## **FUSE AND WIRING RATINGS- PART ONE - FUSES**

This article illustrates the relationship between wire and fuse sizing/selection. The information may be used to select suitable wire and fuse sizes for a given application. The tabulated data is typical of what can be expected, but in every case the motorcyclist must verify with the supplier, the actual fuse and wire ratings as purchased.

## The fuse:

The primary task of a fuse is **to protect the circuit wiring** that is connected to it, against overload and short circuit. The circuit fuse **is not intended to protect the terminal devices** that the circuit suppliers; terminal devices, such as indicators etc, are usually of much smaller current capacity than the wire itself, and would therefore need smaller fuses than the main circuit fuse for protection. Usually the terminal devices on a classic bike are not individually protected by fuses.

It is best to locate the main circuit fuse as close to the bike's battery as possible; this fuse should cover all the wiring on the bike, including tail and stop lamps. A fuse that is too large can, at worst, allow the wiring to overheat in the event of a fault or overload, damage the wiring insulation and possibly cause a fire and severe damage to the bike.

Fuses have fairly wide operating tolerances as indicated in tables 1 and 2 below. These tables indicate the current at which the particular fuse will operate and isolate the circuit within the times shown from inception of a fault. It is also apparent that there is a difference between the two types of fuse listed in the tables; the semi enclosed fuse is open to ambient effects such as cooling due to the air that is in direct contact with the fused element. This will obviously delay the time it takes to operate for a given fault level. The enclosed fuse will not be as affected, and its performance will therefore be somewhat more precise.

The columns indicate the following information;

- Column No.1 gives typical continuous current ratings of the fuses.
- Column No. 2, 3 and 4 give the fault current at which the fuse will operate, within the times given in each column i.e. 0.1secs, 5secs, and +1.5 hours.
- Column No. 5 gives the minimum wire size (cross sectional area of the wire) that can be used with each fuse size and with each fuse type.
- Columns No. 6 and 7 give the minimum wire sizes that can be used for each fuse size, and for the type of wire insulation shown. The continuous rating of the wiring is determined by the limiting temperature of the insulation.

The PVC insulated copper wire in the above tables could operate quite safely and continuously at a conductor temperature of 70°C and, the thermosetting rubber insulated copper wire could operate at a conductor temperature of 85°C when carrying the rated current in free air.

While the fuse ratings and fusing times of tables 1 and 2, will be found to be fairly typical and quite close to what can be purchased from automotive and motor cycle suppliers, it is imperative to obtain the actual ratings from the supplier as these can vary depending on the type of fuse.

|            | SEMI     | OPEN                | TYPE               | FUSES  |                     |                        |  |  |  |  |
|------------|----------|---------------------|--------------------|--------|---------------------|------------------------|--|--|--|--|
| To BS 3036 |          |                     |                    |        |                     |                        |  |  |  |  |
| Nominal    | Fusing   | Current             | (amps)             | Min.   | Min.<br>PVC<br>ins. | Min.<br>Rubber<br>ins. |  |  |  |  |
| Fuse       | 0        | perating tin        | ne                 | Wire   | Wire                | Wire                   |  |  |  |  |
| Rating     | Se       | conds/Hou           | ırs.               | Rating | size                | size                   |  |  |  |  |
| (amps)     | 0.1secs. | 5.0secs             | +1.5hrs.           | (amps) | (mm²)               | (mm²)                  |  |  |  |  |
| 5          | 45       | 13                  | 9                  | 7      | 1                   | 0.75                   |  |  |  |  |
| 15         | 180      | 43                  | 28                 | 21     | 2.5                 | 1.5                    |  |  |  |  |
| 20         | 260      | 60                  | 40                 | 28     | 4                   | 2.5                    |  |  |  |  |
| 30         | 450      | 87                  | 55                 | 41     | 6                   | 4                      |  |  |  |  |
| 45         | 900      | 145<br><b>TABLE</b> | 100<br><b>No.1</b> | 62     | 16                  | 10                     |  |  |  |  |
| col. 1     | col. 2   | col. 3              | col. 4             | col. 5 | col. 6              | col. 7                 |  |  |  |  |

| ENCLOSED OR SEALED FUSES. |          |                     |                   |        |                     |                        |  |  |  |  |
|---------------------------|----------|---------------------|-------------------|--------|---------------------|------------------------|--|--|--|--|
| Nominal                   | Fusing   | Current             | (amps)            | Min.   | Min.<br>PVC<br>ins. | Min.<br>Rubber<br>ins. |  |  |  |  |
| Fuse                      | 0        | perating tin        | ne                | Wire   | Wire                | Wire                   |  |  |  |  |
| Rating                    | Se       | conds/Hou           | ırs.              | Rating | size                | size                   |  |  |  |  |
| (amps)                    | 0.1secs. | 5.0secs             | +1.5hrs.          | (amps) | (mm²)               | (mm²)                  |  |  |  |  |
| 5                         | 30       | 14                  | 8.5               | 5      | 0.75                | 0.75                   |  |  |  |  |
| 15                        | 97       | 46                  | 28                | 15     | 1.5                 | 1                      |  |  |  |  |
| 20                        | 180      | 82                  | 39                | 20     | 2.5                 | 1.5                    |  |  |  |  |
| 30                        | 280      | 125                 | 56                | 30     | 4                   | 2.5                    |  |  |  |  |
| 45                        | 550      | 240<br><b>TABLE</b> | 84<br><b>No.2</b> | 45     | 6                   | 6                      |  |  |  |  |
| col. 1                    | col. 2   | col. 3              | col. 4            | col. 5 | col. 6              | col. 7                 |  |  |  |  |

Note: Information based on 85°C rubber insulation and 70°C PVC insulation. For 60°C rubber insulation wiring, increase 85°C wire size by 35%.

## A few rules of thumb;

- Open or sealed fuses can be expected to fuse at approximately one and a half to two times the listed continuous rating.
- Wiring protected by open or semi open fuses must have a continuous current rating approximately 40% larger than the fuse rating.
- Wiring protected by sealed fuses may have the same continuous current rating as the fuse.

## End of Part One

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