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FAULT CURRENT LIMITING TRANSFORMER BY CONTROLLING LEAKAGE REACTANCE

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***Abstract*— The purpose of this paper is to experimentally prove the ability of AC reactance of a transformer to automatically limit the short-circuit current and to adjust the output voltage. This transformer is able to change its reactance leakage resistance by moving the U-shaped iron mobile unit. It has three functions of voltage conversion, limiting the short-circuit current and voltage regulation. The CLT can limit the short-circuit current in the circuit connected to the secondary winding at a very low level. It consists of an additional U-shaped core between the members. The design of the base region so that it bypasses the flow created by the short-circuit current and limits the secondary side current. In the event of a malfunction, an increase in the current in the secondary output circuit in the increase in the flow in the secondary winding, it will pass through an additional added base region. Thus, the current in the secondary winding does not exceed the rated current. The CLT provides a deeper current limit and may be more suitable for the distribution area. A large transformer can be used to meet the increased demand for a bus without a switch to increase the reliability of the distribution area.**

Keywords— **Fault, Fault Current, Transformer, Leakage Reactance, Current Limit**

INTRODUCTION

Traditionally, a transformer in a distribution network is a passive device, but in the future, it will become an active component of a network that interacts dynamically to provide bandwidth, reliability and network efficiency. The new design specification has created an improved design in the transformer to improve reliability and ease of use.

Because current monitoring plays an important role in various industrial drives, ABB develops an AC current transformer. This transformer is distributed by the primary and secondary windings. The primary winding P1, P2, P3 is placed in the half of the base and S1, S2, S3 are located on the opposite end of the core. Another important change in the design is the usual change in leakage inductance properties. The leakage inductance has the practical effect of limiting the flow of current in without the sink transformer power.

As the leakage inductance is influenced by on the geometry of the core and windings. The change in the leakage inductance is accomplished by adding an additional path to the flow of flux between the ring elements. If you design a transformer with a 100% leakage inductor, the transformer will not burn an event after a short circuit, the secondary winding. Development of approaches to practice ABB design is such a transformer for applications where one uses alternating current, like neon signs, gas discharge lamps, laboratory test tools, etc. In addition, to control the current in the welding units, control the average power in the motor.

II. PROPOSED ALGORITHM

The leakage inductance can be an undesirable property, since it changes the voltage with the load. In many cases this is useful. The leakage inductance has the practical effect of limiting the current flow in the transformer (and load) without itself dissipating power (with the exception of non-ideal standard losses of the transformer). Transformers are generally designed to have a specific value of the leakage inductance so that the reactance leakage resistance created by this inductor is a specific value up to the desired operating frequency.

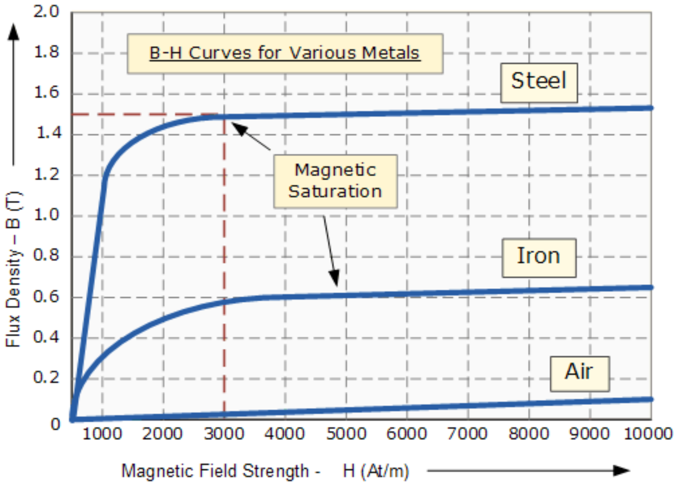

Fig.1-BH Curve at Different Material

Commercial processors are usually designed with a short tour of reactance leakage impedance from 3% to 10%. If the load

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resistive and reactance leakage resistance is low (<10%), the output voltage does not drop more than 0.5% at full load, ignoring other resistance and loss.

High leakage reactance transformers are used for some negative resistance applications, such as neon signs, where voltage amplification (transformer action) is required, and current limitation. In this case, the reactance leakage resistance is generally 100% of the full load impedance, so even if the transformer is short-circuited, it will not be damaged. Without leakage inductance, the negative resistance characteristic of these discharge lamps cause excessive current and will be destroyed. Variable leakage inductance transformers are used to control the current in the welding nodes on the arc.

In these cases, the leakage inductance limits the current to the required value. The leakage inductance comes from the electrical properties of the imperfect coupling of the transformer, in which each winding behaves as a constant self-induction in a series with a corresponding constant ohmic resistance of the winding; these four winding constants also interact with the mutual inductance of the transformer. The inductance of the winding is constant and the associated leakage inductance is due to a scattering flux that does not bind to all windings of the winding of each imperfect one.

III. EXPERIMENT AND RESULT

A small trial apparatus was manufactured in order to demonstrate experimentally the functions described in Section II.

A. Specification of A Manufactured Transformer

Table -1 Specification of a Manufactured Transformer

SR.NO.	SPECIFICATION	QUANTITY
1	KVA rating	3 KVA
2	Primary voltage	441 V
3	Secondary voltage	230 V
4	Primary Current	4.17 A
5	Secondary Current	4.31 A
5	Gauge of Pri. Conductor	18
6	Gauge of sec. Conductor	16
7	Number of primary turns	500
8	Number of secondary turns	300
9	Core area	2060 mm^2
10	Window height	180 mm
11	Window width	50 mm
12	Cooling type	Natural air

To Create Air gap in the middle of Primary Winding and Secondary Winding Extra 15 mm Add in Hw.

B. Structure of a Manufactured Trial Transformer

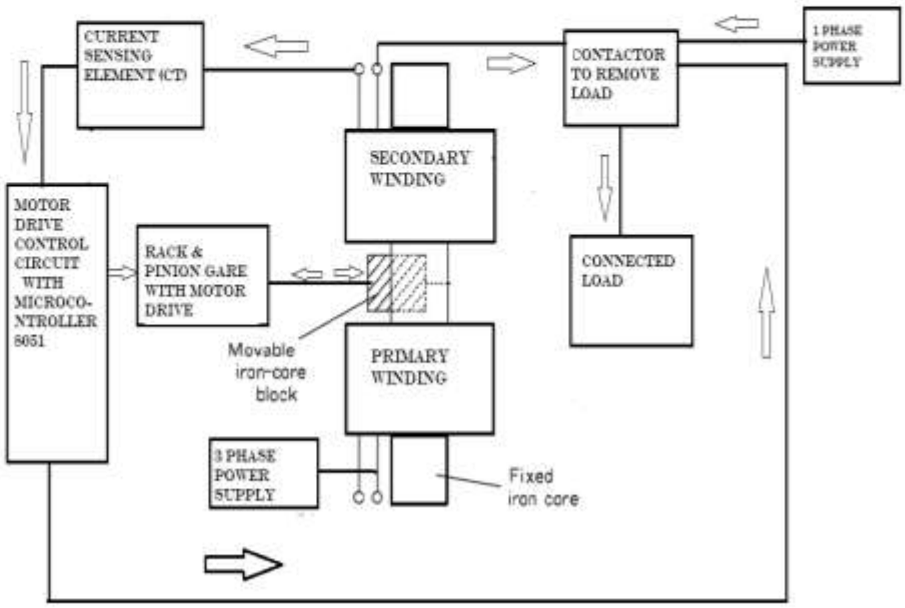

Fig.2-Main Block Diagram

C. Component Description

1. Rack and pinion

The rack is a type of linear drive that includes a pair of gears that convert rotary motion into linear motion. A circular gear is called an " the pinion" engages the teeth on a dashed "gear" linear called "rack"; The rotational motion applied to the gear causes the rack gear to move relative to the pinion, thus translating the rotational motion of the pinion into a linear movement.

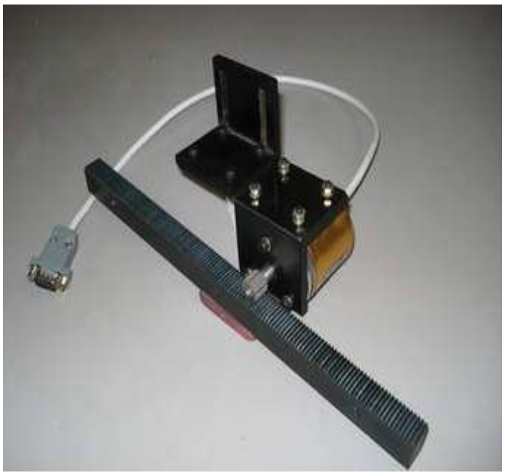

Fig.3-Rack and Pinion Gear

2. Position Encoder MOC7811

Position sensors are used to find the position of the wheel. It consists of an IR LED and a photodiode attached to each other in a plastic housing. When the light emitted by the infrared LED is blocked because of the alternating positions at the logical level of the disk encoder, the photodiodes change. This change in the logic level can be detected using a microcontroller or using a discrete material. This sensor is used to provide feedback on the position of the robot.

IV. FUTURE SCOPE

In this mechanism, we use the start / stop to move the movable iron core. In the future, we can use a proportional regulator to reduce the steady state of the error.

In addition, you can connect any distribution transformer to the area using an interactive system and power management in accordance with the requirements of loads in the control room.

V. RESULT

It is confirmed that the fault current limiting transformer with variable reactance has the following

Table -2 Experiment Result

AT LOAD CONNECTED 1800 WATT	
Sec. Current Without Inserting Core (Amp.)	Sec. Current With Inserting Core (Amp.)
IR2=2.35	IR2=2.09
IY2=2.18	IY2=1.98
IB2=2.10	IB2=2.02

V. CONCLUSION

Restriction or self-limiting transformer (CLT, SLT) is a multifunctional device that combines the functions of a conventional distribution transformer with current limiter functions. Various CLT designs have been studied in order to achieve an optimized contour design. The CLT was tested experimentally for short-time operation modes and a stationary (transformer), where several selected configurations were used. Devices of activated currents were determined in the case of short-circuits for sudden and operation modes of transformers. The results are used to find the optimal implementation of the construction of the CLT.

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