TECHNICAL DATA SHEET

BRUSH SPARKING

01 – ORIGIN

Brush sparking, which is most frequently seen at the leaving (trailing) edge, occurs for several reasons Here is the list of the most common causes:

ELECTRICAL

- In DC machines: incorrect neutral setting (see TDS-06), uneven spacing between the brush arms or a connection defect in the armature winding
- Overloading
- Insulation fault in the windings
- Quality of the power supply…

MECHANICAL: shock and vibrations, due to:

- Excessive friction (unsuitable grade, low roughness – see TDS-02, low humidity – see TDS-17, pre-seating not done – see TDS-19…),
- Major out of round or eccentricity of the commutator / slip ring,
- Insufficient spring pressure on the brushes (see TDS-11),
- Incorrect position of brush-holders,
- Excessive clearance between the brush and the brush-holder, linked to incorrect tolerances or an error of brush dimensions – see TDS-04…

02 – EFFECTS

Whatever the reason may be, the **sparking is always harmful:**

- For the brush, whose rate of wear increases
- To the commutator (or the rings) which is damaged by burning of the metal.

Their degree of aggressiveness depends upon:

- Their **volume**: which can go from being barely perceptible at the edge, intermittent or continuous, to sustained arcing, static or mobile, with or without the generation of incandescent particles (streamers)
- Their **color**:
  - small **violet** sparks are fairly inoffensive, they only affect the brush
  - **red or orange** sparks, with or without generation of incandescent carbon appearing during overloads; cause a higher rate of brush wear
  - **blue** sparks, brilliant and noisy, with burning, generally indicate a serious commutation fault ; it accelerates the rate of brush wear and damages the commutator
  - **green** sparks which are voluminous, always with burning, indicate a serious fault in machine operation and precedes a flash over. It brings about rapid and profound damage to the commutator and to the brushes.

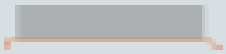
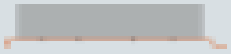
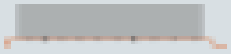
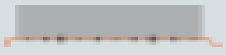
03 – NOTATION

It is often useful to be able to define concisely and precisely the degrees of brush sparking of a machine for a determined operating duty.

Different systems of classification exist. Two of them are used by Mersen teams, they are based on the same schematic representation:

- The **Westinghouse index**, one which is most frequently used, is acceptable in the majority of cases
- The **IEC classification**, based on the International Electrotechnical Commission IEC 60276:2018

Table 1 specifies these definitions with the corresponding schematic representation:

Representation (axial view – carbon brush on commutator)	IEC 60276 classification	Westinghouse index	Designation
	1	1	Black
	2	1 ¼	Intermittent beads
	3	1 ½	A few beads
	4	1 ¾	Numerous beads
	5	2	Intermittent shooting sparks
	6	2 ¼	A few shooting sparks
	7	2 ½	Numerous streamers
	8	3	Heavy and continuous streamers

Bead Shooting Spark Streamer

Table 1 - Classification of sparking in accordance with IEC 60276:2018 and "Westinghouse" classification systems

Usually the admissible limits are:

- **Normal operating conditions:** 1 to 3 within the IEC standard, 1 to 1 ½ within the Westinghouse system
- **Rush operating conditions / Overload:** Up to 4 within the IEC standard, up to 1 ¾ within the Westinghouse system

Very important:

Sparking **above degree 5** within the IEC 60276.2018, **2** within the Westinghouse system, **is considered as injurious** for the commutator or slip ring.

We are at your disposal for any technical assistance.

List of references:
IEC 60276 - Carbon brushes, brush holders, commutators and slip-rings – Definitions and nomenclature – Edition 2 – May 2018
TDS-02: Condition of the surface of commutators and slip rings - Roughness
TDS-04: Dimensions of carbon brushes and brush-holders
TDS-06: Setting the neutral
TDS-11: Pressure on carbon brushes
TDS-17: Air humidity
TDS-19 : Brush seating

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