Brazing

- It is a joining process in which a filler metal is melted and distributed by capillary action between the faying (contact) surfaces of the metal parts being joined.

- Base material does not melt in brazing, only the filler melts.

- In brazing, the filler metal has a melting temperature (liquidus) above 450°C, but below the melting point (solidus) of base metals to be joined.

Advantages of brazing

- Brazing can be used to join a large variety of dissimilar metals.
- Pieces of different thickness can be easily joined by brazing
- Thin-walled tubes & light gauge sheet metal assemblies not joinable by welding can be joined by brazing.
- Complex & multi-component assemblies can be economically fabricated with the help of brazing.
- Inaccessible joint areas which could not be welded by gas metal or gas tungsten arc spot or seam welding can be formed by brazing.

Filler materials used for brazing

Filler Metal	Typical Composition	Approximate Brazing Temperature °C	Approximate Brazing Temperature °F	Base Metals
Aluminum and silicon	90 Al, 10 Si	600	1100	Aluminum
Copper	99.9 Cu	1120	2050	Nickel copper
Copper and phosphorous	95 Cu, 5 P	850	1550	Copper
Copper and zinc	60 Cu, 40 Zn	925	1700	Steels, cast irons, nickel
Gold and silver	80 Au, 20 Ag	950	1750	Stainless steel, nickel alloys
Nickel alloys	Ni, Cr, others	1120	2050	Stainless steel, nickel alloys
Silver alloys	Ag, Cu, Zn, Cd	730	1350	Titanium, Monel, Inconel, tool steel, nickel

Brazing fluxes

Characteristics of a good flux include,

(1) low melting temperature,

(2) low viscosity so that it can be displaced by the filler metal,

(3) facilitates wetting, and

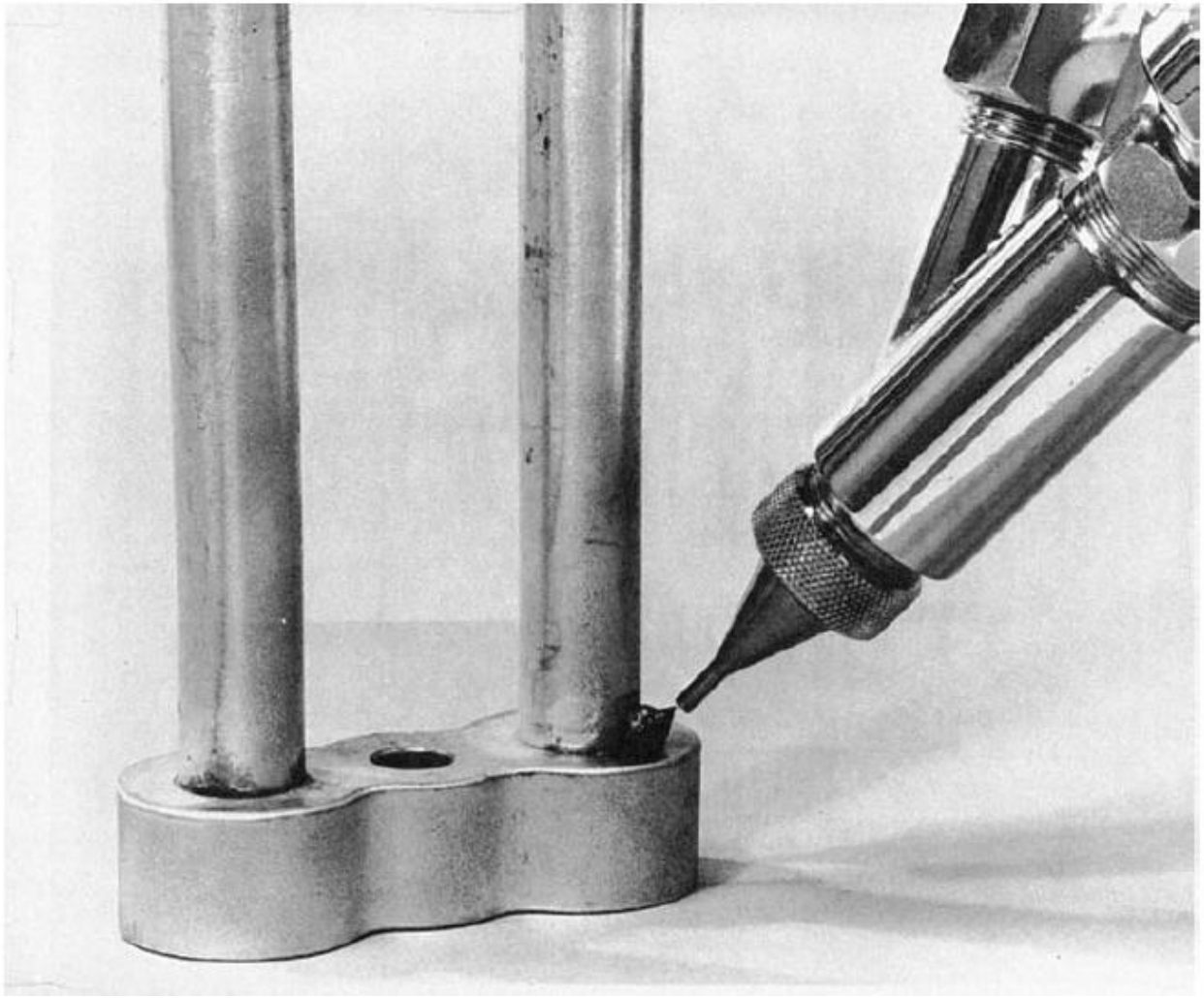
(4) protects the joint until solidification of the filler metal.

On the basis of method of heating, various brazing process are:

Torch brazing

- Flux is applied to the part surfaces and a torch is used to direct a flame against the work in the vicinity of the joint.
- After the workpart joint areas have been heated to a suitable temperature, filler wire is added to the joint, usually in wire or rod form.
- Fuels used in torch brazing include acetylene, propane, and other gases, with air or oxygen.
- Torch brazing is often performed manually, and skilled workers must be employed.

Other types: Furnace brazing, Induction brazing, Resistance brazing, Dip brazing, Infrared brazing



Brazing

- Brazing is a joining process traditionally applied to metals (but also to ceramics) in which molten filler metal (the braze alloy) flows into the joint.
- The melting point of the filler metal is above 450°C, but always below the melting temperature of the parts to be joined, which distinguishes the process from welding where high temperatures are used to melt the base metals together.
- The filler metal, while heated slightly above melting point, is protected by a suitable atmosphere which is often a flux. The molten filler metal cools to join the workpieces together providing a strong join between similar or dissimilar metals.

Brazing Process Contd.

- The atmospheres in which the brazing process can be undertaken include vacuum and other inert and non-inert gases using a torch, furnace, and induction coil.
- To achieve a sound brazed joint, the filler and parent materials should be metallurgically compatible, and the joint design should incorporate a gap into which the molten braze filler can be drawn or distributed by capillary action
- Ideal for joining dissimilar metals, brazing is a commercially accepted process used in a wide range of industries

Source: TWI

Soldering

- Solder is melted by using heat from an iron connected to a temperature controller. It is heated up to temperatures beyond its melting point at around 600°F which then causes it to melt, which then cools creating the soldered joint.
- As well as creating strong electrical joints solder can also be removed using a desoldering tool
- Solder is a metal alloy used to create strong permanent bonds; such as copper joining in circuit boards and copper pipe joints. It can also be supplied in two different types and diameters, lead and lead free and also can be between .032” and .062”. Inside the solder core is the flux, a material used to strengthen and improve its mechanical properties
- Tin, lead, brass or silver are the metals used in solder for soldering joints

Soldering Contd.

- Occasionally at the site of the joint, there are impurities such as oil, dirt or oxidation, the flux helps prevent oxidation and can sometimes chemically clean the metal.
- The flux used is **rosin flux** which helps the mechanical strength and electrical contact of electrical joints.
- Sometimes it is also possible to apply a ‘wetting agent’ to reduce the surface tension.

Source: TWI

SOLDERING

Soldering is similar to brazing and can be defined as a joining process in which a filler metal with melting point (liquidus) not exceeding 450°C is melted and distributed by capillary action between the faying surfaces of the metal parts being joined.

As in brazing, no melting of the base metals occurs, but the filler metal wets and combines with the base metal to form a metallurgical bond.

Filler metal, called Solder, is added to the joint, which distributes itself between the closely fitting parts.

SOLDER: Alloys of Tin and Lead. Tin is chemically active at soldering temperatures and promotes the wetting action required for successful joining.

Filler Metal	Approximate Composition	Approximate Melting Temperature °C	Approximate Melting Temperature °F	Principal Applications
Lead–silver	96 Pb, 4 Ag	305	580	Elevated temperature joints
Tin–antimony	95 Sn, 5 Sb	238	460	Plumbing and heating
Tin–lead	63 Sn, 37 Pb	183[a]	361[a]	Electrical/electronics
	60 Sn, 40 Pb	188	370	Electrical/electronics
	50 Sn, 50 Pb	199	390	General purpose
	40 Sn, 60 Pb	207	405	Automobile radiators
Tin–silver	96 Sn, 4 Ag	221	430	Food containers
Tin–zinc	91 Sn, 9 Zn	199	390	Aluminum joining
Tin–silver–copper	95.5 Sn, 3.9 Ag, 0.6 Cu	217	423	Electronics: surface mount technology