



ONTARIO HYDRO
RESEARCH DIVISION REPORT

To Mr. J.R. Leslie
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CURRENT TRANSFORMERS FOR THE HIGH CURRENT LABORATORY

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This report gives specifications for a current transformer (CT) that is suitable for measuring current in the High Current laboratory. The performance of the CT described in this report is not as good as the CT described in Research Division Report E75-20-K. The transformer does, however, meet all the requirements, is smaller, and is expected to be less expensive.

Requirements

The requirements of the CT are to reproduce accurately current waveforms up to 100 kA (symmetrical) fully offset with a transient component having a 40 ms time constant. The requirements also include good accuracy at a current of only a few hundred amperes. The output required from the CT is a voltage in the range of 1 to 10 volts rms such as might be developed across a non-inductive shunt connected to the CT.

In addition to the above, the transformer must fit over a rectangular bus (150 mm by 100 mm) and be shielded from the effect of nearby current carrying busses.

The Current Transformer

The proposed current transformer is very similar to the CT designed for timing the vacuum breaker (Research Division Report 70-304-H). The ratio of the transformer has been increased to accommodate the larger current and two shield windings have been added to shield the transformer from the magnetic field of nearby current carrying busses.

A diagram for the transformer is appended. The transformer core consists of two core-halves, with each core-half wound from 50-mm wide tape of grain-oriented silicon steel, 300 mm inside diameter and 400 mm outside diameter. Each core-half is covered with suitable insulation and then a combined shield and bias winding

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consisting of 9 40-turn sections of 12 gauge enamelled wire connected in parallel. The shield and bias windings of each core-half are connected in series-opposition as shown in the attached diagram.

A second shield winding consisting of 8 40-turn sections of 12 gauge enamelled wire connected in parallel, is applied over the two assembled and suitably insulated core-halves. The secondary winding, consisting of 5000 turns of 14 gauge enamelled wire is applied over the second shield winding. The finished transformer is estimated to be 230 mm inside diameter, 480 mm outside diameter and 175 mm high.

Performance

With a one-ohm non-inductive shunt the transformer is expected to accurately transform a current of 100 kA, fully offset with a time constant of 40 milliseconds. The instantaneous error under the above conditions is expected to be less than 0.1 per cent of the peak current anywhere on the cycle. The errors of the transformer, under steady state conditions and the one-ohm shunt, are expected to be less than 0.02 per cent over the current range of 10-to-100 kA.

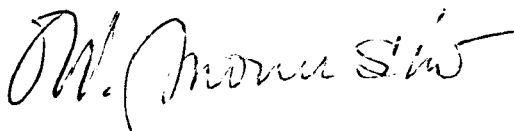
At lower currents and higher shunt resistances, the accuracy at steady state is expected to be according to the table below:

<u>Current (kA)</u>	<u>Shunt Resistance (ohms)</u>	<u>Accuracy (%)</u>
10	5	0.05
1	50	0.3
0.2	50	0.6

Conclusion

The current transformer described in this report is expected to meet most of the requirements of measuring and recording of test current waveforms in the high current laboratory.

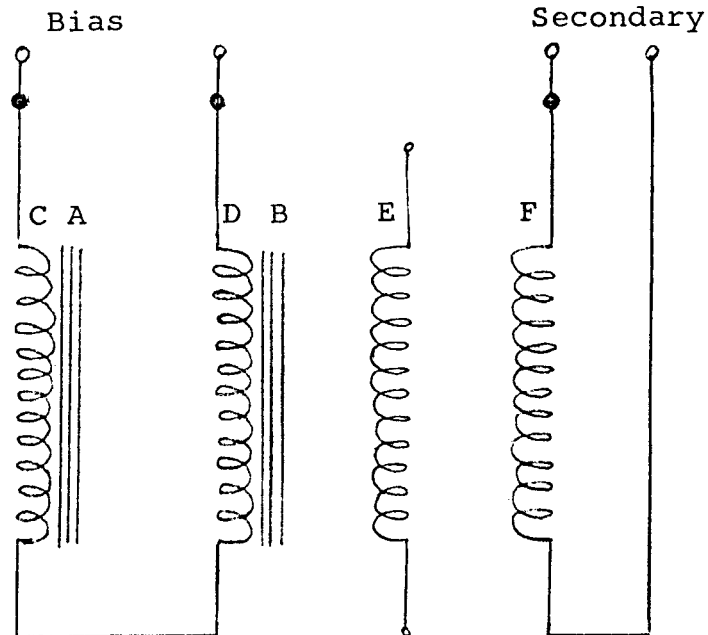
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METERING TRANSFORMER FOR HIGH CURRENT LABORATORY



- A - toroidal core wound from 50 mm wide strip, 300 mm ID, 400 mm OD.
- B - same as A.
- C - 9 sections, each of 40 turns of 12 gauge wire, wound over core A and connected in parallel.
- D - 9 sections, each of 40 turns of 12 gauge wire wound over core B and connected in parallel.
- E - 8 sections, each of 40 turns of 12 gauge wire wound over both cores and connected in parallel.
- F - 5000 turns of 14 gauge wire wound over both cores.