RESISTANCE WELDING

- Resistance welding process is a welding process where both heat and pressure are applied on the joint but no filler metal or flux is added.

- The heat necessary is obtained by the **heating effect of the electrical resistance** of the joint and hence, the name resistance welding.

Principle:

- In resistance welding (RW), a low voltage (typically 1 V) and very high current (typically 15000 A) is passed through the joint for a very short time (typically 0.25 s).

- This high amperage heats the joint, due to the contact resistance at the joint and melts it. The pressure on the joint is continuously maintained and the metal fuses together under this pressure.

RESISTANCE WELDING

- The heat generated in resistance welding can be expressed as

$$H = kI^2Rt$$

- where, H = the total heat generated in the work, J
  I = electric current, A
  t = time for which the electric current is passing through the joint, s
  R = the resistance of the joint, ohms
  and k = a constant to account for the heat losses from the welded joint.

- The amount of heat released is directly proportional to the resistance.

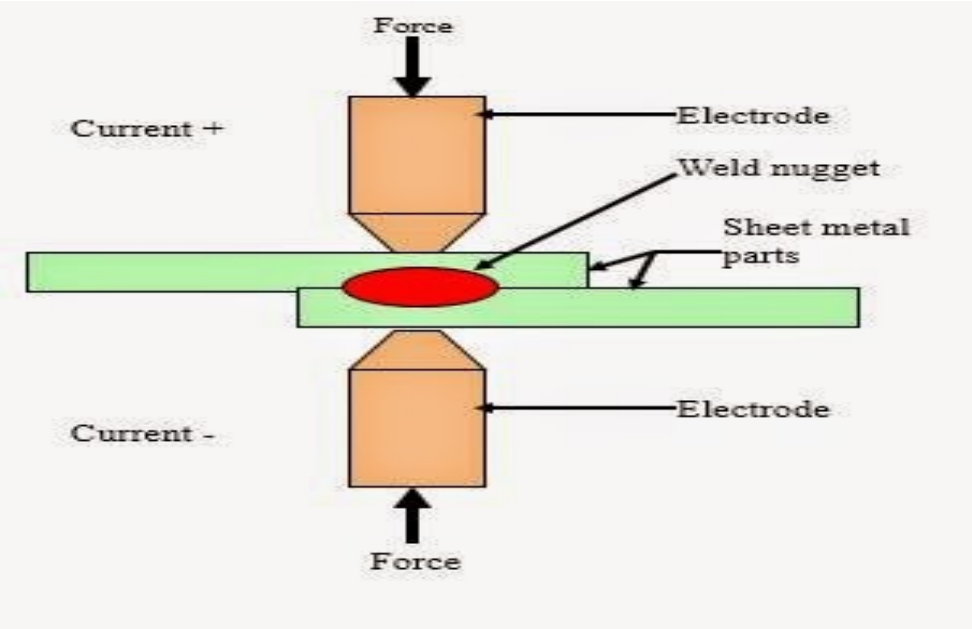
- The only place where large amount of heat is to be generated to have an effective fusion is at the interface between the two work piece plates.

RESISTANCE SPOT WELDING

- This is the most common resistance welding process. This is essentially done to join two sheet metal jobs in lap joint forming a small nugget at the interface of the two plates, as shown in Fig.

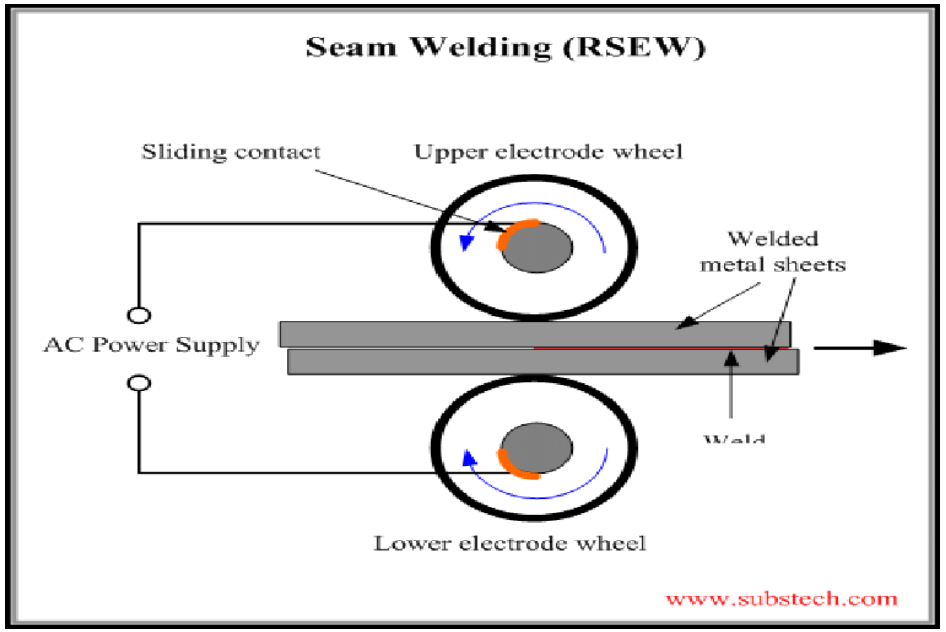
- It essentially consists of two electrodes, out of which one is fixed. The other electrode is fixed to a rocker arm (to provide mechanical advantage) for transmitting the mechanical force from a pneumatic cylinder. This is the simplest type of arrangement.

- The other possibility is that of a pneumatic or hydraulic cylinder being directly connected to the electrode without any rocker arm.



RESISTANCE SEAM WELDING

- The resistance seam welding (RSEW) is a specialised process of spot welding. Here the cylindrical electrodes are replaced by disc electrodes.
- The disc electrodes are continuously rotated so that the work pieces get advanced underneath them while at the same time the pressure on the joint is maintained.
- The electrodes need not be separated at any time



Numerical on Resistance Welding

Two steel sheets of 1.0 mm thick are resistance welded in a lap joint with a current of 10,000 A for 0.1 second. The effective resistance of the joint can be taken as 100 micro ohms. The joint can be considered as a cylinder of 5 mm diameter and 1.5 mm height. Density of steel is 0.00786 g/mm3 and heat required for melting steel be taken as 10 J/mm3. Calculate the melting efficiency.

Numerical on Resistance Welding

$$\text{Heat supplied} = 10\,000^2 \times 100 \times 10^{-6} \times 0.1\ 1 = 1000\ \text{J}$$

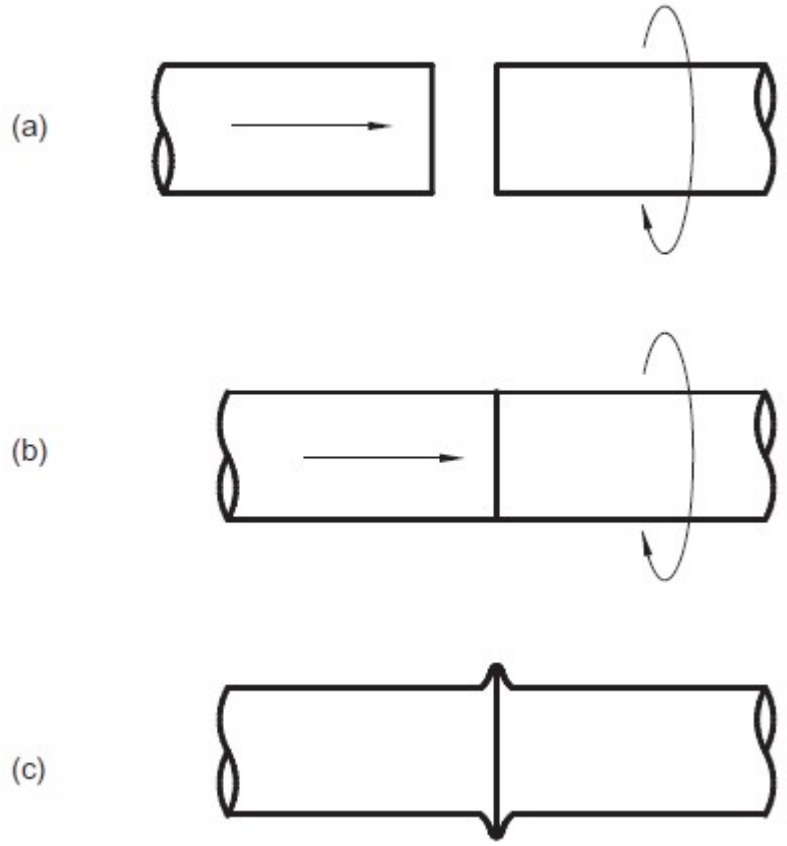
$$\text{Volume of the joint} = \frac{\pi \times 5^2 \times 1.5}{4} = 29.452\ \text{mm}^3$$

$$\text{Heat required for melting} = 29.452 \times 10 = 294.52\ \text{J} \approx 295\ \text{J}$$

$$\text{Heat lost to surroundings} = 1000 - 295 = 705\ \text{J} = 70.5\%$$

FRICTION WELDING

- The heat required for welding in this process is obtained by the **friction between the ends of the two parts** to be joined.
- One of the parts to be joined is rotated at a high speed around 3000 revolutions per minute, and the other part is axially aligned with the second one and pressed tightly against it, as shown.
- The friction between the two parts raises the temperature of both the ends.
- Then the rotation of the part is stopped abruptly and the pressure on the fixed part is increased so that the joining takes place. This process is termed **Friction Welding (FRW).**



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