IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

DESIGN AND FABRICATION OF PORTABLE WELDING MACHINE

[1]Vetrivel P, Student,
Department of mechanical Engineering,
Paavai Engineering college,
Namakkal.

[2]Mohammed Riyas A, Student,
Department of mechanical Engineering,
Paavai Engineering college,
Namakkal.

[3]Ashif Ali M, Student,
Department of mechanical Engineering,
Paavai Engineering college,
Namakkal.

[4]Nishanth R, Student,
Department of mechanical Engineering,
Paavai Engineering college,
Namakkal.

ABSTRACT

This Project is design and fabrication of an electric arc welding machine from locally made materials. The major components employed in the construction of the electric arc welding machine are the transformer and digital voltmeter. The transformer used is a shell type transformer mounted on the casing bed with bolt and nut. The system was tested with varying numbers of turns and its voltage was recorded. The components were tested using a digital multi-meter (DMM) to ensure proper functioning of component's expected data. Results showed that the arc welding machine transform slow voltage, low amperage primary power into low voltage, high amperage power used for welding at high frequency. This high- frequency transformation helps to reduce the weight and size of the transformer.

Keywords: arc welding, welding machine, fabrication of machine, portable welding, transformer, digital voltmeter

INTRODUCTION

Welding can be defined as the process of joining two or more pieces of metals using electricity or flame to make the art a simple piece. Arc welding is a process that is used to join metal to metal by using electricity to create enough heat to melt metal, and the melted metals when cool result to binding of the metals. It is a type of welding which uses a power supply to create an electric arc between an electrode and the base material, to melt the metals at the welding point. Arc welding processes may be manual, semi-automatic, or fully automated (Asiwe *et al*., 2018).

Arc welding can be carried out using

designed machine or equipment that uses welding power supply to create an electric arc between direct current (D.C) or alternating current (A.C), and consumable, and non-consumable electrodes.

The arc welding machine uses an electric power as the input that is supplied through the primary winding and then transferred to the secondary winding by induction. It is used to carry out welding work by connecting through the output terminal to the welding cables. The output of the machine is designed in a manner that it can be varied by adjusting the crank of the machine in a clockwise or anti-clockwise direction, either to increase or decrease the output current depending on the size of the material it is to be used on (Takasaki, 2003).

Arc welding machine provides an electric current of various characteristics to perform its welding functions. The use of such machine is essential for the following:

i. To convert A.C supply to D.C supply when direct current welding is desired.

ii. To reduce the high supply voltage to a safe and suitable voltage for welding purposes.

iii. To provide high current necessary for arc welding drawing correspondingly high current from the supply mains.

iv. To provide suitable voltage/current relationships necessary for arc welding at a minimum cost.

Arc welding usually requires high current(over80amperes),and it may require above 12,000 amperes in spot welding. It can be used to join pipes in pipe lines, power plants at the construction sites, and for home appliances. Furthermore, arc welding is used in ship building, automobile manufacturing, and repair (X u, 2020).

The major component of the arc welding machine is the transformer. AsI we *et al*.(2018) investigated the design and construction of an arc welding machine's transformer. The transformer was a single phase having shell type of lamination core and insulated windings of copper coils. They reported that with the help of an angle iron and lamination core, the core loss, iron loss in the machine was reduced to minimum. AsI we *et al.*, (2018) observed that the scaling factor and the turn factor at terminal A was almost the same indicating that the higher the turns the better the transformer. This feature helps to avoid high current which may cause spark, and also, improve the efficiency of the transformer.

Ibrahim *et al.* (2016) investigated the construction of a welding system which used a low frequency transformer that operated at the utility mains frequency of 50 or 60 Hz with variable current selectors to avoid power quality problem such as voltage, current, and frequency deviation from nominal value in electrical distribution and utilization system. The welding machine was presumed heavy with regards to the construction details of the work done.

LITERATURE REVIEW

W. Provost (1982) explored the impacts of a pressure alleviation warm behavior on the strength of weight container quality steels. The aftereffects of this work depict the impact of post weld warm medicines on the strength of welded joints in

weight vessels quality steels. Uncommon consideration is paid to the base plate thickness for which a post weld warm treatment ought to be prescribed. The acquired outcomes demonstrate that, in spite of the fact that the present code prerequisites are tasteful for C-M n steel. They were totally modified for N b-micro alloyed steel, welded through high warmth input. **T.A Lechtenber and J.R. Foulds (1984)** explored the impact of pre-warm on the microstructure, hardness and strength of HT-9 weldments. A diminished preheat, affecting a quicker weld metal cooling rate, results in an expanded upper rack vitality and lower pliable weak progress temperature with no charge in weld metal. SEM examinations show a diminished dendrite separating and bring down inter dendritic isolation with a quicker cooling rate. It is obvious that the shifting inter dendritic ferrite substance and morphology and the dendrite dividing, both constrained by the cooling rate, assume a critical job on the weld metal unique crack conduct. The outcomes propose the most reduced preheat perfect with great welding practice causes in to accomplish the greatest advantages to the weld metal crack mechanics. **J.N Clark (1986)** researched about the weld fix of low compound downer safe steel castings without preheat and post-weld warm treatment. Extra information on downer pliability of the weld metal were given and talked about reference to the more extended term honesty of fixes. **O.M. Akselsen and O. Grong (1992)** explored the forecast of weld metal Charpy V score durability. A progression of exact conditions has been produced which relates the durability to the weld metal microstructure and elasticity. A correlation among expectations and analyses demonstrated that the best understanding is accomplished by the utilization of estimated qualities for a definitive elasticity and the acicular ferrite content. The charts can, thus, fill in as a reason for legitimate choice of consumables for welded steel structures. **V.S.R. Murti, P.D. Srinivas, G.H.D. Banadeki and K.S. Raju (1993)** researched the impact of warmth contribution on metallurgical properties of HSLA steel in multi-pass MIG welding. Here its weldability via Auto MIG welding utilizing 309L terminal wire has been examined. This outcomes in high welding rate, high statement rates and more profound infiltration.

SPECIFICATION

Duty Cycle:

It is the ratio of time during which the machine is loaded to the total time elapsed during one welding cycle with the machine is remain energized. 60%dutycycle means that a machine is loaded for 3 minutes in a cycle of 5 minutes. Duty cycle is 100% for automatic, 60%for continuous DC Hand Welding, 55% for AC welding.

Maximum Hand Welding Current:

It is the maximum current, which a machine can deliver without exceeding the permissible temperature rise. It is 1.3 times the rated current.

Minimum Hand Welding Current:

It is the minimum current that a machine can deliver. It should be 20% of the rated current.

Open Circuit Voltage:

It is a voltage with secondary open circuit. It should be 30 to60 volts minimum.

Welding Load Voltage:

It is the voltage of secondary with specified current flowing through the welding circuit.

V=20 +0.4 x

I=44 volts,

Where,

V-is the welding load voltage and

I –welding load current.

Rated Current:

Welding machine is rated at current and duty cycle corresponding to the maximum continuous welding current. It should be 150, 200, 300, 400, 500, 600, 900.

MATERIALS AND METHODS

Components Identification and Description:

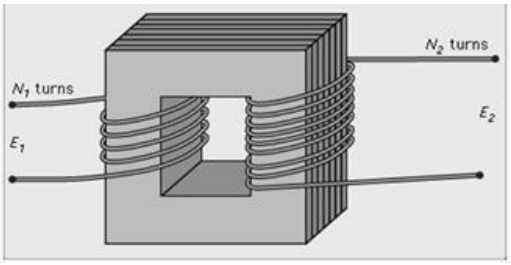
The components/devices used for the construction of the welding machine are explained below.

Switch

The switch is used as power ON and OFF for the arc welding machine. The circuit breaker protects the arc welding machine from over-current, and it acts as an isolator. An isolator is a device that can break an electrical circuit, interrupting the current or diverting it from one conductor to another.

Transformer

The transformer is defined as a static piece of apparatus by means of which electric power in one circuit is transformed into electric power of the same frequency in another circuit.



Digital Voltmeter

A digital voltmeter is a measurement device that measures the electric potential difference between conductors. A digital voltmeter shows voltage directly as numerals. This meter can *determine* voltage values to several significant figures. This instrument can measure voltages of either direct or alternating electric current on a scale usually graduated in volts, milli volts (0.001 volts), or kilovolts (1,000 volts). The typical commercial or laboratory standard voltmeter in use today is likely to employ an electromechanical mechanism in which current flowing through turns of wire is translated into a reading of voltage. Other types of voltmeters include the electrostatic voltmeter, which uses electrostatic forces, thus, it is the only voltmeter to measure voltage directly rather than by the effect of current.

Electrode Holder

An electrode holder is a clamping device used for holding the electrode securely in any position. The welding cable is attached to the holder through the hollow insulated handle. The design of the electrode holder permits quick and

easy electrode exchange.

Fan

The fan serves as the heat regulator because as the welding machine operates, the transformer generates a lot of heat and thus needs to be cooled.

Metal OxideVaristor

The metal oxide varistor otherwise, known as the MOV is a voltage-dependent, nonlinear device that provides excellent transient voltage suppression. MOV have a fast response, high stabilization for circuit voltage, excellent voltage ratio, and can serve as surge protector (Teraja,2008).

Measuring Equipment Used:

Digital clamp meter

The digital clamp meter is an electrical device having two jaws which open to allow clamping around an electrical conductor. This allows properties of the electric current in the conductor to be measured without having to make physical contact with it or to disconnect it for insertion through the probe.

Micrometre screw gauge

It is used to measure the diameter of the copper conductor. It is a device incorporating a calibrated screw, widely used for precise measurement of components in machining.

Construction of an electric arc welding machine

The major components employed in the construction of the electric arc welding machine are the transformer, and the digital voltmeter. The transformer used in this case is a shell type transformer mounted on the casing bed with bolt and nut. Other parts like the electrode holder, earth lead etc., are as well connected.

WELDING PROCEDURES

i) Activity prior to welding

ii) Activity during welding

iii) Activity after welding.

A) Prior to Welding:

i) The area about 15mm from each side of the are at welded shall be properly cleaned.

ii) The area to be welded shall be free from dust, dirt, grease, oil, paints etc. Any non corrosive and suitable organic solvent (Kerosene oil, Benzene etc) can be used for removing grease, oil & paints.

iii) Stainless steel wire brushes should be used to remove tenacious layer of Chromium oxide for better strength of joint.

B) During Welding:

i) The welding parameter in the machine shall be set as per commendation of manufacturer.

ii) If welding is carried out by MMAW process, connect the electrode with positive terminal of welding equipment (DC+) when welding with DC.

iii) Use70 OCV(min) transformers while welding with AC.

C) After Welding:

i) The stainless steels are susceptible to corrosion if the surface is rough. To avoid the corrosion, surface should be made smooth & polished. It is therefore, necessary to finish the stainless steel joint by grinding & subsequent polishing using fine grinder.

ii) Mild steel & corten steels both are anodic to the stainless steels, hence any small portion of

Mild steel & corten steel in contact with stainless steel will corrode severely in short time. Proper & quick corrosion protection is therefore, required in these locations.

SAFETY REQUIREMENT

- Inspect the cables periodically for looseness at the joints, defects due to wear, or other damage. Defective or loose cables are a fire hazard. Defective electrode holders should be replaced and connections to the holder should be tightened.
- Welding generators should be located or shielded so that dust, water, or other foreign matter will not enter the electrical windings or the bearings.
- Disconnect switches should be used with all power sources so that they can be disconnected from the main lines for maintenance.

WORKING PRINCIPLE

It uses the high-temperature arc generated when the positive and negative poles are short-circuited instantaneously to melt the solder and the material to be welded on the electrode to achieve the purpose of combining them. The structure of the electric welding machine is very simple. To put it bluntly, it is a high power transformer, which converts 220/380V AC into low- voltage, high-current power supply, which can be DC or AC. Welding transformers have their own that is, they have a sharp drop in voltage. After the electrode is ignited, the voltage drops. In the adjustment of the working voltage of the welding machine, in addition to the primary 220/380Vvoltage conversion, the secondary coil also has adapted voltage conversion , and at the same time, it is adjusted by an iron core. The adjustable iron core welding machine is generally It is a high-power transformer, which is made by using the principle of inductance. The inductance will produce huge voltage changes when it is switched on and off. The high voltage arc generated by the instantaneous short circuit of the positive and negative poles is used to melt the welding rod. Solder to achieve the purpose of combining them. A voltage is applied between the electrode and the work piece, and the arc is ignited by scratching or contacting, and the energy of the arc is used to melt the electrode and heat the base material.

CONCLUSION

Portable arc welding is an efficient and convenient method for welding various materials in different locations. It offers flexibility and ease of use, making it a popular choice for welding professionals and hobbyists alike. Its compact design and portability make it easy to transport from one job site to another, enabling welders to work on different projects without the need fora fixed welding station. Furthermore, advancements in technology have made portable arc welding equipment more reliable, efficient, and durable than ever before. With the use of inverter technology, welders can produce high-quality welds with greater control and precision, while also reducing power consumption and overall weight. Despite its advantages, portable arc welding does have some limitations. The size of the welds that can be produced is limited by the

power output of the equipment, and the quality of the welds is highly dependent on the skill of the welder.

REFERENCES

[1] As I we, U. M., Edema, A. & Edeafead he, G. (2018). Design and construction of an electric arc welding's machine transformer. International Journal of Trend in Scientific Research Development, 2(6), 924-929.

[2] Evboghai, M. J. E., Akhadeloor, S. A., Ighalo, G, I., Anyasi, F. I., & Aimuanwosa, I. O. (2007).Realization of3kvasinglephaseelectric arcwelding machine with facilitiesfor charging batteries. International Journal of Electrical and Power Engineering, 1(5), 537-542.

[3] Howard,B.C.&Helzer,S.(2005).ModernWeld ingTechnology.PrenticeHall.Ibrahim,I.
I. & Adamu, B. I. (2016). Design and construction of a welding machine with a variable current selector. International Journal of Pure and Applied Science.

[4] Ovbiagele, U. & Obaitan, B. (2015). Design and construction of an inverter type 3KVA, 50 Hz, single-phase arc welding machine. International Journal of Scientific and Engineering Research, 6(5), 931-942.

[5] Takasaki, Y., Sonoda, T. & Fujii, S. (2003). Development of a portable spot welding machine. IEEE International Magnetics Conference. DOI: 10.1109/INTMAG.2003.1230907
Theraja,B.L.&Theraja,A.K.(2008).ATextbookofEl ectricalTechnology.S.Chand& Company Ltd. ISBN 81-219-2441-3. www.en.wikipedia.org [Viewed 02/01/2020].

[6] Xu, W. (2020). Friction welding for making metallic parts and structures. Reference module in material science and materials engineering. https://doi.org/10.1016/B978-0-12-819726-4.00017-X.