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Internal Assessment Test - II

Sub:	<b>Elements of Mechanical Engineering</b>						Code:	15EME24	
Date:	10 / 05 / 2017	Duration:	90 mins	Max Marks:	50	Sem:	II	Branch:	ALL

Answer Any FIVE FULL Questions

		Marks	OBE	
			CO	RBT
1.	Define Welding. Explain Electric Arc Welding with the help of a neat sketch.	[10]	CO5	L4
2(a)	Explain the following milling operations with neat labeled diagrams. i) Plain Milling;            ii) End milling;            iii) Slot milling.	[06]	CO3	L4
(b)	List out any five boiler accessories and explain briefly any two boiler accessories (only functions).	[04]	CO1	L1
3.	What is fire tube Boiler? Briefly explain the construction & working of Lancashire Boiler with the help of a neatly labelled diagram.	[10]	CO1	L4
4(a)	With help of neat sketch explain different types of flames and their applications in gas welding.	[06]	CO5	L4
(b)	Differentiate between fire tube boiler and water tube boiler.	[04]	CO1	L2
5.	Explain, with the help of a Temperature-Enthalpy diagram the formation of steam from water at 0° Celsius at constant pressure. Also mark the Latent Heat of evaporation, Sensible heat, amount of superheat and degree of superheat in T-H diagram.	[10]	CO1	L2, L4
6.	Explain with a neat sketch the working of an open cycle gas turbine (OR) Pelton Wheel Turbine.	[10]	CO2	L4
7.	Differentiate between Soldering, Welding and Brazing.	[10]	CO5	L2

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# Elements of Mechanical Engineering (IAT-2)

## SCHEME OF EVALUATION.

Q1) Define welding. Explain electric Arc welding with the help of a neat sketch. [10]

Ans

Welding Definition [2]

Sketch [4]

Working [4]

2(a) Plain milling [2] & sketch, End milling [2] & sketch, slot milling [2] & sketch [6]

(b) Name of 5 boiler accessories. Explain 2 boiler accessories [4]

(3) Define Fire tube boiler [10]  
Diagram of Lancashire Boiler  
Working of Lancashire Boiler

4(a) sketch & explanation of each type of flame. & example applications [6]  
2 marks each  $\Rightarrow 2 \times 3 = 6$

(b) Difference - fire tube boiler vs water tube boiler (atleast 4) [1 M - each]

(5) Formation of steam

[10]

(i) Temperature - enthalpy diagram. [2]

(ii) Mark

→ latent heat of evaporation [4]  
→ sensible heat  
→ amount of superheat  
→ degree of superheat

(iii) Explanation of formation. [4]

(6) Working of Pelton wheel / open cycle gas turbine. [10]

→ Diagram - Neatly sketched [5]  
→ Working [5]

(7) Difference b/w Soldering, Welding & Brazing [10]

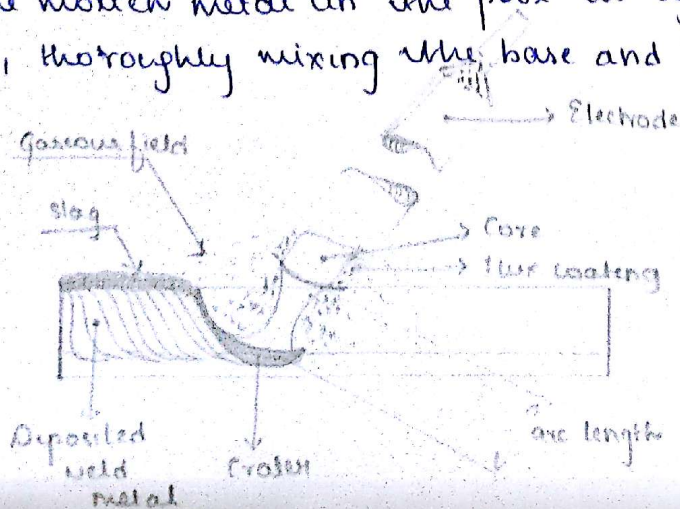
→ At least 5 differences - 2 marks each 

1. Define welding. Explain electric arc ~~discharge~~ welding with the help of neat sketches.

Ans: It is a process of uniting two similar or dissimilar metal pieces permanently with or without filler material using (i) only heat (ii) heat and pressure at plastic state.

When 2 conductors of an electric circuit are touched together momentarily and then instantaneously separated slightly, assuming that there is sufficient voltage in the circuit to maintain the flow of the current, an electric arc is formed.

Usually, the parts to be welded are wired as one pole of the circuit, and the electrode held by the operator forms another pole. When an arc is produced the intense heat melts the workpiece metal which is directly under the arc forming a small molten metal pool. At the same time, the tip of the electrode at the arc also melts, and this molten metal of the electrode is carried over by the arc to the molten pool of the workpiece. The molten metal in the pool is agitated by the action of arc, thoroughly mixing the base and the filler metal.



Q(a) Explain the following milling operations with neat labeled diagrams.

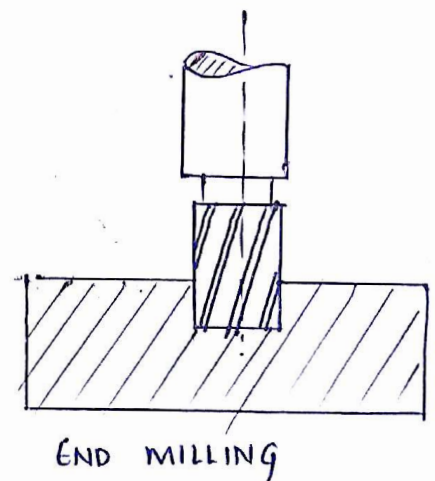
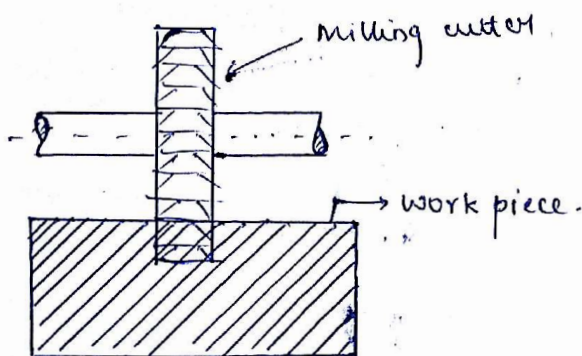
(i) Plain milling:

It helps to produce flat or formed surfaces parallel to the cutter axis. A plain or slab milling cutter which has straight or helical teeth is used in the process. There are two types.

(i) up milling (ii) Down milling.

(ii) Slot milling:

It is also called groove or keyway cutting is done on a horizontal milling cutter or using a end cutter as shown.



(iii) End Milling.

It is a combination of peripheral and face milling operations. The cutter has teeth both on its periphery and its end. If the direction of helix of the cutter is same the direction of rotation of it.

The end cutting edges are used only to remove metal.

If the direction of helix and the direction of rotation of the cutter are opposite to each other, the periphery cutting edges are used to remove metal.

2(b) List out any five boiler accessories and explain briefly any two boiler accessories.

Ans: Safety Valves:

Their function is to maintain safe pressure inside the boiler. If the pressure inside increases, the excess steam will blow-off through safety valve automatically, preventing the explosion of the boiler.

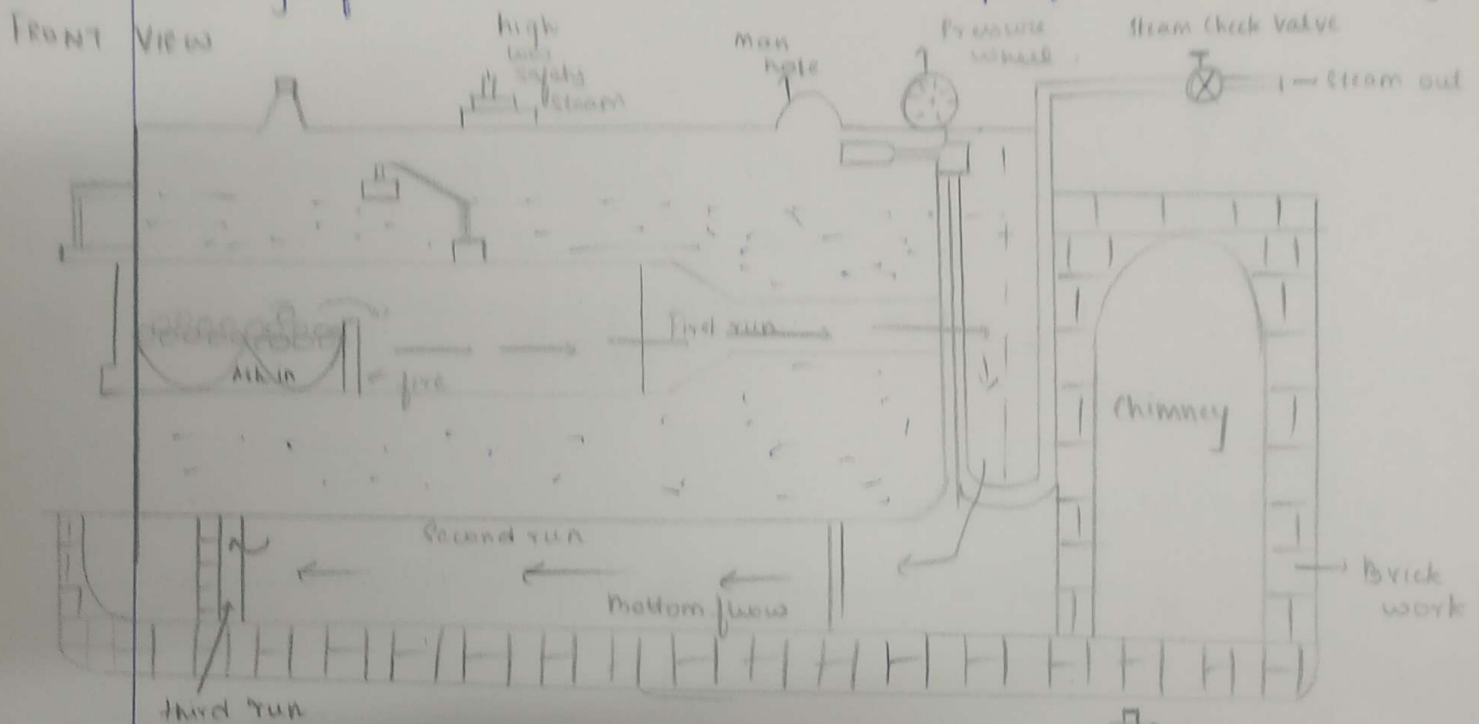
(b) Water level indicator:

Their functions is to indicate the safe water level inside the boiler shell to avoid overheating damage.

The 5 boiler accessories are:

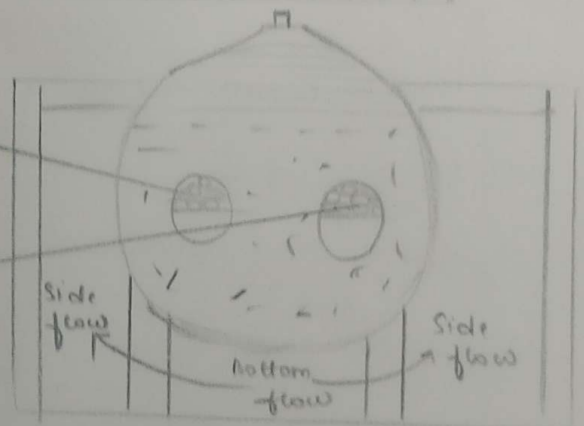
- 1) Safety Valves
- 2) Water level indicator.
- 3) Fusible plug.
- 4) Pressure Gauge
- 5) Feed Check Valve.

3. What is fire tube boiler? Briefly explain the construction and working of Lancashire boiler with the help of neatly labelled diagram.



**CONSTRUCTION :**

The boiler consists of a horizontal cylinder shell placed on the brick work sitting as shown. 2 large flow tubes of diameter about 0.4 times that of boiler shell. The space underneath the grate is the ash pit.



The brick setting is provided so that the boiler is enclosed. The boiler shell is filled with water to  $\frac{3}{4}$ th of its volume which in turn is connected to side channels 1 and 2.

**WORKING :**

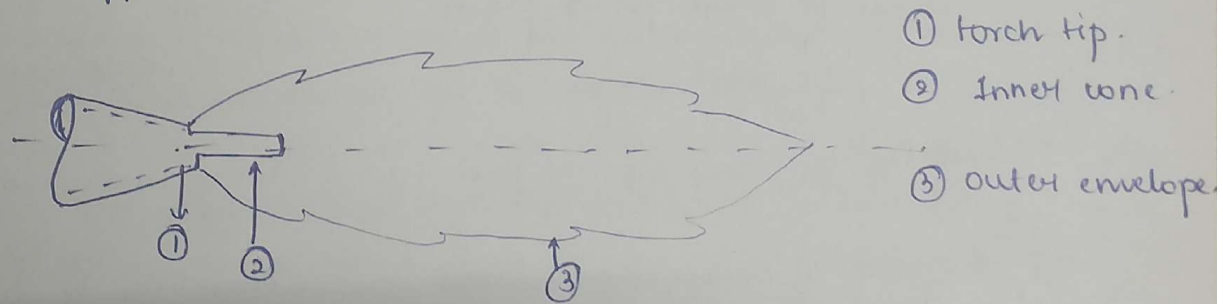
The coal is heated and the air in connected with coal is heated. They are passed through fire tube. The hot gases produced by burning of the fuel initially in first run passes through a long length of tubes. As these hot gases pass through the tubes heat transfer takes place from the hot gases to the water. This is the first run. In the second run, from the rear end, they pass downwards and unite in the bottom central and travel from rear to front end of boiler. The steam accumulated in the steam space is taken out through the steam stop valve.

4(a) With the help of a neat sketch explain different types of flames and their applications in gas weldings.

Ans: Neutral Flame:

It may be obtained by controlling the mixing of oxygen and acetylene in equal proportions. As a result two distinct zones appear with a hissing sound in the flame.

The inner cone develops heat and the outer one protects the molten metal from oxidation. As neutral flame has least chemical effect on the weldments, it is used to weld steel, stainless steel, cast iron, Copper, Aluminium, etc.



① torch tip.

② Inner cone.

③ outer envelope.

② Oxidizing flame:

It may be obtained by allowing excess oxygen than acetylene in the torch. As a result with a loud roar, a small purplish stinging flame appears at the tip and a small and narrow envelope surrounds the inner one as shown.



① Torch tip

② Small pointed

③ Small and narrow envelope.

③ Carburizing Flame

It may be obtained by allowing less oxygen and excess acetylene in the torch. As a result 3 distinct zones appear in the flame as shown in the fig.



① - Torch tip

② - whitish inner cone

③ - acetylene feather

④ - bluish outer envelope



## 4(6) Differentiate between fire tube and water tube boilers

### Water tube

- Here the water circulates through number of tubes and the hot flue gases surround them externally.
- Generation of steam is quicker.
- Suitable for large power plants and ships.
- Suitable for any type of fuel.
- Bursting of water tube is less serious.
- High initial cost but reliable.

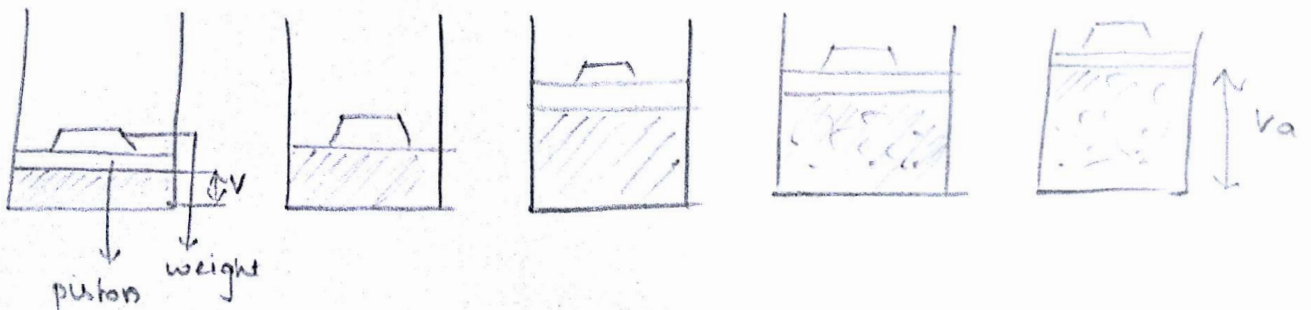
### Fire Tube

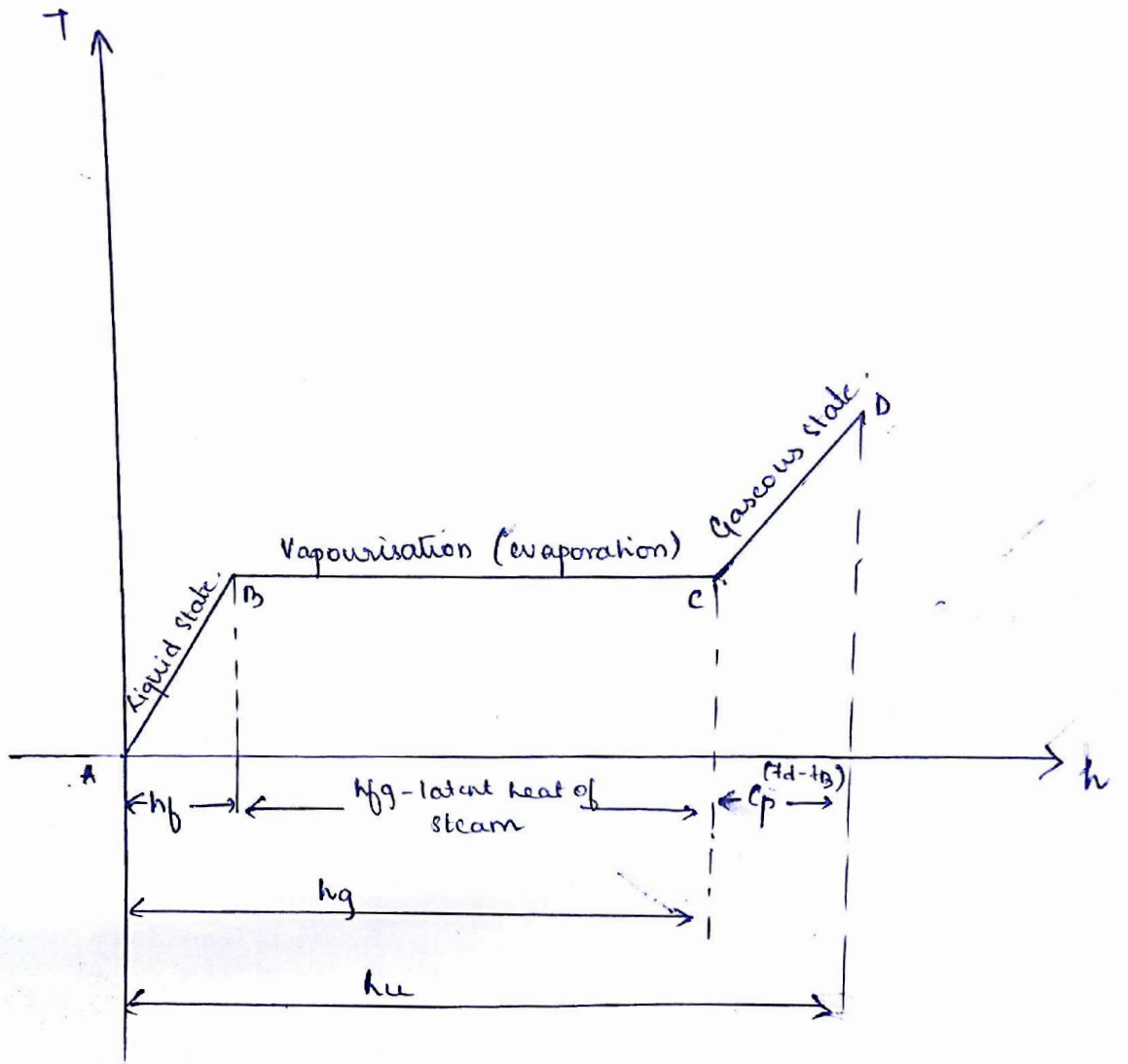
Here the hot flue gases pass through 2 or more tubes which are surrounded by water.

- Generation of steam is slow.
- Suitable for low power plants and locomotives.
- Only coal is suitable as fuel.
- Bursting of fire tube is dangerous.
- Low initial cost but less reliable.

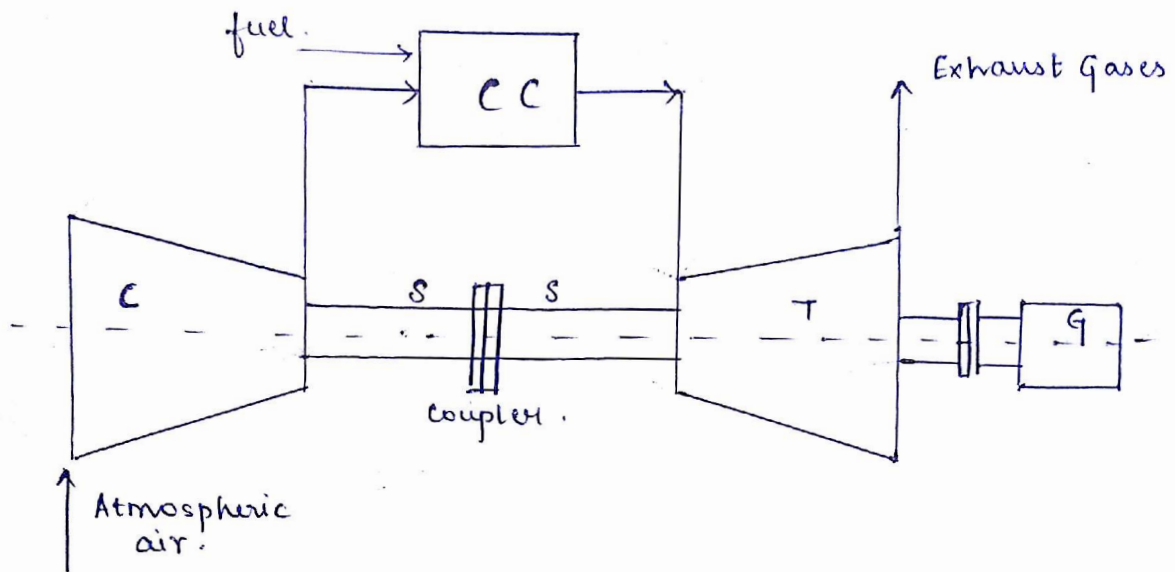
5) Explain with the help of a Temperature - Enthalpy diagram the formation of steam from water at  $0^\circ \text{C}$  at constant pressure. Also mark the latent heat of vaporation, sensible heat, amount of Superheat and degree of Superheat in T-H diagram.

Ans: When water is heated at high temperature rises till the boiling point is reached. When the boiling point is reached, there will be a slight increase in the volume of water as shown. The temperature at which the water boils depends on pressure acting on it. This temperature is called saturation temperature. The amount of heat required to raise the temperature of 1kg of water from  $0^\circ \text{C}$  to saturation temp is sensible heat. Further addition of heat, initiates the evaporation of water while the temperature remains at the saturation temperature  $T_s$  because the  $\text{H}_2\text{O}$  will be saturated with heat and addition of heat changes the phase. This evaporation will be continued at the same saturation temperature. On heating further at constant pressure, increases the temperature above the saturation temperature  $T_s$ . During the process of heating dry steam will be heated from the dry state, and this process of heating is Superheating. and steam is Superheated Steam.





6) Explain with a neat sketch, the working of an open cycle gas turbine.



The fuel is burnt in a combustion chamber at constant pressure with the help of high pressure air. The products of combustion at high pressure and high temperature made to flow through the turbine to get the work done. Later they will exhaust to the atmosphere.

Here a combustion chamber is connected between a compressor and turbine. The compressor, turbine & generator are coupled coaxially.

The atmospheric air is drawn into the compressor. The compressed air is delivered to the combustion chamber. Meanwhile fuel is injected into the chamber at constant pressure heat is supplied by burning the fuel. The products of combustion at high pressure and temperature are fed into the turbine. There it ~~works~~ expands and mechanical work is done. After the work is done, the gases exhaust to the atmosphere.

7) Differentiate between soldering, welding and brazing.

SOLDERING

BRAZING

WELDING :

•  $< 450^{\circ}\text{C}$

$> 450^{\circ}\text{C}$   
but below the melting  
point of parts to be  
joint.

Above melting  
of parts to be

• Filler metal is  
must called  
solder

(Must) Spelter / braze  
alloy.

filler metal is  
not necessary

• Weak

Mild (moderate)

Strongest.

• Pb-Sn alloys  
Cu-Zn alloys

Al-Si, Cu-Zn, Mg  
alloys.

Any type of  
metal.