RESISTANCE WELDING

- **Objectives :**
  - To perform resistance spot welding (RSW) on ~~two~~ three similar mild steel sheets of same gauge by varying the heat energy.
  - To analyse the influence of heat energy on nugget dimensions
  - To correlate the joint strength with the various welding parameters.
- **Equipments :**
  - Resistance spot welding machine.
  - Travelling microscope
  - Dial gauge
  - Displacement measuring setup.
- **Theory :**
  - Heat is generated through the flow of current in the resistance formed in the parts being welded.
  - The parts are usually an integral part of the electrical circuit.
  - Contact resistance → heats the area locally by I^2Rt → melting → formation of a nugget.
  - Contact resistance must be higher at the point to be welded than anywhere else.
  - Usually used to join overlapping sheets or plates as lap joints, which may have same or different thicknesses.

Components and Process Variables

- Pairs of water-cooled copper electrodes.
- Applied Pressure

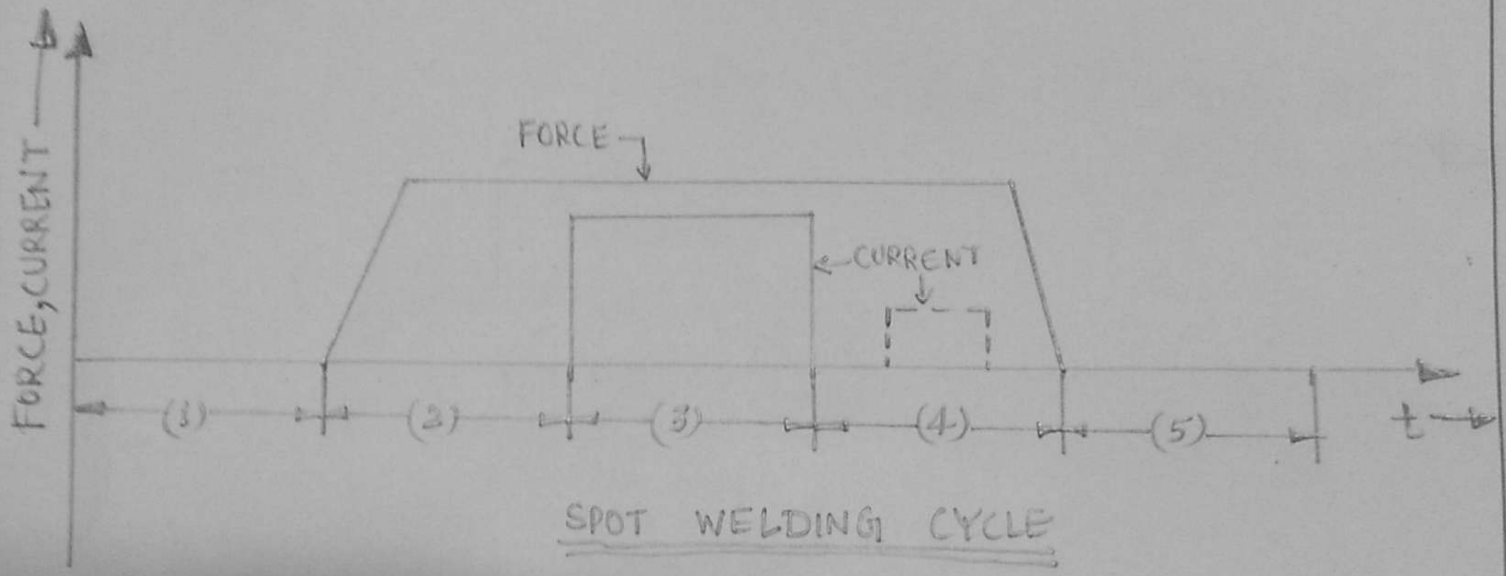
Principal process variables:

→ Welding current
→ Welding Time
→ Electrode force and shape.

- DC Power.

Resistance Welding Cycle

- Squeeze Time
- Weld Time
- Hold Time
- Off Time



SPOT WELDING CYCLE

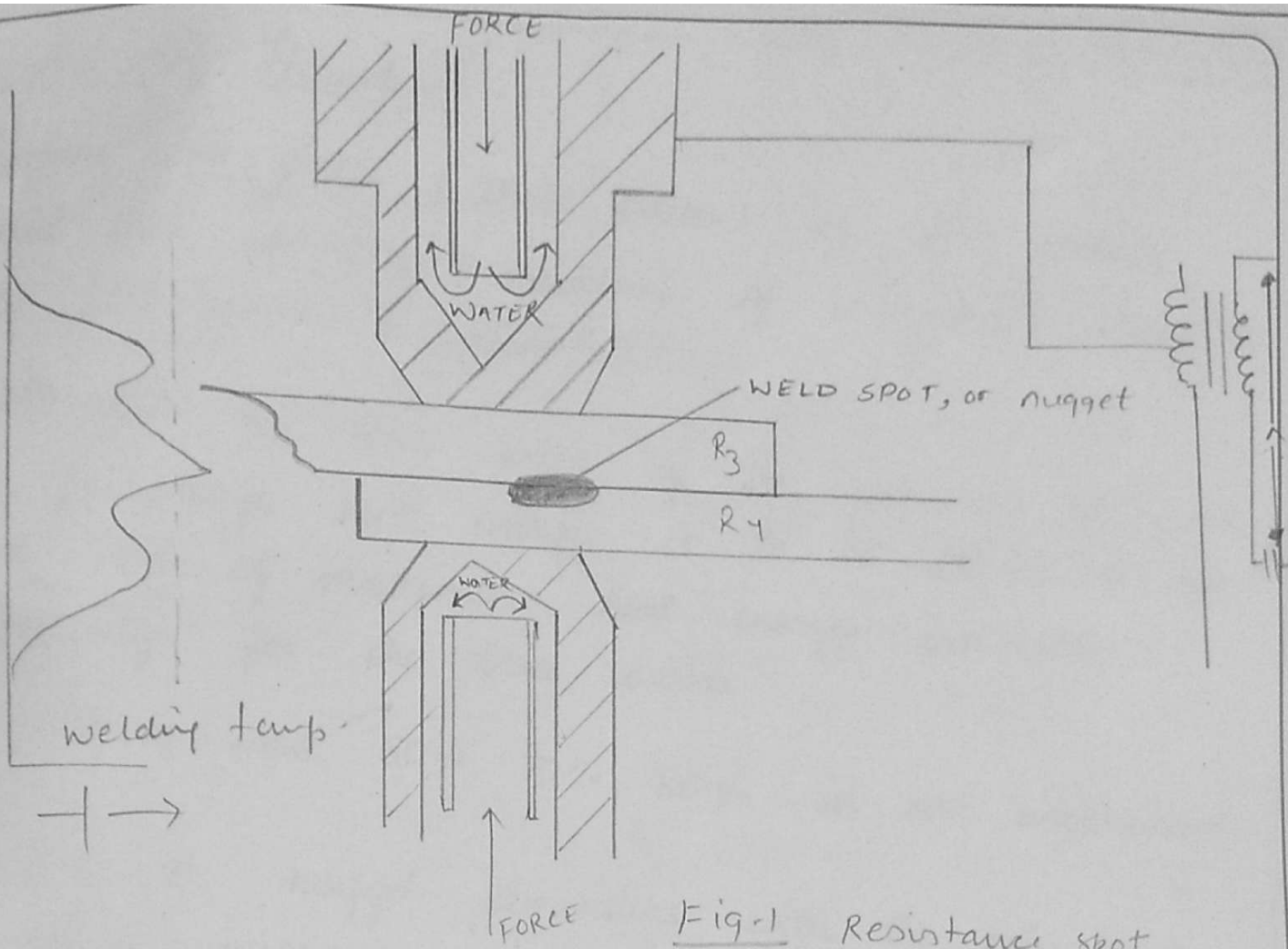


Fig-1 Resistance spot welding setup.

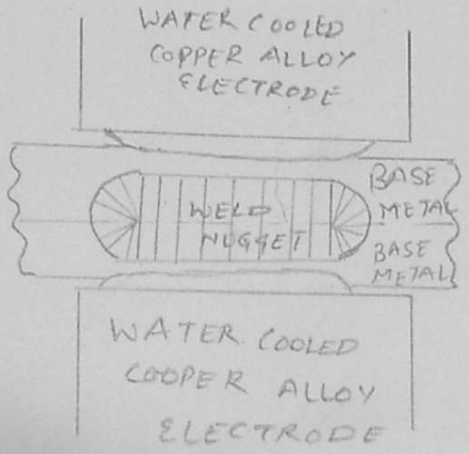


Fig 2. NUGGET formation

Experimental Procedure -

1. Prepare six pieces (three pairs) of sheet metals, mild steel of 1 mm thickness, of acceptable small size (50 × 20 mm recommended).

2. Spot weld the three pairs of the prepared specimens. The percentage heat energy is to be set as 25, 30 and 35 % of maximum heat energy available respectively for the three welds.

   * We have used 60 %, 70 %, 80 % in our experiment.

3. Measure the nugget dimensions with the help of a travelling microscope.

Observation :-

Thickness of the sheet metal = 1mm

Least count of the travelling microscope = 0.01 mm

- Welding parameters

Squeez cycles = 25 (0.5 s) Weld cycles = 15 (0.3 s)

Hold cycles = 30 (0.6 s) Off cycles = 30 (0.6 s)

Pressure = 2 kg/cm^2

Sl. no.	Heat energy (%)	Nugget Diameter (mm)
1.	36	4.88
2.	49	6.15
3.	64	8.59

DATE:

Results and Discussion:

Q- Interpret how the variation in heat energy is influencing the nugget dimensions and weld strength

→ As heat energy provided to the weld is increased, the size of the nugget increases. It can be easily seen from the observation table that diameter increases as heat is increased.

As heat is increased, weld strength increases upto an optimum value. After that if heat energy is increased weld strength decreases.

As heat energy is increased, heat affected zone becomes larger and larger.

Q- What are the desirable properties of a metal that would provide good weldability in resistance welding?

→ Weldability is controlled by 3 factors :-

1) Resistivity
2) Thermal conductivity
3) Melting temperature.

~~Conclusions :-~~

~~Explain how a variation in heat~~

Metals with high resistance to current flow and with low thermal conductivity ~~when~~ and relatively low melting temperature would result in difficulty in welding.

Good conductivity results in high generation of heat energy at the interface of the 2 metal plates.

Q- Discuss about other variants of resistance welding processes

→ There are following types of resistance welding

① Resistance seam welding
② Resistance projection welding
③ Resistance flash welding
④ ~~offset~~ Upset welding
⑤ Percussion welding

Seam welding :- Overlapping spots are produced.

Projection welding :- Projections or dimples in overlapping joint elements are welded.

flash welding → Used in butt joints by bringing 2 surfaces in contact.