

Vehicles, Motor / R&D, Testing

Winding the Secondary Coil (Detection Winding) when Measuring Iron Loss with the 2-Coil Method

- This application note provides guidance on how to wind a detection coil. Learning the methods is extremely valuable for carrying out precise measurement of reactor loss in booster chopper circuits as shown in Fig. 1.
- The key to winding is to improve the coupling coefficient between the primary coil (N_1 (turns)) and the detection coil (N_2 (turns)). Detecting all the magnetic flux generated from the primary coil with the detection coil makes it possible to measure the reactor loss without error generated by the leakage flux.
- The wire diameter of detection coil may be made smaller as no current will be flowing through it.
- The voltage induced across the detection coil depends on the turn ratio. Ensure a sufficient number of winding turns so that enough voltage is induced when measuring it with a Power Analyzer, but bearing in mind that in order to keep the effects of the input impedance of the power analyzer small, the number of turns of the detection coil should not be too high. You can get the best results with $N_1 = N_2$ in many cases.

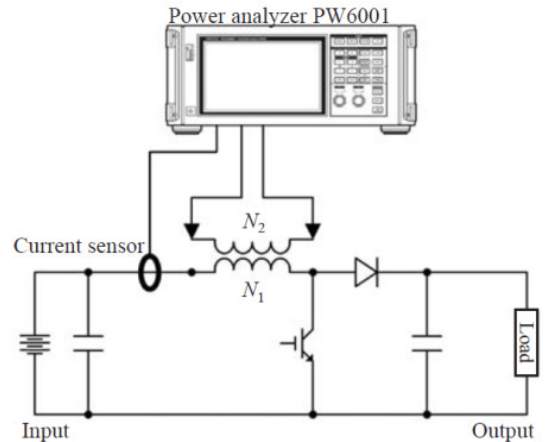


Fig. 1. Reactor loss measurement with 2-coil method

[Definitions]

- 2-coil method

Method to derive iron loss by measuring the current of the primary coil and the voltage of the detection coil.

- Copper loss and iron loss

$$\text{Copper loss} = \text{Total loss} - \text{Iron loss}$$

1. Toroidal core

By winding the primary coil along with the detection coil as illustrated in Fig. 2, the coupling coefficient between primary and detection coils can be maximized.

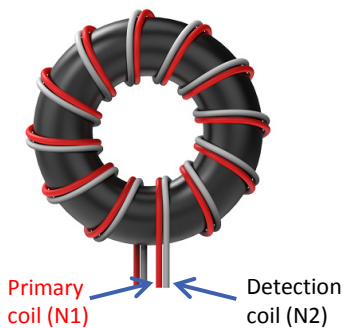


Fig. 2. How to wind primary and detection coils

Practically, the primary coil would be already wound on a core. In that case, wind uniformly the detection coil on the primary coil as shown in Fig. 3.

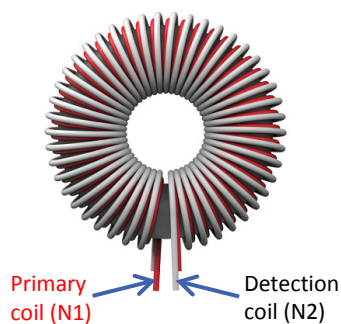


Fig. 3. How to wind detection coil on primary coil

2. EI-shaped core

Basically for EI-shaped cores, the same applies as for the toroidal core. By winding the primary coil along with the detection coil as illustrated in Fig. 4, the coupling coefficient between primary and detection coils will be maximized. When the primary is already wound on a core under test, wrap the detection coil evenly over the primary coil.

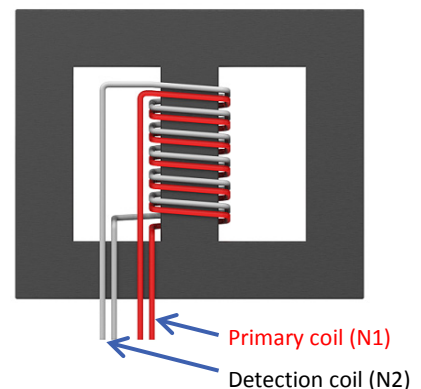


Fig. 4. How to wind detection coil on primary coil