

Differential Transformer Cores for Ground Fault Interrupting Circuit Breakers

GÜENTER B. FINKE, SENIOR MEMBER, IEEE

Abstract—The magnetic requirements of differential transformers used in ground fault interrupters (GFI) for the sensing of 5 mA ground faults over the temperature range from -35°C to $+66^{\circ}\text{C}$ have been established. Ring laminations made of vacuum-melted permalloy and annealed so that the magneto-crystalline anisotropy $K_1 \sim 0$ just above the maximum operating temperature meet these requirements. Such heat treatment will produce rings with low remanence in which the low-flux-density permeability is stable with temperature and changes little from the demagnetized to the remanent state. The processing of rings and the influence of impurities are briefly discussed.

INTRODUCTION

Ground-fault-interrupting circuit breakers (GFI) are devices that interrupt an electrical supply circuit when a "fault current" of a predetermined value flows from this circuit to ground Fig. 1. These devices have been in use for several years to

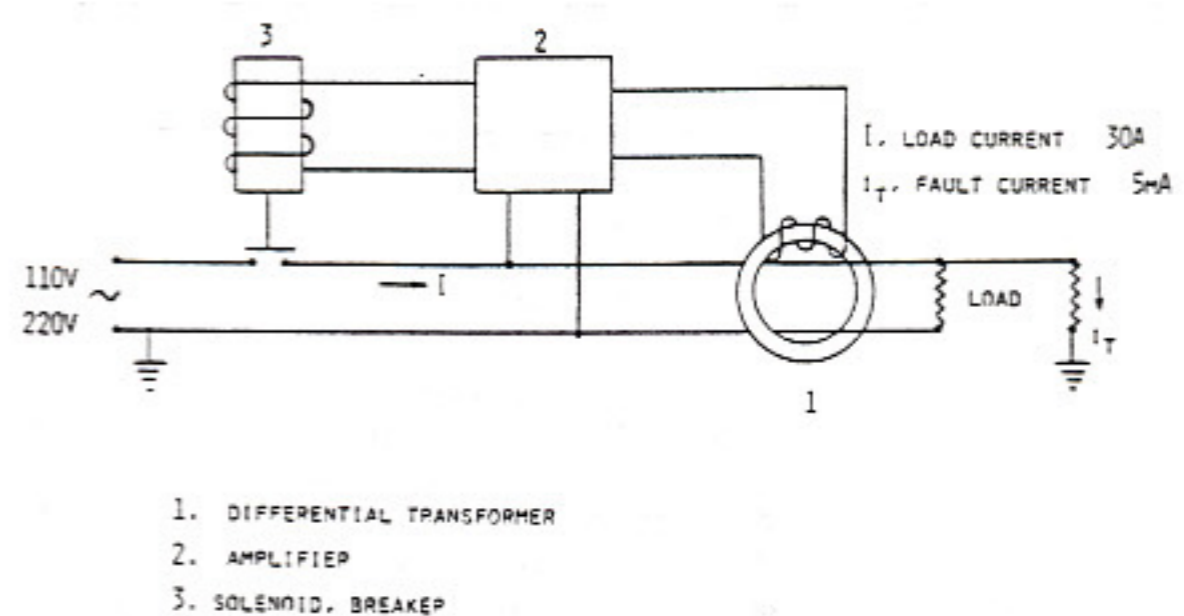


Fig. 1. Schematic ground fault interrupter GFI.

protect people in many countries from the hazards of electrical shock.

Operation of the GFI is such that the ground fault current I_T , which may be only 5 to 300 mA with load current I up to 50 amperes, is sensed by the core of a differential transformer. Response is to the differences in magnitude between magnetic fields produced by load currents flowing into and out of the consumer circuit.

Most European countries have standardized on a ground-fault current of 30 mA for tripping the device, which of course