TESTING AND VERIFICATION OF DESIGN SPECIFICATIONS FOR SQUID FEEDBACK TRANSFORMER

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Authority to Redline Procedure
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Note: Feedback transformer is not ESD sensitive.

Superconductive Feedback Transformer Specification
Primary Coil
- Resistance < 10 ohms
- Inductance sufficient to achieve mutual inductance given below
Secondary Coil
- Inductance less than or equal to 0.2 µH
  - Resistance < 10^{-12} ohms
- Mutual Inductance = 0.4 µH +/- 30%
Capacitance between Primary and Secondary < 10 nF
Substrate Size < 0.2" by 0.3" max.
Magnetics: Part must pass zone 2B requirement.
Interface to SQUID Wiring:
Located at Periphery of Transformer Die

solderable (gold over niobium for example)

2 Ea.
for Primary; 0.040" x 0.040"
minimum size

2 Ea.
for Secondary; 0.040" x 0.040"
minimum size
Transformer should be corrosion resistant

Testing of Completed Feedback Transformer
MATERIALS AND EQUIPMENT
Feedback Transformer
Plexiglas Rod 1/4” X 1/4” X 6’
Sapphire Carrier 3/8” X 1-7/8” X .025” with 4 gold bond pads separately interconnected to copper solder pads over Niobium metalization.
Kapton Tape
60/40 PbSn Solder
Soldering iron
2 - 10 foot twisted pairs formed from 30 gauge insulated stranded hookup wire, each wire of a different color
Super Glue
Westbond Ultrasonic
Wedge Bonder
Tanaka’s Superconductive wire 2 mil
Dewar with at least 6” of liquid helium
HP 4277A LCZ meter with 16047A test fixture
Fluke 77 Ohm meter
Acetone
PROCEDURE

Record transformer’s serial number in Table 1.

Turn on the LCZ meter. Allow at least 30 minutes warm up prior to making measurements.

Attach the transformer to be tested to the sapphire carrier with a single drop of super glue.

Using the ultrasonic bonder attach fly wires between each of the transformer’s bond pads and the carrier’s bond pads using the superconductive wire.

Solder twisted pair wires to the primary’s solder pads on the carrier. Solder twisted pair wires to the secondary’s solder pads on the carrier. Make note of which twisted pair goes to the primary and which pair goes to the secondary.

Attach the sapphire carrier to one end of the Plexiglas rod using Kapton tape. Secure the two twisted pairs along the length of the rod with Kapton tape.

Immerse the carrier in liquid helium. Measure the resistances at the free ends of each of the two twisted pairs with the ohm meter. Verify that the resistance of
both primary and secondary circuits are less than 1 ohm when the transformer is immersed in liquid helium_____________(Y/N).

Measure the resistance between one wire each of the twisted pairs from the primary and secondary of the transformer. Verify that the primary to secondary resistance exceeds 20 MΩ____________(Y/N).

Set up the LCZ meter as follows:
CKT MODE in AUTO
LC[Z] RANGE in AUTO
TEST SIGNAL in LOW
DISPLAY in L
FREQ at 100kHz

Measure and record in Table 1 the primary and secondary inductances.

Connect one wire from the primary to one input terminal. Connect one wire from the secondary to the other input terminal. Connect the remaining wires from the primary and secondary together. Record in Table 1 the displayed value of the primary secondary inductance (Lps). Now reverse the wires from the primary, connecting the one that was previously connected to the input of the meter to the free wire from the secondary and the
wire from the primary that was previously connected to the secondary to the input of the meter. Record in Table 1 this second primary - secondary series inductance L(sp). The mutual inductance M of the transformer is found by dividing the difference of the above two series inductance values by 4. Record M in Table 1.

Change the display setting on the LCZ meter to C. Connect one wire from the primary to one input terminal and one wire from the secondary to the other input terminal. Leave the other two wires floating. Record in Table 1 the displayed value of the primary to secondary capacitance (C).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Measure</th>
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<tbody>
<tr>
<td>serial number</td>
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<tr>
<td>Lp</td>
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<tr>
<td>Ls</td>
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<tr>
<td>M (</td>
<td>Lps-Lsp</td>
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<td>C</td>
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</table>

LCZ meter serial # 00008646231
Cal. Date_________
Database #_________

Fluke Ohmmeter serial #66970626
Cal. Date_________
Database #_________
Remove transformer from dewar and test probe. Store part in container marked with part number and serial number.

Procedure Complete

______________ QA Rep.
______________ MIP Signoff
______________ Barry Muhlfelder
______________ Date