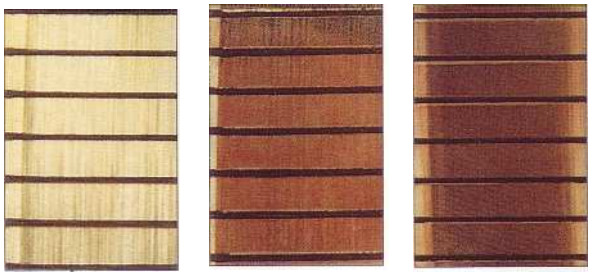
Assessment of Performance of Carbon Brushes

Commutator Appearance

In addition to the physical appearance of the surface of the commutator, the skin or patina is of equal importance for the good running of the carbon brushes. Each carbon brush builds a characteristic patina which is affected by operating and ambient conditions. The patina consists mainly of copper oxides, graphite deposits and adsorbed water, and its appearance is of importance when assessing the most suitable brush grade. The following pictures show typical appearances of commutation surfaces. The pictures are not of an international standard specification but are used by carbon brush manufacturers and users of brushers as a guide to assist in judging the operation of carbon brushes.

Normal Skin or Patina Formation



P2, P4 and **P6** are examples of normal skin or patina formation. When a machine runs well, the patina or skin on a commutator will be even, slightly shiny and coppery brown to black in colour. There may be appearance of greyish, blueish and reddish hues. but of importance is the evenness of the skin formation and not its colour.

Appearances of Badly Formed Patina or Skin

P12 • Appearance: Streaky patina having some wide and narrow tracks of different colour.
No commutator wear
Causes: High humidity, oil vapour, aggressive gases in the atmosphere, low electrical load on the brushes

P14 • Appearance: Torn patina, general appearance as in P12, but with narrower tracks and commutator wear
Causes: As in P12, but the conditions have been maintained for a longer period causing commutator damage

P16 • Appearance: Smutty patina, uneven skin having patchy colours and random spots
Causes: Uneven commutator or unclean operating conditions

P22 • Appearance: Patina with dark areas, regular or irregular patches covering one or more commutator segments
Causes: Out of round commutator, vibrations of the motor caused by badly adjusted shaft or damaged bearings

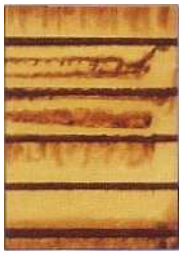
P24 • Appearance: Dark patchy patina having definite edges as in TI2 and T14
Causes: Raised segment or group of segments causing the brush to bounce

P26 • Appearance: Commutator segments having patches in the middle or at the edges. Causes: Often due to faulty grinding of the commutator

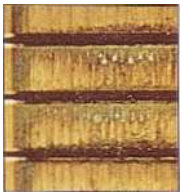
P42 • Appearance: Alternating light and dark bar markings
Causes: Uneven current distribution over two parallel windings caused by double windings crossing in the same slot

P46 • Appearance: Mat patches in double pole pitches
Causes: Usually by faulty soldering of the risers or segment connections

Bar Burning

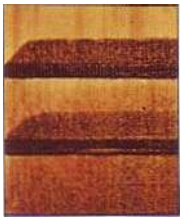


B2, B6, B8. Appearance: Bar edge burning or burning in the middle of bar
Causes: Sparking caused by commutation problems

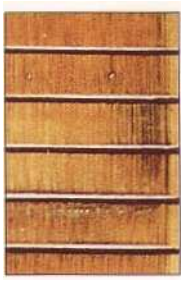


B10 • Appearance: Perforated patina, light, dense or distributed build-up spots
Causes: Patina destruction caused by too large electrical resistance

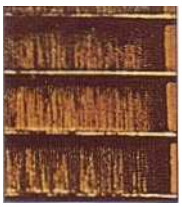
Bar Marking



T10 • Appearance: Dark patches at edge of bars in direction of rotation
Causes: Frequently caused by long periods with the motor being stationary without power or short stationary periods under load



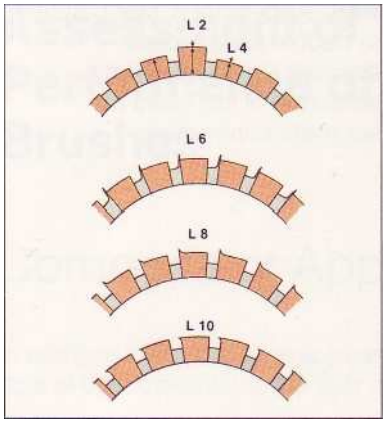
T12 • Appearance: Burning of a trailing edge and the next leading edge of a bar
Causes: Caused by protruding segment as in L2



T14 • Appearance: Dark markings
Causes: Sign of a low segment, could also be caused by a flat spot on the commutator (see L4)

T16 • Appearance: Clearly defined dark markings together with segment edges burnt
Causes: Raised mica (see L6)

T18 • Appearance: Dark markings
Causes: Badly undercut segment edges (see L8)



L2 • Protruding segment
L4 • Low segment
L6 • Raised mica
L8 • Ridge on the segment edge
Causes: Faulty commutator segments

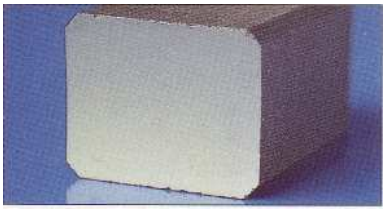
L10 • Copper drag
Causes: Bumps or vibrations from various causes

Appearance of the Brush Sliding Face

The following pictures show typical brush-sliding faces. For easy identification we suggest you use the symbols **S1, S3** etc.

S1, S3 and S5 are satisfactory sliding faces, indicating that there are no mechanical or electrical problems. Depending on the carbon material the sliding surface appears dense or porous, and shiny dull or matt.

If there is dust in the circulating air fine hairlining may occur as shown in S5.



S1 • Dense, shining sliding face

Problem free operation

S3 • Slight porous sliding face

Problem free operation

S5 • Fine hairlining

Normal operation, slight dust influence

S7 • Hairlining

Causes: Underloaded, influence of dust, oil or grease

S9 • Tracking with hairlining and groves

Causes: Like S7, but stronger

S11 • Ghostmarks, difficult commutation

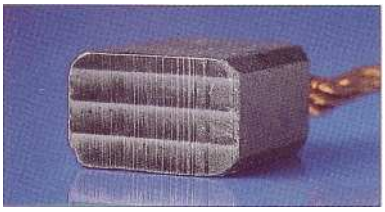
Causes: Commutation problems, e.g. false or incorrect position of the neutral zone or interpole

S13 • Burning edge of the leaving or trailing edge

Causes: Difficult commutation, heavy sparking, interruption of contact due to out of round of commutator or insufficient brush holder spring pressure

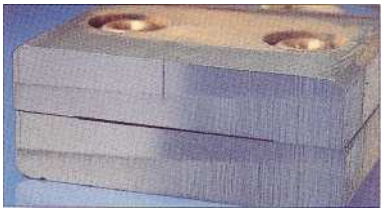
S15 • Eroded brush face

Causes: Electrical overload, interruption of contact



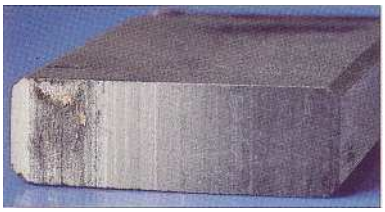
S17 • Lamination of sliding face

Causes: Burned segments of the sliding face caused by a winding fault giving voltage surge during commutation



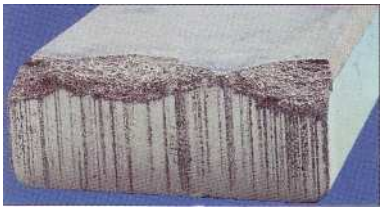
S19 • Double facing here for a twin brush

Causes: Tilting of the brush in dual direction machine



S21 • Copper nests

Causes: Pick up of copper particles, often following copper drag



S23 • Broken edges

Causes: High raised lamination, commutator seriously out of round, brush chatter