FOREWORD

This booklet has been prepared by our technical team in order to guide the Industries employing Resistance Welding Technology in their line of manufacture. We have tried to bring the information on the company, its product range and more particularly, recommended practices for resistance welding.

It is important to recognize that these recommended practices are not presented as the only possible conditions for welding the material and thickness shown; they are rather offered as a guide for setting up welding schedule to be followed in any particular fabrication, modified according to specific fabricating conditions and production requirement involved.

Our Technical Team has prepared these recommended practices, in the hope that they will serve as an incentive to the industries, to develop methods and procedures improving upon the practices presented herein, which will prepare the way for raising of quality and performance standards. If this is achieved, we will be amply awarded on our efforts and devotion for preparing this booklet.

The tables presented in the booklet give information such as the requirement of current, weld time, pressure, preparation of job, limitations, electrode configuration and their materials etc., for selection of appropriate machine and also for setting up of the welding parameters.

Detailed information on the various types of the machines of Mechelonic product range are available in their technical bulletin. With the help of technical bulletin and the data presented, one can select the machines for their various requirements. Should further information on the technology be required, you are welcome to contact the company for further guidance.

Communication on these practices is most welcome.

MECHELONIC

The birth of Mechelonic took place a decade ago – in January 1972.

Established by a group of enterprising technocrats, the company started with the manufacture of simple spot welding machines.

With the passage of time, however, the Mechelonic range grew extensively to cover the entire spectrum of resistance welding machines, with sophisticated electronic controls based on totally indigenous know-how.

Today, the Mechelonic range of products includes spot, projection, seam, butt and flash butt welders, and metal-gathering as well as electro-brazing machines in capacities ranging from 1 to 500 KVA (single and 3 phase systems).

Beside the standard range of machines, Mechelonic also manufactures several custom-built special purpose and supporting machines, to meet the needs of various industries.

RESISTANCE WELDING

Resistance welding incorporates a group of processes – Spot, Seam, Projection and Butt Welding – in which the heat for welding is generated, by the resistance to the flow of electrical current, through the parts being joined. Resistance welding differs from other forms of welding, in that no extraneous materials, such as fluxes, filler rods, etc are used. Resistance welding further differs from the fusion welding process by utilizing the application of mechanical pressure to forge the heated parts together. The effect of pressure is to refine the grain properties in most cases equal to parent mental and sometimes even superior.

Resistance welding machines and their operation often appear mysterious to the layman, when he sees good welds made so quickly and easily.

In order to better understand the nature of resistance welding and how it is accomplished, it is best to consider a simple spot weld. The basic principle will apply to all other resistance welding and heating methods except flash butt welding.

The spot weld is made by pressing two pieces of metal while an electric current is passed through them to heat the localized contacting surfaces to the welding temperature. The fundamental principle of heat generation in resistance welding is the physical law that heat is produced in a conductor by passage of an electric current.

The most important characteristic of the process is the rapidity with which this heat can be produced. This is comparable to the time required for heating a filament of an ordinary light-bulb. For a complete understanding of the resistance weld, it should be noted that Ohms' Law is the basic electrical theory. This fact leads to the principal consideration in resistance welding – the generation of heat.

The formula of heat generation in electrical circuit is H- I^2R where H = Heat, I = Current and R= Resistance. In a spot welding process, a pair of electrodes conduct electrical current through the metal parts forming the weld. Force is always applied before, during and after the application of current to ensure the continuous electrical circuit and to forge the heated parts together. The main process variables are, welding current, current time, electrode force and electrode characteristics. Although the current needed may be 10 to 100 times that used in arc welding, the time to make the single weld is usually a fraction of a second. The characteristic of resistance welding which has the greatest economic significance is high speed of operation.

Mechelonic Welders Pvt Ltd

GUIDELINE TO MAINTENANCE OF MACHINE

Intelligent servicing and maintenance of the resistance welding equipment can be accomplished by a thorough understanding of the principles of resistance welding and of the mechanical and electrical assemblies and the mechanical and electrical assemblies and the electronic controls. Quite a lot of information on these can be obtained from the machine manufacturer and also form the instruction and maintenance manuals supplied along with the machine.

Installation should be done as per instructions from the manufacturer and the commissioning preferably should be done in the presence of the manufacturer's engineer who will ensure that all service connections are tight and free of defects.

Operating Start-up

See all sliding or rotary parts move freely. All the bolts, nuts, couplings, unions and hose connections are tight. Lubricate the machine parts wherever necessary. Fill in the air lubricator with a good grade light machine oil. Switch on air, water and power supplies. In 'no weld' mode, check the machine operation and ensure squeeze, weld, hold, and off time controls are working.

The machine now can be tested for welding after setting up the various variables like pressure, heat control, squeeze, weld, hold and off timings.

Routine maintenance consists of lubrication of machine parts, cleaning and replacing worn out or broken parts as and when required. Preventive maintenance on the other hand consists of a regular inspection programmer aimed at prevention of the likely trouble. Since the welding machine develops a very high current, special attention should be paid to the secondary circuits. Adequate cooling water flow should be ensured. After the machine is operated for several hours the secondary current path should be checked for any excessive temperature rise. A powerful air-jet can expel the obstructing material, if any, in the water path. Air cylinders can get hot if the lubrication is inadequate. Air lubricator should be periodically topped up and should be serviced to ensure that the jets are not blocked. Improper air lubrication can lead to frequent failures of seals and can gaskets in the cylinders and can cause rusting of the cylinder or piston parts ultimately leading to break-downs. Solinoid valves should be checked for proper electrical connections and for any likely leakage.

Electrodes should be clean and should be dressed to the correct shape to ensure proper current concentration at the welding area. Sufficient cooling water should reach the electrode through the holders and it should be seen that the electrodes are not getting hot during welding. Electrodes should be aligned using a straight edge.

Water line through the thyistor assembly should be checked to ensure free flow of water. All the wiring terminals and relay contacts should be tightened. The interior of the cabinet should be kept clean and

should be dusted with a fine brush. Never use compressed air to blow of dust in the control cards, unless the same is dry and applied through a diffuser.

Limited switch and pressure switch contacts should be checked periodically.

PREVENIVE MAINTENANCE

Daily:

- Wipe off dirt, grease, oil and water. Clean all the fixtures and clamps.
- Check for water flow and ensure that no leaks are there.
- Check oil levels in lubricator, gear boxes or variable speed units, if any, and in oil reservoirs.
- Check pressure gauge, air filter-regulator & lubricator.
- Align the electrodes.
- Operate the machine in the weld mode a few times to ensure smooth movements.
- Check whether all indicator lamps and control sequences are working.
- At the end of the shift or day dust away dirt and swarf and wipe dry the machine. Close all valves and switch off the power supply; guards of the machine and panels should be closed.

WEEKLY :

- Inspect electrode holders. Clean all fixture and clamps. Remove any misalignment of electrode holder. Tighten all joints.
- Clean the working area.
- Tighten cylinder mounting nuts. Tighten piston rod lock nut.

MONTHLY :

- Flush the entire cooling system to remove any accumulations.
- Replace worn out or cracked hoses.
- Clean strainers.
- Check all the valves.
- Tighten all terminals and electrical connections in the system.
- Make a through visual inspection of the entire machine and its controls and accessories.

Annually:

- A minor overhaul of the machine should be made. Secondary contact surfaces should be cleaned with an abrasive paper and polished before tightening again. Alternatively any good chemical cleaner can be used to clean to copper contacts. Check all protective and overload devices. Check all the seals and gaskets. Clean of rust and repaint the machine. Flush gear box

or reservoirs and fill in fresh oil. Excessively worn out bearings, trunions and bushes should be replaced.

- Calibrate the gauges and replace regulator diaphragms. Lubricate all bearings and moving parts.

RESISTANCE WELDING ELECTRODES

ELECTRODE FUNCTIONS :

Resistance welding electrodes perform three important functions: they conduct welding current to the work; they transmit to the weld area the required pressure to produce a satisfactory weld;

They dissipate the heat from the weld zone rapidly or gradually depending on the process being employed and the necessity for removal of heat.

Successful execution of any resistance welding operation therefore depends upon the proper functioning of electrodes.

In the case of electro-brazing operations the electrodes are chosen to retard dissipation or radiation of heat from the brazing zone. It is, therefore, very important to take care in the selection, design and maintenance of electrodes when good welds are desired. However, it does not mean that unsatisfactory welds indicate only faulty electrodes, because even the best electrodes cannot produce good welds unless the welding machine is providing the required current and pressure under proper control.

ELECTRODE MATERIALS

The alloys recommended for use as electrode materials have higher annealing or softening temperatures than copper, together with improved compressive strength and wear resistance. This has necessarily been accompanied by some sacrifice in conductivity. The best choice of electrode material for a given application is the alloy which has sufficient conductivity to prevent burning or alloying of the electrode face with the work and which possesses adequate strength to resist deformation or change of contour while in operation.

ELECTRODE MATERIAL STANDARDS

American Resistance Welding Machine Manufacturers' Association has classified most of the alloys into two group 'A' – Copper Base alloys; Group – B – Refractory Metal compositions.

ELECTRODE DIAMETER AND SHAPE

The electrode diameter and shape are equally important in welding applications. For spot welding two general formulas are often used in determining small diameter 'd' for a given sheet thickness: d = 2 T + 0.1 in. and d=√T. The first has been found more applicable for thinner material, the second for thicker material. (Refer to welding data on 'd'). in the case of seam welding the electrode width is equally important. (Refer to welding data on 'W').

It is suggested to refer to the manufacturer or Mechelonic to recommend the right class of electrodes and their dimensions for various applications.

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