

# BRUSH FLEXIBLE CONNECTIONS

It is possible to imagine many ways of connecting flexibles to brushes, but, in fact, they all fall more or less into four basic types:

- 1 - Tamping
- 2 - Riveting
- 3 - Moulding
- 4 - Soldering

Each of these methods must comply, within their own appropriate limits of use, with two imperative conditions.

- Low electrical resistance (a few hundreds of microhms), constant, independent of temperature and thermal shock.
- High mechanical resistance (resistance to traction of several hundreds of Newtons) independent of mechanical shocks or vibrations.

## TAMPED FLEXIBLES

This effected by tamping copper powder around the flexible in a suitable hole, the quality of the connection being dependent upon the ability of the carbon material to sustain, without breakage, the vibrations and shocks exerted by the tamping machine. Two conditions must therefore be respected:

The brush should be:

- **thick:** for diameter flexible  $\varnothing$  (mm), the thickness  $e$  (mm) of the brush must satisfy the relationship:

$$e \geq 3 \text{ to } 4 \varnothing$$

- **hard:** the material must have a flexural strength in excess of a minimum value, fixed approximately at 13.5 MPa\* (2,000 lbs/sq.in).

The solidity of the tamping depends also on the depth  $p$  of the hole. Between  $p$  and the diameter  $\varnothing$  of the flexible the following approximate relationship can be applied:

$$p \approx 5 \varnothing$$

## RIVET

The flexible, formed in a loop, is solidly compressed to the brush by a copper rivet.

Long thin rivets are to be avoided because of the danger of "buckling".

In practice, rivets used fulfill the two following rules:

$$L \leq 8 \varnothing_e \text{ (with } L \leq 32 \text{ mm)}$$

where:  $L$  = rivet length

$\varnothing_e$  = outside diameter of rivet

\* 1 MPa = 10.194 kg/cm<sup>2</sup>

To improve the contact it is recommended to copper plate or copper spray the top of the brush.

This method of connection is best suited for all brushes which are:

– **soft:**

Particularly, some of our graphite brushes, LFC grades are rivetted.

– **flat and thin:**

Particularly when brush thickness is such as to make fixing impossible.

For example: brushes with reduced thickness (e) and important load, which involves a large flexible diameter  $\varnothing$  (e < 3 to 4  $\varnothing$ ).

**Remarks:**

In brushes with rivetted flexibles, it is necessary to avoid anything that could loosen or harm the rivet, particularly with respect to the quality of contact between flexible and carbon. Thus, for example, all connections where the flexible and stainless steel pressure plate are retained by the same rivet and therefore influenced directly by brush vibrations, should be avoided.

## MOULDED FLEXIBLE

The flexible is introduced into the mould at the same time as the powder, the whole is compressed and afterwards sintered in a special oven, at suitable temperature and controlled atmospheric conditions.

This method of connection is only used for mass produced brushes and for particular grades.

## SOLDERED FLEXIBLE

The flexible is soldered directly on to the top of the brush which has previously been coppered, or on to a tag which in turn is rivetted to the brush.

This technology is only used for special brushes which cannot be realised by other more modern processes.



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