**Practical No. 12: Connect the fuse in electrical circuit and check its operation at normal and abnormal conditions.**

**I Practical Significance:**

An electrical fuse is a safety device that operates to provide protection against the overflow of current in an electrical circuit. An important component of an electrical fuse is a metal wire or strip that melts when excess current flows through it. It helps to protect the device by stopping or interrupting the current.

**II Industry/ Employer Expected Outcomes(s):**

Select the relevant fuse for different requirements.

**III Course Level Learning Outcomes(s):**

Use electrical safety devices in electrical circuit.

**IV Laboratory Learning Outcomes(s):**

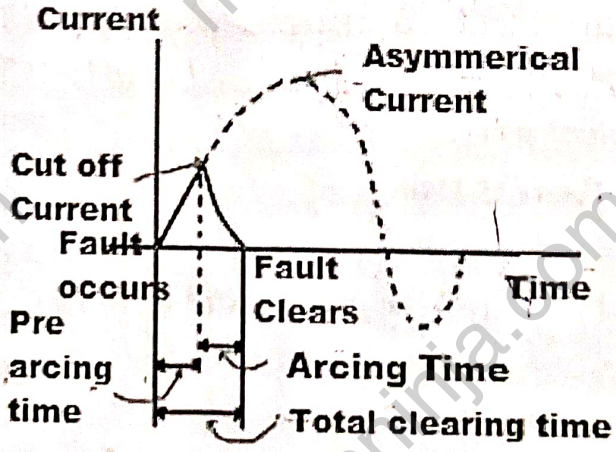
Connection of fuses in electrical circuit.

**V Relevant Affective Domain related outcome(s):**

Follow safety electrical rules for safe practices.

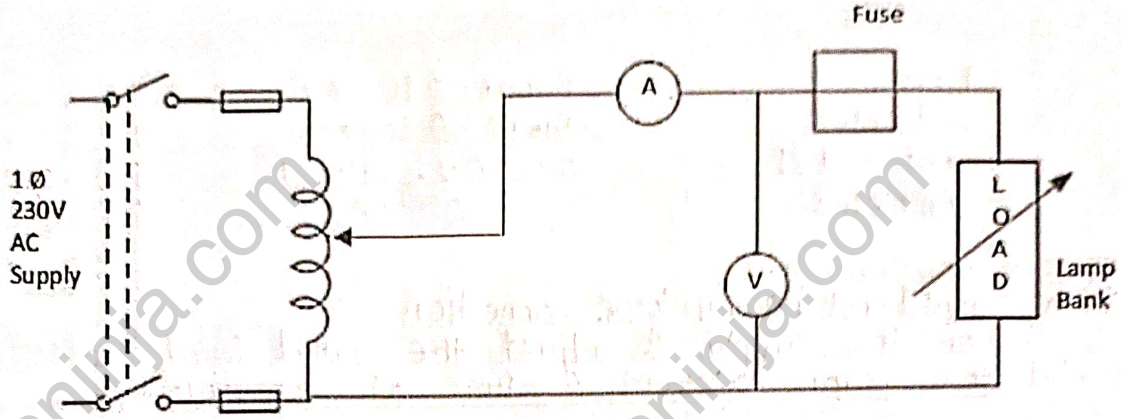
**VI Relevant Theoretical Background:**

Fuses are basic safety devices widely deployed in electrical circuits for excess current or overcurrent protection. If a stronger than expected current surges through the fuse, it will blow and break the circuit, minimising heat damage and reducing the risk of electrocution or fire. It consists of a small link of soft metal, which melts when excessive current passes through it. The fuse wires are usually bare wires and made of lead and tin. Lead alloy is used for small current and tinned copper wire is used for large current. Upto 3 amperes load, lead fuse wires are used, upto 15 amperes alloy of lead and tin is used and above 15 amperes, tinned copper wires are used. If a short circuit occurs anywhere in the wiring system, excessive current flows through the wires and fuse and if fuse operates properly, it will melt, cutting of the current before any harm can be done to the connected equipment or circuit.




Cut off Characteistics of Fuse

**VII Actual circuit diagram used in laboratory with equipment specification:**




**VIII Required Resources /apparatus/equipment with specifications:**

| Sr. No. | Particulars | Specification | Quantity |
|---|---|---|---|
| 1 | Fuse | Range – 0 to 6 A | 01 |
| 2 | Voltmeter | Range 0-300V | 01 |
| 3 | Auto-transformer (Dimmer) | Single phase, 0-270V, 50 Hz , 6A | 01 |
| 4 | Ammeter | 0-10A | 01 |
| 5 | Resistive Load / Lamp Load (Bank) | Range 10-20 A | 01 |

**IX Precautions to be followed:**

1. There should not be any loose connection.
2. Ensure the proper rating of fuse is selected for the given circuit.
3. Ensure that supply is OFF while replacing the fuse.
4. Follow electrical safety rules,

**X Procedure:**

1. There should not be any loose connection.
2. Switch on the supply and adjust the rated load current.
3. Gradually increase the load current in steps of 10% of rated and note down the time of operation for each current above rated till fuse blows.
4. Plot the graph between current and time of operation.

**XI Resources Used (Students should write the required resources):**

| S.No. | Name of resources | Broad Specifications | Quantity |
|---|---|---|---|
| 1 | Fuse. | Range - 0 to 60 A. | 1 |
| 2 | voltmeter. | Range - 0 to 300 V. | 1 |
| 3 | Auto - t/f | 0 - 270 V, 50Hz, 6A | 1 |
| 4 | Ammeter. | 0 - 10A | 1. |

**XII Actual Procedure followed:**

1] There should not be any loose connection.
2] Switch on the supply & adjust the rated load current.
3] plot the graph current & time of operation.

**XIII Observation table:**

| Sr. No. | Voltmeter reading in volts | Current through fuse element in Amps. | Time of operation in seconds |
|---|---|---|---|
| 1 | 12 V | 15 A | 0.7 sec |
| 2 | 24 V | 3 A | 0.6 sec |
| 3 | 36 V | 4.5 A | 0.5 sec |
| 4 | 48 V | 6 A | 0.4 sec |
| 5 | 60 V | 7.5 A | 0.3 sec |
| 6 | 72 V | 9 A | 0.2 sec |
| 7 | 84 V. | 10.5 A | 0.1 sec. |

**XIV Results:**

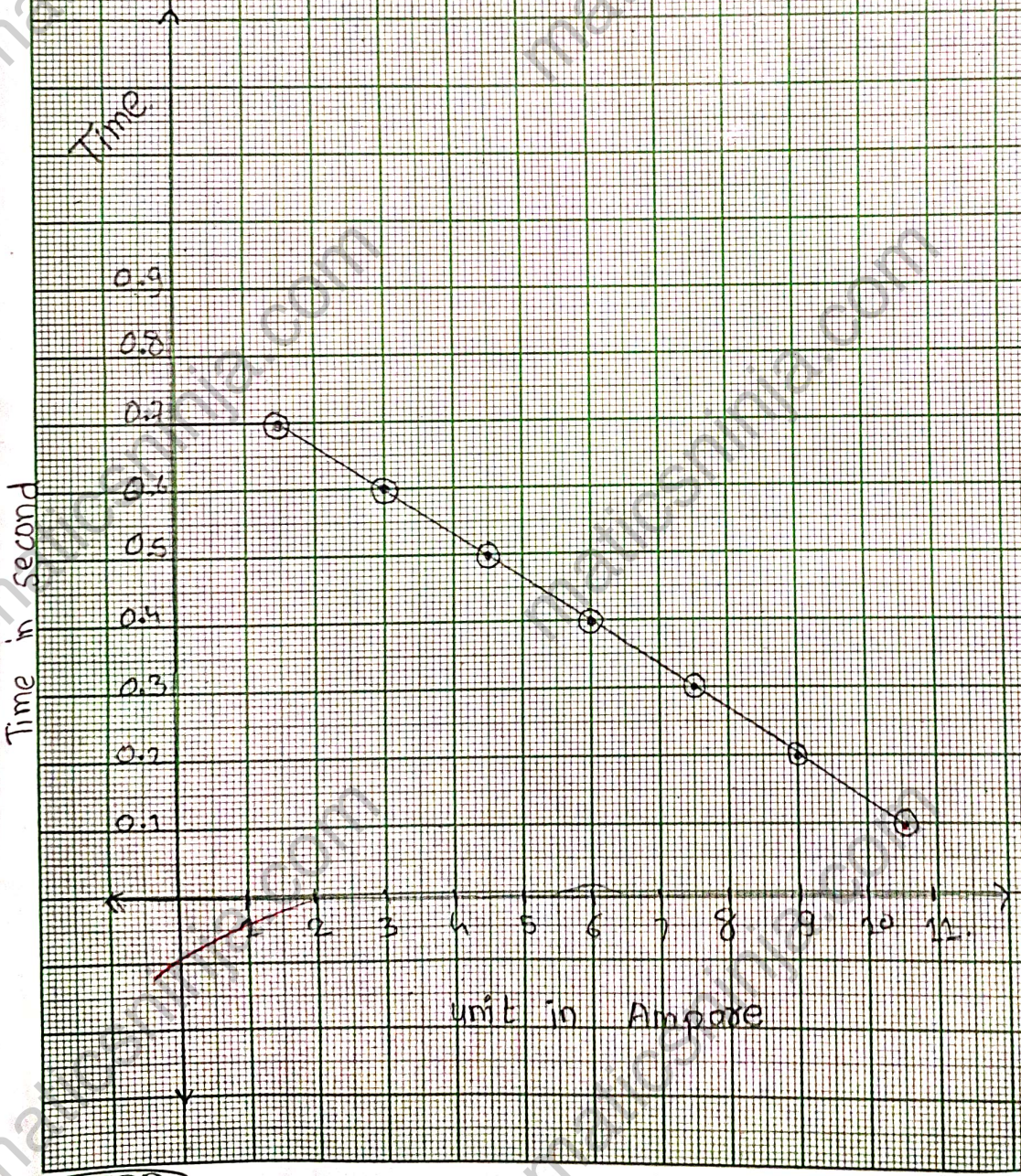
When the current is passes through above the rated value then the fuse elements coils are melted.

**XV Interpretation of Results:**

As the voltage is increased the value of current also increase.

**XVI Conclusions and recommendation:**

Hence we have learned to connect the fuse in electric circuit & check it operation at normal and abnormal condition.


Time
Time in second
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
1
2
3
4
5
6
7
8
9
10
11
Current
unit in Ampere

**XVII Practical Related Questions: (Use separate sheet for answer)**

1. State the function of fuse.
2. State the limitations of fuse.

1] →

The function of the fuse is to protect electrical circuits from over current as short circuits by breaking the circuit when an excessive current flows through it these is V. preventing damage to the circuit of the equipment.

2] →

Some of the limitations of fuse are mentioned below.

1] limited lifespan.

2] Inability to rest

3] slow response time.

4] single use

5] voltage limitations

6] limited fault protections.

**XVIII References/suggestions for further reading :**

1. https://www.youtube.com/watch?v=W770Z1yvXs8
2. https://www.vedantu.com/physics/working-principle-of-an-electrical-fuse
3. https://byjus.com/question-answer/what-are-the-characteristics-of-fuse-wire/
4. https://electrical-engineering-portal.com/fuse-characteristics-protection-circuits
5. https://testbook.com/physics/electrical-fuse