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PLC Based Welding Transformer

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ABSTRACT

Welding transformer sometimes produces excess current on its output terminal to generate arc for welding purpose. Current scenario is that every industry uses welding transformer. Welding machine is utilized 91% for the industrial sectors, majorly in workshops and fabrications. High power ratings from Kilowatts to Megawatts are required which also results in heavy power wastage in the form of no-load loss and core loss. In case of these welding transformers they have to face lots of power losses and improper welding. Which indirectly affects on efficiency of transformer. While using this transformer the operator cannot select appropriate current rating and time duration for specific type of gauge and material. This can be impressively decreased by designing to a remarkable level and it will not affect the performance of machine. Also, thereby minimizing no load loss and magnetizing component in welding machine the overall efficiency of machine can be effectively improve to a desirable level. To overcome above mention problems in the existing welding transformer automation is produced as automation plays vital role in keeping accurate weld, reduction losses, appropriate amount of current, saving in time. In this scheme programmable logic Controller (PLC) which is used to control the current and time duration set on the Human Machine Interface (HMI) by the operator.

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I. INTRODUCTION

The main purpose of PLC Based Welding transformer is to reduce no load losses and magnetizing component in order to make it economic and efficient. According to the survey around 50 lac welding machines are supplies out of which at least 7.5 lac machine are always in operation. The power saving and reduction in losses can be precisely achieved by positive utilization of energy i.e. the core loss component and undesirable excessive amount of current should be reduced to its maximum level, if we succeed in saving the wastage of power it will ultimately saves energy and make our system economical. Thus, it is very clear that the energy saving means the energy generated and faster growth to industry.

The magnitude of magnetizing current depend on thickness of winding and material, shape of winding(cylindrical, rectangular).The current in transformer depends on number of turns and induced emf.The tertiary winding is introduced in this concept which will produce its own flux and the direction of this flux is opposite in nature with the main winding flux. In case of welding transformer, the no load losses vary between 25% to 45% of the total power rating thus an attempt should be made to reduce the no load power loss in proper welding heat loss which is the main aim of the project.

In existing type of welding, we use general step-down transformer so we don't get precise output current for welding. This is due to following reason-

-moving magnetic shunt

-tapping on secondary side

In this technique instead of using general step-down transformer we are using DC bias transformer. Due to this

we get appropriate amount of output current suitable for welding material. This is possible because of tertiary winding.

II. PROPOSED TECHNIQUE

1. **Block Diagram:**

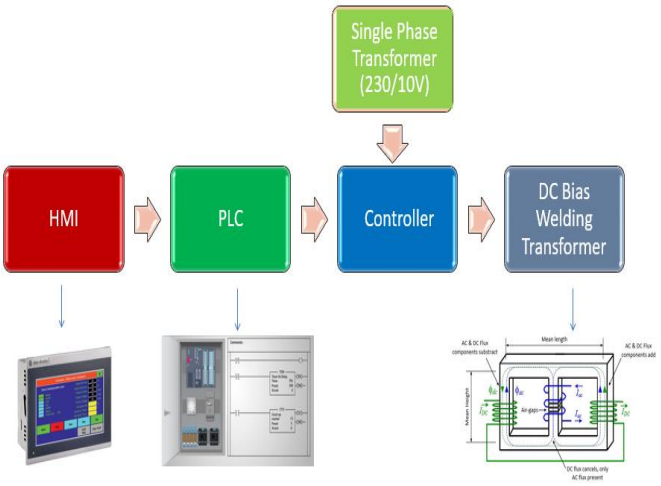

Fig. 1. Block Diagram of PLC Based Welding Transformer.

2. Methodology:

First select the current & time for specific type of material & thickness of material on HMI.

HMI is interfaced with the PLC and the program for welding process is stored in the PLC.

This program will give the controller appropriate value of current and time duration for welding process.

Then the controller will process the output of PLC.

The output of controller is given to the tertiary winding of DC bias welding transformer.

Thus, we get desired welding in optimum energy usage.

Quality & Accuracy in welding process.

The use of equipments like PLC, Controller & DC Bias Transformer for controlling action of the system effectively results in increased production, less time consumption and better safety for the employees.

This procedure is done on the trial and error basis. The welding will be conducted on different gauge of material and type of materials. This will also provide us with appropriate time duration required for proper and efficient welding. Form this test conducted on different type of gauge and type of material a data sheet will be prepared which will further helps the operator to select exact current rating and the time duration for the selected material for welding process. As appropriate amount of current cannot be selected in the existing welding transformer sometimes it leads to breaking of the base metal. This results into economical loss.

According to the data sheet prepared the welding is done only for the selected time duration after that the welding process will automatically stop this will save our time as compared to conventional welding process eventually it will reduce the wastage of power and process becomes efficient and economical.

3. **Components:**

i) Human-machine interface (HMI):

ii) Programmable Logic Controller (PLC):

iii)Controller:

iv)Single Phase Transformer:

v)DC Bias Welding Transformer:

i) Human-machine interface (HMI):

The HMI is interface with PLC from this HMI appropriate current rating and time duration as per the material. This value will be display on HMI.

Fig. 2 Human Machine Interface

ii) Programmable Logic Controller (PLC):

In the PLC the program is set using the mathematical instructions and other special instruction like timer, scale with parameter. According to program input is taken from HMI i.e. time and current. PLC will give the output proportion to 0V to 10V to controller.

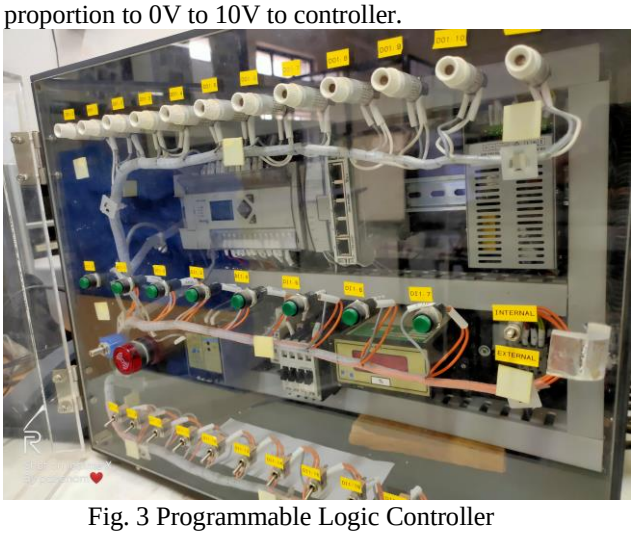

Fig. 3 Programmable Logic Controller

iii)Controller:

The controller will be supplied with 230V, 50HZ AC supply for its own working. If the DC supply to the tertiary winding of the DC bias transformer is less than the required magnitude then the controller will integrate the DC current and if these DC currents is more than the required magnitude then controller will Derivative the DC current.

v)DC Bias Welding Transformer:

This transformer is work on the principle of SRPFC i.e. Saturable Reactor for Power Flow Control.

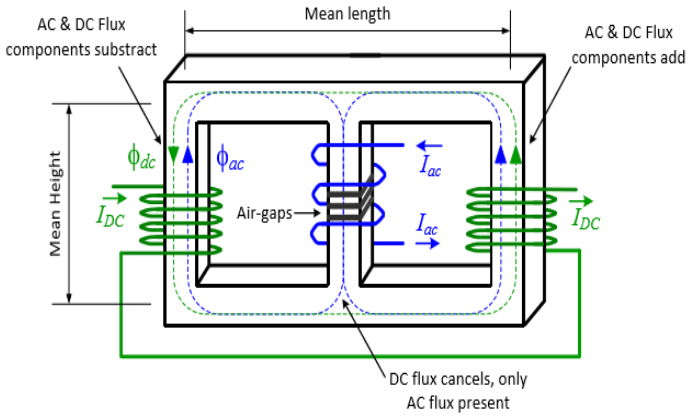

Fig. 4 Schematic Diagram of DC biased Transformer

The DC bias transformer is same as the normal transformer the only difference the construction is that we have to introduce the one extra winding known as the tertiary winding. This winding place on the middle limb of the transformer or the outer limbs. If we place the tertiary winding on the middle limb then the DC current direction is opposite the the main direction of the transformer at that condition if we increase the DC current the output of the transformer will be reduced.

In case of 2nd condition the tertiary winding is place on the outer limb of the transformer, then the direction of the DC current and the transformer current is same, at that condition if we increase the DC current then output of the transformer will increase.

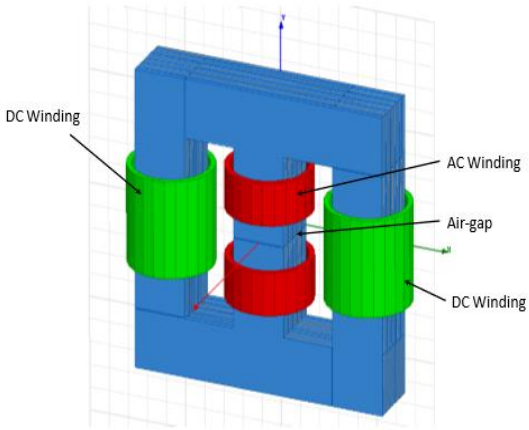

Fig. 5 Construction of DC Biased Transformer.

This is the specialty of that transformer we can control the output of the welding transformer without using any Hardware control device or equipment.

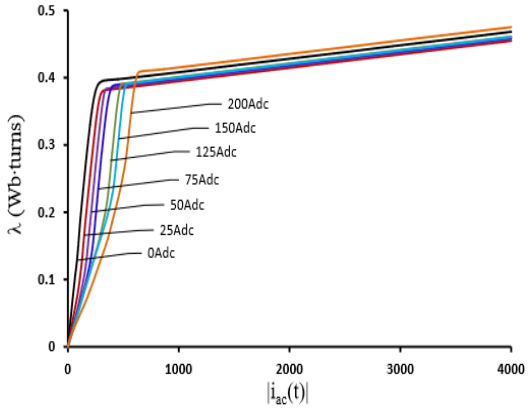

Fig. 6 Flux Vs AC current graph.

The above graph is plot between weber per turn and ac current shows the as the DC current increases the output of the welding transformer is decrease.

III. CONCLUSION

Thus, we get desired welding in optimum energy usage.
Quality & Accuracy in welding process.
The use of equipments like PLC, Controller & DC Bias Transformer for controlling action of the system effectively results in increased production, less time consumption and better safety for the employees.

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