## Surface Appearance of Brushes

### Smooth Polished Surface (S1)


This shows good performance. However, if the polish is mirror-like (shiny), high frequency chatter due to low current may be the cause. Check the side-faces of the brush for marks of vibration.

### Open Textured Surface (S3)


This shows that brush performance is satisfactory. Actual appearance will depend on the type of grade.

### Finely Lined Surface (S5)


Another reasonable condition. The existence of dust in the atmosphere, is indicated by fine lines. This might be overcome by the use of filters or ducting the machine's air source from another area.

### Finely Serrated Surface (S7)


This is a further development of (S5) above. The causes are normally lack of load current or atmospheric contamination.

## Heavy Serrated Surface (S9)


As (7) above, but problem is more severe or has been allowed to continue for longer period.

## Ghost Marked Surface (S11)


This may be related with difficult commutation and can arise from incorrect neutral position, interlope problems or other causes of poor commutation.

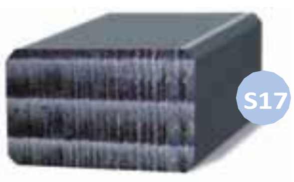
## Burnt Edges (S13)


Normally occurs on the trailing edge of the brush. Caused by poor commutation and heavy sparking.

## Pitted Surface (S15)


Indicates heavy under-brush sparking as a result of current overload or brush instability.

## Laminated Surface (S17)




This is an unusual condition caused by an armature winding fault giving rise to poor commutation.

## Double-bedded Surface (S19)


This occurs as a result of brush tilting on a reversing machine, i.e. the brush beds itself in both directions of rotation. In itself this does not give any cause for concern.

## Copper Particles (S21)


Copper pick-up from commutator surface can result from copper drag problems or heavy peak loads. It can cause further commutator wear.

## Chipped Edges (S23)


Normally occurs on the leading (entering) edge of the brush. Breakage can result from poor commutator profile, high micas and severe brush instability.

# Patina

## Light Film (P1)


Over the entire commutator surface is one of the many normal conditions often seen on a well-functioning machine. Film tone is dependent on the brush grade and current density.

## Patina Dark (P3)


Good condition. Film can be light to dark in color but the important feature is that it is uniform and even. Normally, a good film will have a slightly polished appearance.

## Blotchy Film (P5)


The non-uniform filming condition is the most common appearance. The accumulated tolerances in the machine such as commutator roundness, brush contact pressure, unequal magnetic fields and chemical vapors all contribute to this type of film development.

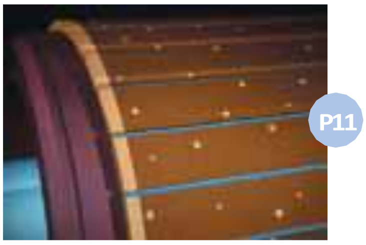
## Slot Bar Filming (P7)


Repeating light and dark filming patterns related to the number of armature coils per slot. This pattern is dependent on the machine design and usually not a function of the brush grade.

## Streaking (P9)


Streaking of only the film is not detrimental to the commutator. Brush and commutator life are not at risk in this condition. If metal transfer develops, this condition will progress into threading. This type of filming can be dependent on current density or brush grade.

## Bright Spots (P11)




Bright spots in the film suggest poor contact or overloading. The resultant under-brush sparking tends to destroy the patina and will eventually erode the commutator.

## Patina Streaked with Collector Wear (P13)


A streaky film with no commutator wear, tracks can vary in width and color. Caused by atmospheric conditions (humidity, oil vapor or other gases) or insufficient load.

## Grooving (P15)

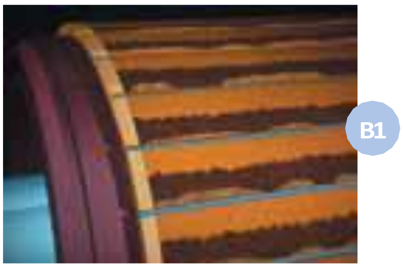

It is the uniform circumferential wear, the width of the brush that is exhibited on the commutator. Excessive abrasive dust in the atmosphere or an abrasive brush can cause this condition. Extreme light spring pressure (below 1.5 psi) can also cause this condition. Proper brush applications and filtering the air on force ventilated motors can reduce the commutator wear.

**Copper Drag (P17)**


Occurs when high energy transfers copper in a molten state. These particles become coated by contaminants from the surrounding environment or the brush treatment and do not oxidize properly to form the film on the commutator surface. These particles accumulate at the edge of the bar, eventually shorting across the insulating mica. This condition needs to be addressed immediately when discovered or serious damage may occur. Chamfering the commutator bar edges is necessary to stop the progression of this condition.

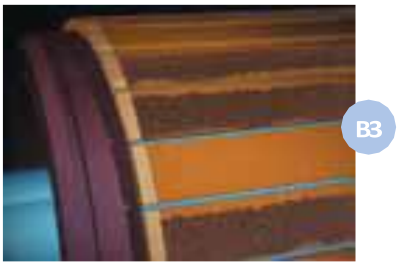
# Bar Burning

## Bar Burning (B1)




Is the erosion of the trailing edge of the commutator bar. Failed machine components, maladjusted electrical symmetry of the machine or a poor commutating brush can result in bar burning. If not corrected, this condition can cause severe commutator damage or a flashover.

## Slot Bar Burning (B3)




Results in commutator erosion of every second, third, or fourth bar depending on the winding design of the armature. Improper brush material, brush design or electrical adjustment of the machine can cause this condition. This condition severely damages the commutator and reduces brush life.

## Pitch Bar Burning (B5)


Results in commutator bars being eroded in a pattern related to 1/2 the number of brush arms, progressing into a pattern equal to the number of brush arms. This condition is caused by a cyclic mechanical or electrical disturbance such as an unbalanced armature, misaligned shafts, bent shaft, bad bearings, weak foundation, failed equalizers or a poor riser connection. If not corrected this condition will result in a flashover.