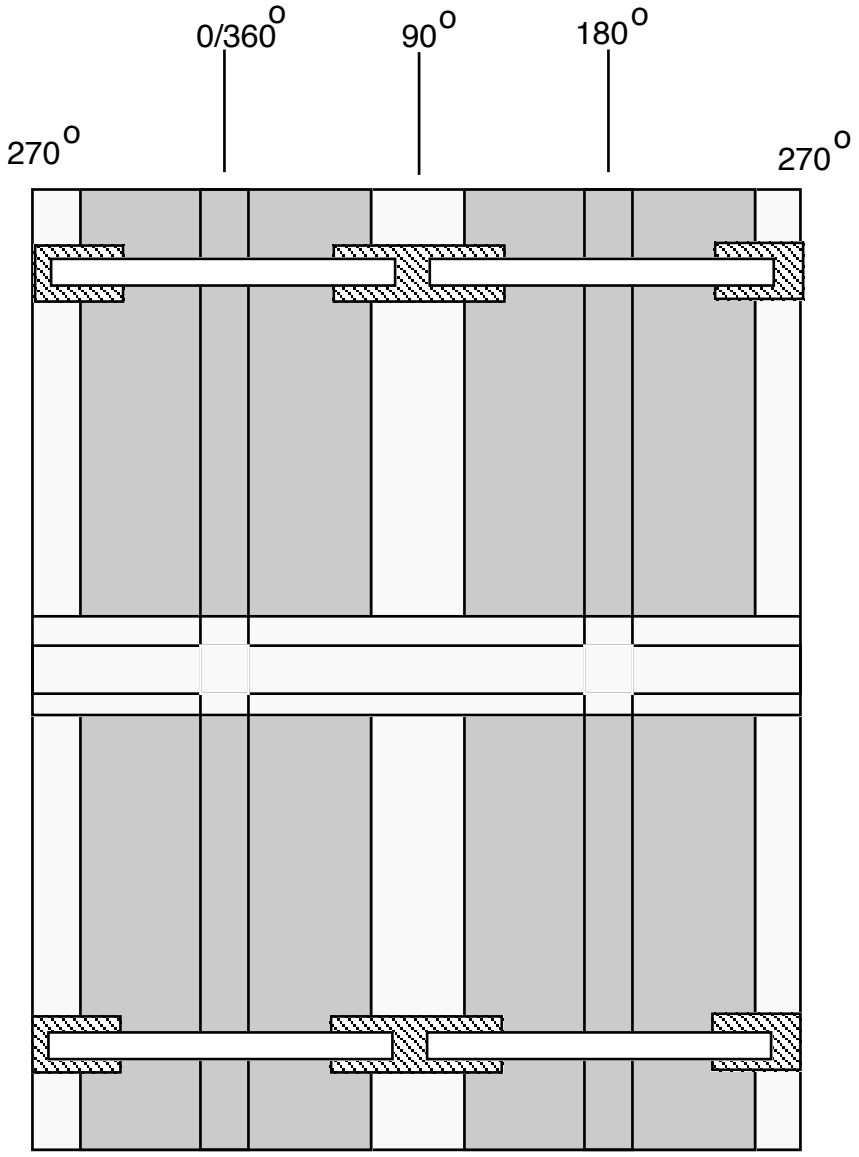


Grounding

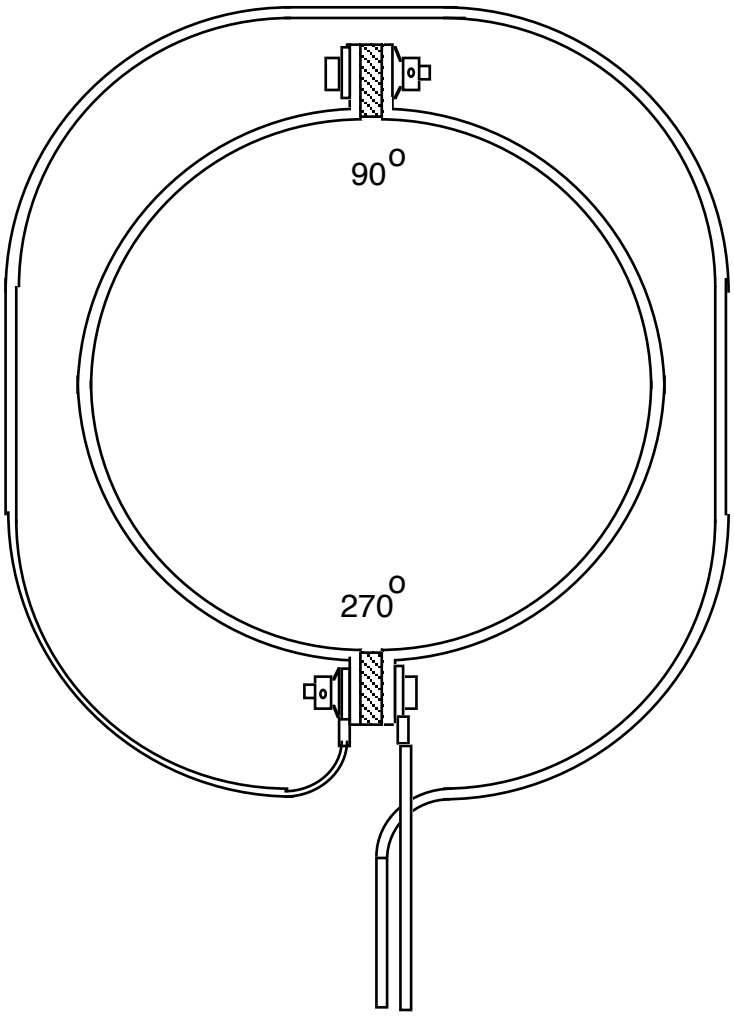
• Apply 2" wide Kapton tape, approximately 4" from the two opposite ends of the ground plane region, in the circumferential direction, overlapping the regions masked in the prior step (Ranbar B-2-135 type semi-conductive paint exposed) by 2" on either side as shown in the following figure (Kapton pieces 2+4+2 = 8" long).



• Affix, using clamps with dielectric breaks, at each end of the coil, 1" wide braided copper conductors with soldered ends, such that a 1" gap exists at the 90º and 270º positions, per the following figure.



• Suggested clamp design is shown in the following figure. Clamp is made from 2 pieces of thin (e.g. 1/16") non-magnetic stainless steel, 1" wide to cover copper braid. At joints, G-10 spacer block, and G-10 nut/bolt provide dielectric break in toroidal direction. Spring washer under nut provides for thermal expansion/contraction. Set screw through nut/bolt provides locking. Wire lug under bolt head and nut at one position (either 90 or 270º) connects to 10' long #10 (600V insulated, stranded) conductor. One of the wires is wrapped around the coil before joining the other to cancel net linked flux. Subsequent routing of the pair lf wires should keep them nested together (e.g. twisted). Final point of connection of ground wires will be determined later. Most likely a series resistor (10's of Ω) will be introduced in each path.



• After installation, measure resistance between all four ground leads:

1-2
1-3
1-4
2-3
2-4
3-4

• With 2" wide stripes of the hi resistance paint, the toroidal resistance, per inch, and the current flow and dissipation in the paint due to OH loop voltage (< 10V) is indicated in the following table.

Hi R Band Width	2	in
#Bands	2	
Hi R	2500	Ω/sq
Lo R Band Width	34.7	in
Lo R	1	Ω/sq
Toroidal R, Hi R	10000	Ω/in
Toroidal R, Lo R	34.7	Ω/in
∑R	10034.71699	Ω
Vloop	10	V
Current	0.0010	A/in
∑I	0.2093	A
I^2R	0.0050	W/in
T	0.005	sec
W	2.48273E-05	Joule/in

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NSTX File

* = w/o attachments