RESISTANCE SPOT WELDING MACHINE

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ABSTRACT

Resistance spot welding is a welding technique that is used for almost all known metals. The actual weld is made at the interface of the parts to be joined. The electrical resistance of the material to be welded causes a localized heating at the interfaces of the metals to be joined. Welding procedures for each type of material must be developed for the most satisfactory results. It is possible that shunt currents flowing through a previously made spot weld will take welding current away from the second spot weld to be made. This will occur if the two spot welds are too close together, and it will happen with all metals. This type of welding requires a very short period of time and is mostly used in automobile industries for mass production. The construction of the machine is also simple and easy to use for the operator.

Keywords: - *Resistance, Spot, Welding*

1. INTRODUCTION

1.1 Working Principle

Resistance welding is accomplished when current is caused to flow through electrode tips and the separate pieces of metal to be joined. The resistance of the base metal to electrical current flow causes localized heating in the joint, and the weld is made. The resistance spot weld is unique because the actual weld nugget is formed internally in relation to the surface of the base metal. A resistance spot weld nugget compared to a gas tungsten-arc (TIG) spot weld. The gas tungsten-arc spot is made from one side only. The resistance spot weld is normally made with electrodes on each side of the work piece. Resistance spot welds may be made with the work piece in any position.

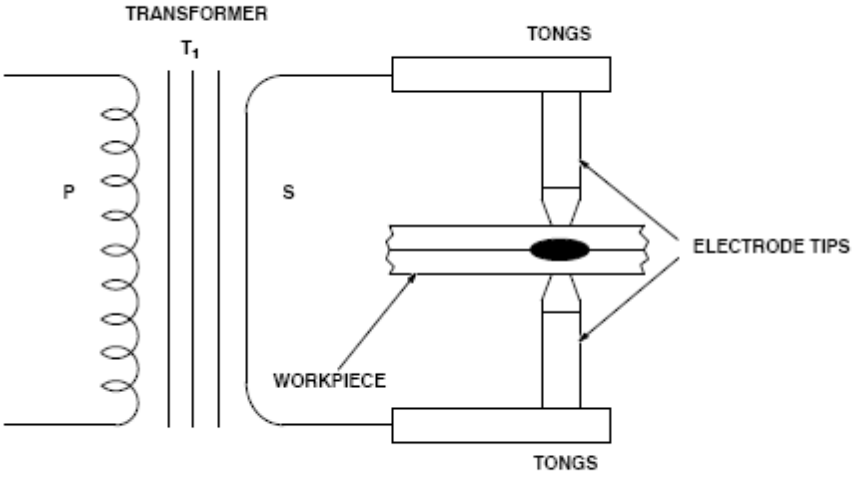
The resistance spot weld nugget is formed when the interface of the weld joint is heated due to the resistance of the joint surfaces to electrical current flow. In all cases, of course, the current must flow or the weld cannot be made.

The pressure of the electrode tips on the work piece holds the part in close and intimate contact during the making of the weld. Remember, however, that resistance spot welding machines are NOT designed as force clamps to pull the work pieces together for welding.

1.2 Spot Welding Time Cycle

Squeeze Time: Time between pressure application and weld.
Heat or Weld Time: Weld time in cycles.
Hold Time: Time that pressure is maintained after weld is made.
Off Time: Electrodes separated to permit moving of material for next spot.

2. PROJECT DIAGRAM



Resistance Spot Welding Machine With Workpiece

2.1 Working

1. When the power supply is ON, the electricity goes to the transformer where the voltage is stepped down and the current increases being inversely proportional to voltage.
2. The two pieces of metal to be joined are squeezed together by the electrodes on the welding machine so they are in good electrical contact.
3. Then electric current is passed through them, heating them until they begin to melt at the spot where they are in contact.
4. The molten metal from the two pieces flows together; then the current is turned off and the molten metal solidifies, forming a solid metallic connection between the two pieces. The term “Resistance Welding” comes from the fact that it is the electrical property of resistance of the metal being welded that causes heat to be generated when current flows through it.

3. DESIGN PARAMETERS

3.1 ELCTRODE FORCE

Electrode Force is the result of air pressure applied to the air piston connected directly to the head. The actual amount of electrode force depends on the effective air pressure, weight of head, and piston diameter. Most welders have electrode force charts on the side of the machine, tabulating air pressure vs. electrode force. If there is no chart available for the machine, use the following formula:

Electrode Force = 0.78 x D^2 x P or π x $\frac{D^2}{4}$ x P

Where, D is the piston diameter in inches

P is the air pressure in pounds per square inch

Electrode Force is in pounds.

3.2 ELCTRODE TIP DIAMETER

When you consider that it is through the electrode that the welding current is permitted to flow into the work piece, it is logical that the size of the electrode tip point controls the size of the resistance spot weld. Actually, the weld nugget diameter should be slightly less than the diameter of the electrode tip point. If the electrode tip diameter is too small for the application, the weld nugget will be small and weak. If, however, the electrode tip diameter is too large, there is danger of overheating the base metal and developing voids and gas pockets. In either instance, the appearance and quality of the finished weld would not be acceptable. Determining electrode tip diameter requires some decisions on the part of the weldment designer. The resistance factors involved for different materials will certainly have some bearing on electrode tip diameter determination. A general formula has been developed for low carbon steel. It will provide electrode tip diameter values that are usable for most applications.

"The tip diameter discussed in this text refers to the electrode tip diameter at the point of contact with the work piece. It does not refer to the major diameter of the total electrode tip.

The formula generally used for low carbon steel is as follows:

Electrode tip diameter = 0.100 in. + 2t

where " t " is the thickness in inches of one thickness of the metal to be welded.

This formula is applicable to the welding of metals of dissimilar thicknesses. The formula is applied to each thickness individually, and the proper electrode tip diameter selected for each size of the joint.

For example, if two pieces of 0.062 in. sheet metal are to be joined, the electrode tip diameter would be the same for both sides of the joint. The calculation would be as follows:

Electrode tip dia. = 0.100 + 2t

= 0.100 + 2 x 0.062 in.

= 0.100 + 0.124 in.

Electrode tip dia. = 0.224 in.

If the two pieces were unequal in thickness, such as one piece 0.062 in. and the other 0.094 in., two calculations would have to be made. Each thickness would be treated as the basis for one electrode tip diameter determination, as follows:

Electrode tip dia. = 0.100 + 2t

= 0.100 + 2 x 0.062 in.

= 0.100 + 0.124 in.

Electrode tip dia. = 0.224 in. (one side only)

For the other side, the calculation is as follows:

Electrode tip dia. = 0.100 + 2t

= 0.100 + 2 x 0.094 in.

= 0.100 + 0.188 in.

Electrode tip dia. = 0.288 in. (one side only)(**for low carbon steel**)

4. ADVANTAGES

- The Resistance welding process can be referred as green process, since,
  1) It does not generate gases and flames
  2) It is an environment friendly process and uses renewable energy sources.
- This process reduces the operators fatigue to a great extents
- It can be easily automated.
- The spot welding helps to joint component in one shot which reduces valuable time.
- This kind of welding can produce continuous and fast welds.
- Very much helpful for mass production.
- The equipment used in this process can be automated easily.
- They conserve materials as no filler metal, shielding gases, flue gases, flux etc.
- Skilled operator is not required.
- Dissimilar metal can be easily joined.
- A high degree of reliability and reproducibility can be achieved.

5. DISADVANTAGES

- The equipment has high initial cost.
- Restricted to fewer types of joints.(Mostly lap joints)
- Skilled maintenance persons are required to service the controlling components.
- Some Materials require special surface preparation prior to welding.

6. APPLICATIONS

Resistance spot welding machine has many applications in industry as well as small workshops. Some of them are as follows:

- Spot welding of thick steel plates has been done and it has replaced the need for riveting.
- The welding of two or more sheet metals can be joined by mechanical means more economically by using the spot welding methods. We don't need gas tight joints.
- Spot welding can be used for attaching braces, pads or clips with cases, bases and covers which are mainly product of sheet metal forming.
- Automobile and aircraft industries relies greatly of spot welding these days.

7. CONCLUSION

With the help of all the previous literature and online websites we have conducted a thorough study required for the successful completion of our project i.e., the components required , working principle, factors affecting the welding process , the materials to be welded as well as the design of structure required for various components of the project. The spot welding helps to joint component in one shot which reduces valuable time. This machine is very much helpful for mass production.

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