Application Note

Demagnetization with DEM60C Instrument

Introduction

After a DC current test, such as a winding resistance measurement, the magnetic core of a power or instrument transformer may be magnetized (remanent magnetism or remanence). Also, when disconnecting a transformer from service, some amount of magnetic flux trapped in the core could be present. That practically means that, although there is no presence of an external magnetic field, magnetic induction in the transformer core (marked Br on the B-H curve, Figure 1) is not equal to zero.

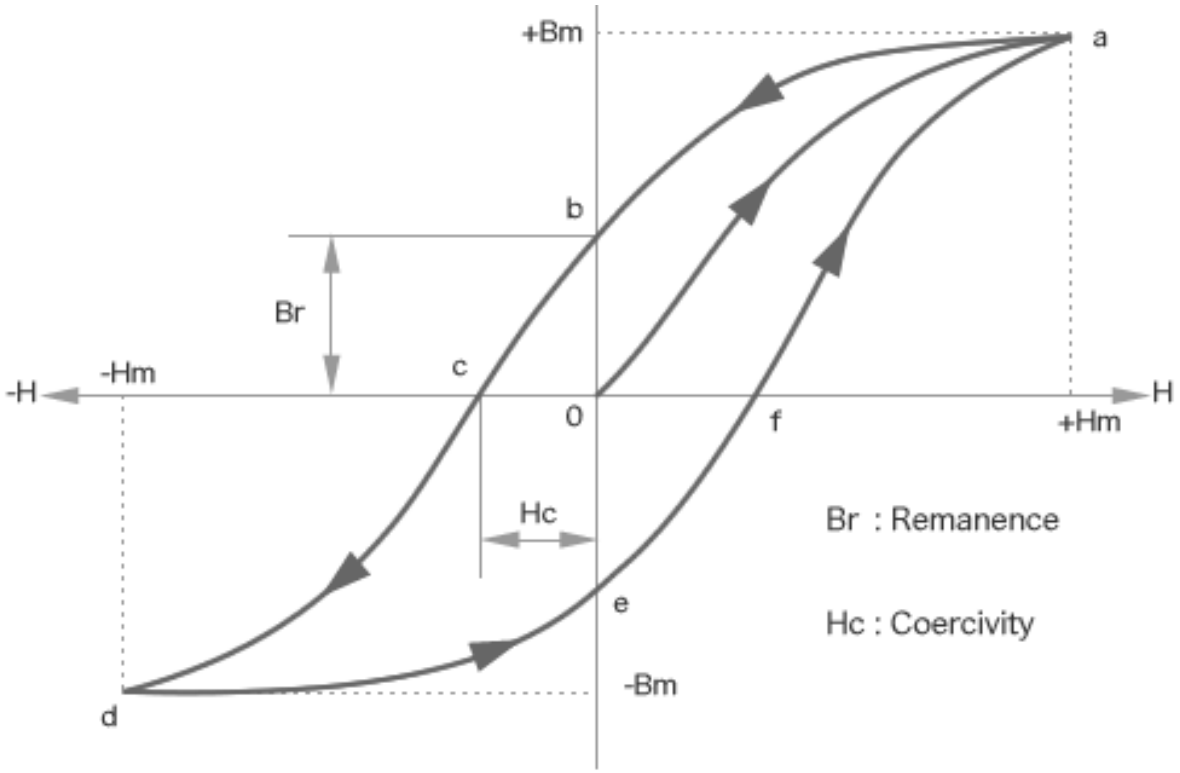

Figure 1. *B-H curve*

The remanent magnetism can cause various problems such as erroneous diagnostic electrical measurements on a transformer, or an inrush and asymmetrical currents at start-up of power transformer (Figure 2), or incorrect operation of protective relays due to magnetized CT cores.

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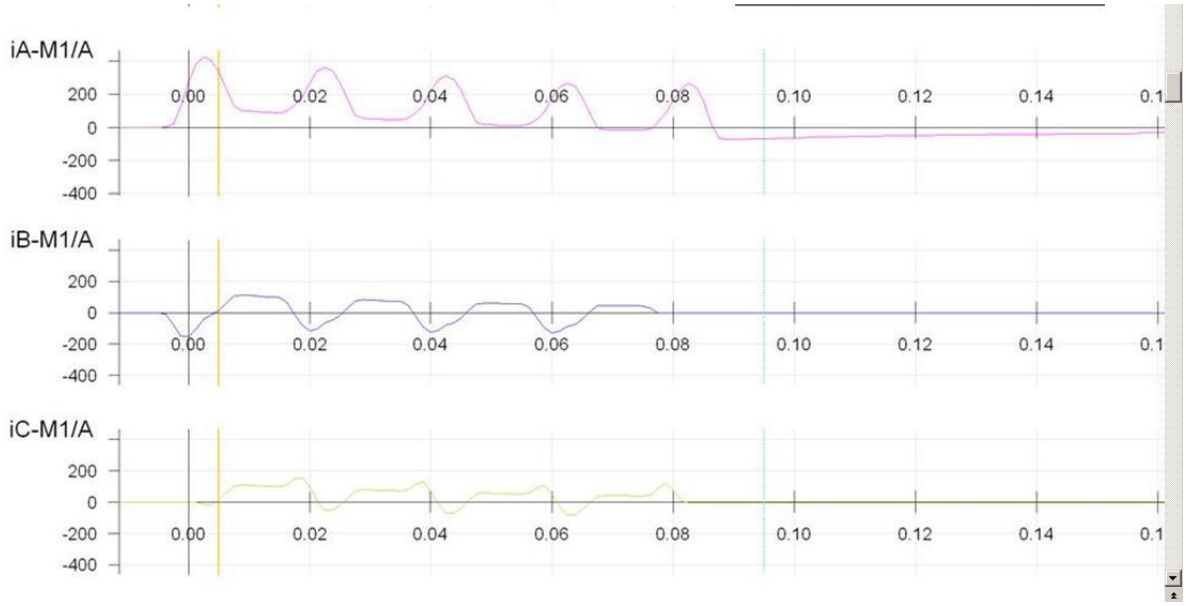

Figure 2. *Assymetrical currents at start-up of a three-phase transformer*

To eliminate this source of potential problems, demagnetization should be performed.

How to Detect Remanence

When suspecting remanent magnetism, various tests like magnetization/excitation current measurement test or FRA (Frequency Response Analysis) can be performed, in order to check the transformer core magnetization.

An easy and highly effective method for confirmation that the magnetic core is magnetized or demagnetized is excitation current measurement, which can be effectively performed with our TRT series devices.

Excitation current is the current that magnetizes transformer core. The more energy is needed to magnetize the transformer, the higher this current will be. This principle is used when determining if transformer core is successfully demagnetized. Excitation currents are measured before and after demagnetization, and compared. If the measured excitation currents follow a symmetrical pattern as expected for that particular construction, then the transformer is demagnetized. Otherwise, demagnetization needs to be performed.

Different magnetization level of the transformer core legs can easily be detected with FRA tests. FRA testing results are highly influenced by inductance value, which is dependent of the magnetization level.

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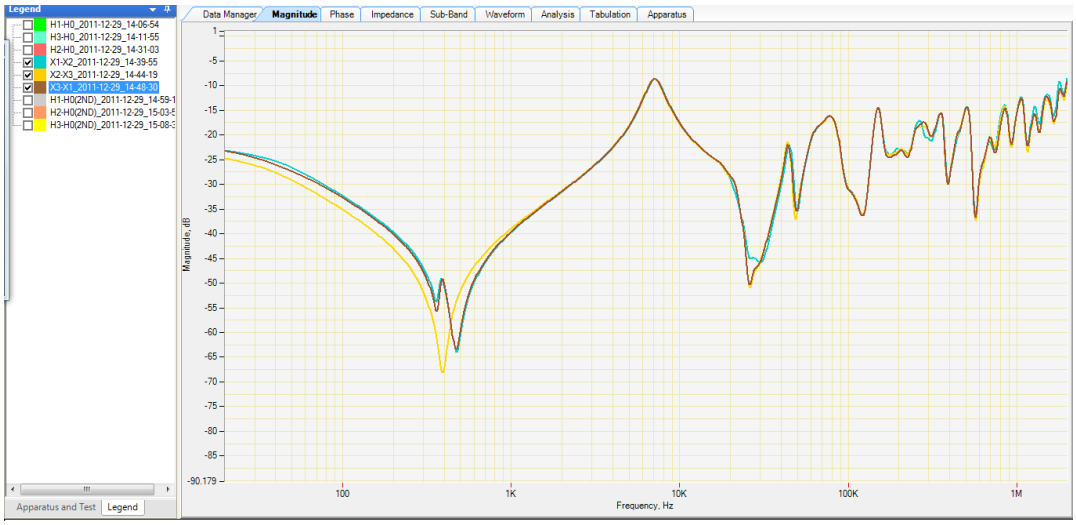

Figure 3. *FRA test results of transformer core legs*

Demagnetization with DEM60C Device

If a customer suspects possible remanence, or when the remanent magnetism is confirmed by TRT instruments or in some other tests, demagnetization needs to be performed.

The DEM60C instrument performs fast and reliable fully automatic demagnetization. High output currents of up to 60 A (at 30 V) provides an efficient demagnetization independently of the transformer core state.

Transformer core demagnetization is performed by applying alternating dc current with decreasing magnitude down to zero, following a proprietary developed program. By reducing the magnitude of the applied current to the zero value, the total magnetic flux, or remanent magnetism, is also annulled.

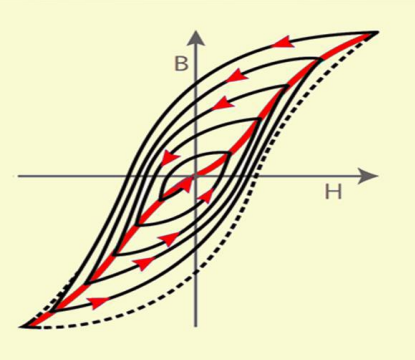

Figure 4. *The demagnetization process*

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In order to perform an effective demagnetization, one needs to be very careful in defining a starting demagnetization current for the test. It is recommended that the starting current has the starting value of at least 20% above the value of the transformer saturation current.

The demagnetization process duration depends on the total inductance of the transformer. The higher the inductance of the transformer under test is, the duration of the demagnetization process is increased.

Example

The 100 MVA transformer, 110/36,75 kV, YNyn0, was tested. After the winding resistance test, the DEM60C device was used to demagnetize the transformer.

The demagnetization current waveform is presented in the figure 5. A three-phase demagnetization was performed using the starting current of 5 A.

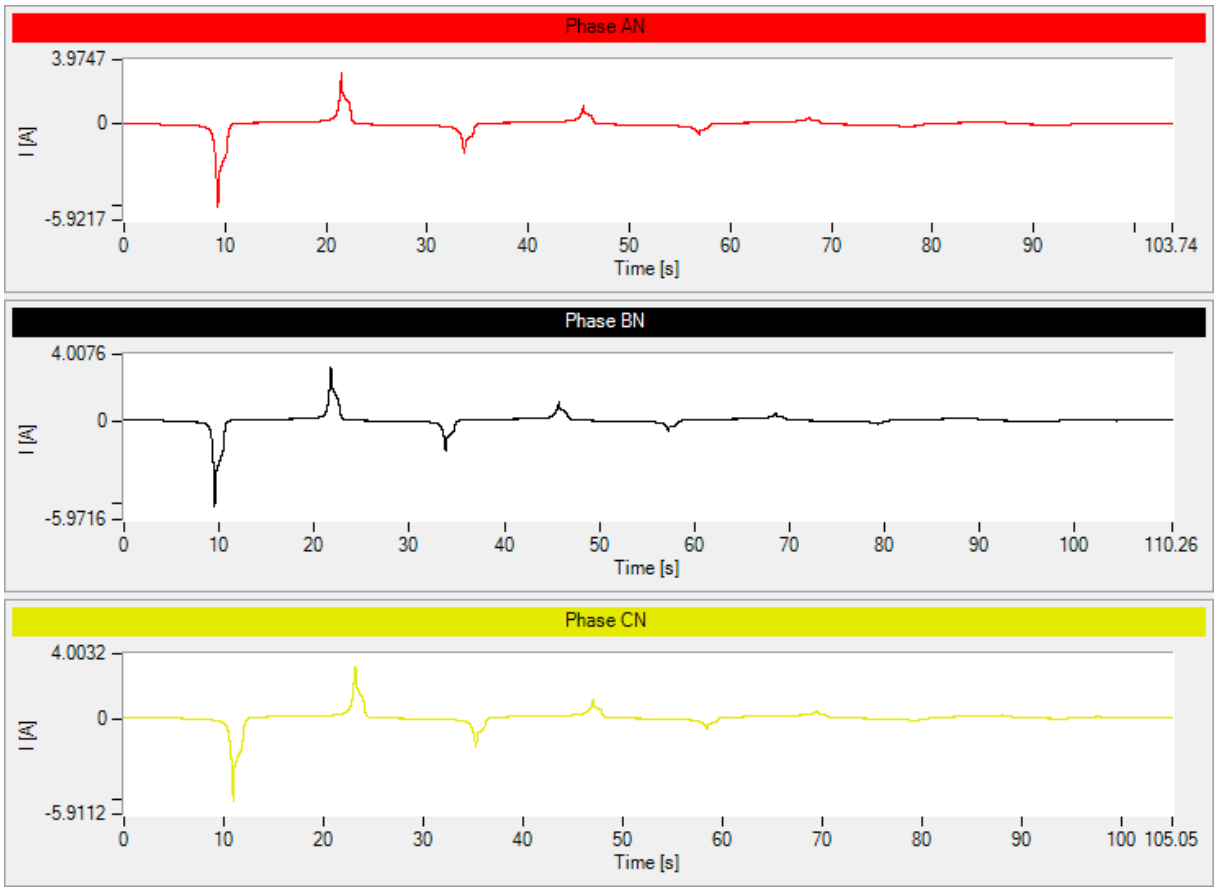

Figure 5. *The demagnetization current waveform*

The efficiency of the demagnetization process was confirmed by measuring excitation currents using TRT device, and comparing values taken before and after the demagnetization.

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