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WELDING : A FABRICATION PROCESS

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19.1 INTRODUCTION

The welding is a process of joining two similar or dissimilar metals by fusion, with or without the application of pressure and with or without the use of filler metal. The fusion of metal takes place by means of heat. The heat may be obtained from electric arc, electric resistance, chemical reaction, friction or radiant energy.

Important Terms

1. Autogenous Welding

The process of joining similar metals by melting the edges together, without the addition of filler metal, is called autogenous welding.

2. Homogeneous Welding

The process of joining similar metals with the help of filler rod of the same metal is called homogeneous welding.

3. Heterogeneous Welding

The process of joining dissimilar metals using filler rod is called heterogeneous welding.

4. Weldability

Weldability of a metal is the ease with which two similar or dissimilar metals are joined by fusion with or without the application of pressure and with or without the use of filler metal.

5. Base Metal

The metal to be joined or cut is termed as the base metal.

6. Bead or Weld Bead

Bead is the metal added during welding.

7. Weld Pass

A single movement of the welding torch or electrode along the length of the joint, which results in a bead, is a weld pass.

8. Backing

It is the material support provided at the root side of a weld to aid in the control of penetration.

9. Deposition Rate

The rate at which the weld metal is deposited per unit time (kg/hr).

10. Penetration

It is the depth upto which the weld metal combines with the base metal as measured from the top surface of the joint.

11. Puddle

The portion of the weld joint that is melted by the heat of welding is called puddle.

12. Root

It is the point at which the two pieces to be joined by welding are nearest to each other.

13. Tack Weld

A small weld, generally used to temporarily hold the two pieces together during actual welding, is called the tack weld.

14. Toe of Weld

It is the junction between the weld face and the base metal.

15. Weld Metal

The metal that is solidified in the joint is called weld metal. It may be only base metal or a mixture of base metal and filler metal.

19.2 CLASSIFICATION OF WELDING

In general, various welding and allied processes are classified as follows :

Gas Welding

- ❖ Air-acetylene welding.
- ❖ Oxy acetylene welding.
- ❖ Oxy-hydrogen welding.
- ❖ Pressure gas welding.

Arc Welding

- ❖ Carbon arc welding
- ❖ Shielded metal arc welding
- ❖ Flux cored arc welding
- ❖ Submerged arc welding
- ❖ TIG (Tungsten Inert Gas) welding. (Gas Tungsten Arc Welding)
- ❖ MIG (Metal Inert Gas) or GMAW (Gas Metal Arc Welding)
- ❖ Plasma arc welding

- ❖ Electroslag welding
- ❖ Electrogas arc welding
- ❖ Stud arc welding.

Resistance Welding

- ❖ Spot welding
- ❖ Seam welding
- ❖ Projection welding
- ❖ Resistance butt welding
- ❖ Flash butt welding
- ❖ Percussion welding
- ❖ High frequency resistance welding.

Solid State Welding

- ❖ Cold welding
- ❖ Diffusion welding
- ❖ Explosive welding
- ❖ Forge welding
- ❖ Friction welding ✓
- ❖ Hot pressure welding
- ❖ Roll welding ✓
- ❖ Ultrasonic welding ✓

Thermo-chemical welding processes

- ❖ Thermit welding ✓
- ❖ Atomic hydrogen welding ✓

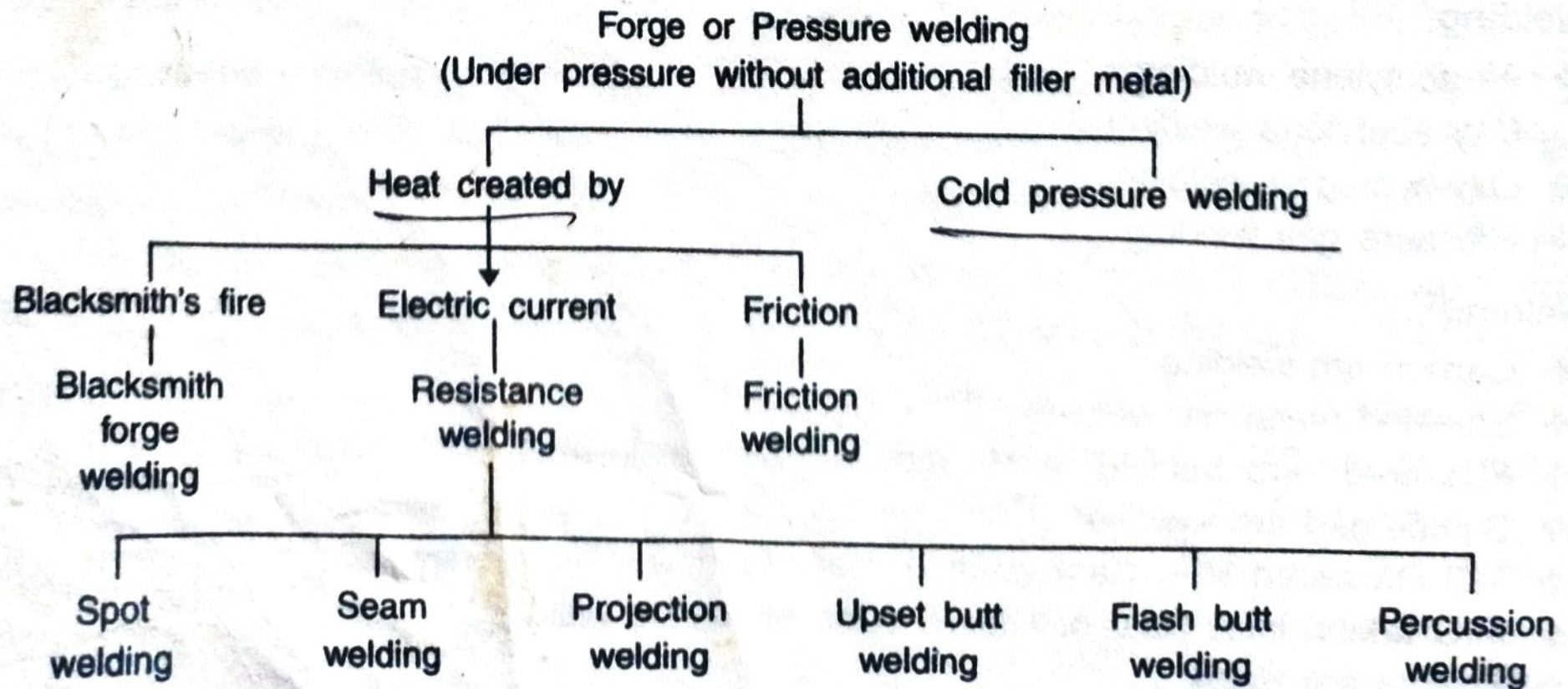
Radiant Energy Welding Processes

- ❖ Electron beam welding
- ❖ Laser beam welding.

Welding processes can also be divided into the following two groups :

1. Forge or Pressure Welding (Plastic Welding)

In forge or pressure welding, the workpieces are heated to plastic state and then, the workpieces are joined together by applying external pressure on them.



2. Fusion or Non-pressure Welding

In this welding, the material at the joint is heated to a molten state and then allowed to solidify.

Fusion or Non pressure welding
(With additional filler metal)

Heat created by

Electric arc ✓

Gas

Chemical reaction

Oxy
acetylene

Air
acetylene

Oxy
hydrogen

Thermit
welding

Atomic
hydrogen
welding

Carbon
arc
welding ✓

Metal
arc
welding

Submerged
arc
welding ✓

Inert gas
arc
welding -

Stud arc
welding ✓

Tungsten
inert gas
arc
welding (TIG)

Metal
inert gas
arc
welding (MIG)

19.4 ADVANTAGES OF WELDING

- ❖ A good weld is as strong as the base metal.
- ❖ A large no. of metals/alloys can be joined by welding.
- ❖ Repair by welding is very easy. ✓
- ❖ Welding can be easily mechanized. ✓
- ❖ Portable welding equipment is available.
- ❖ General welding equipment is not very costly.
- ❖ Total joining cost is less in case of welding joint. ✓

19.5 DISADVANTAGES OF WELDING

- ❖ Welding produces the harmful radiation, fumes and spatter.
- ❖ A skilled welder is required.
- ❖ Welding heat produces metallurgical changes. ✓
- ❖ Cost of equipment (initial cost) is high. ✓
- ❖ Edge preparation is required before welding. ✓
- ❖ More safety devices are required.
- ❖ Jigs and fixtures are required to hold the parts to be welded.

19.7 APPLICATIONS OF WELDING

1. Automobile construction.
2. Railroad equipment.
3. Ships.
4. Aircraft construction.
5. Building construction.
6. Bridges construction.
7. Pressure vessels.
8. Storage tanks.
9. Piping and pipe lines.
10. Fabrication of jigs, fixtures and machine tools.
11. Repair of broken and damaged parts.
12. Household furniture.
13. Material handling equipments etc.