






# Shah Engineering Works

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## Technical Support Commutator Patina

As a further guide to the performance of your machine, this commutator film chart shows the main patterns of film build-up on commutators, and indicates the type of brush/commutator interaction which gives rise to each pattern. This information may be useful on its own, or as supporting evidence for your findings from the chart of common difficulties.

	<p><b>LIGHT FILM</b> 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.</p>
	<p><b>PATINA DARK</b> Good condition. Film can be light to dark in colour but the important feature is that it is uniform and even. Normally, a good film will have a slightly polished appearance.</p>
	<p><b>BLOTCHY FILM</b> this nonuniform 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.</p>
	<p><b>SLOT BAR FILMING</b> 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.</p>
	<p><b>STREAKING</b> 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.</p>

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	<p><b>BRIGHT SPOTS</b> 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.</p>
	<p><b>BAR BURNING</b> 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.</p>
	<p><b>SLOT BAR BURNING</b> 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.</p>
	<p><b>PATINA STREAKED WITH COLLECTOR WEAR</b> A streaky film with no commutator wear, tracks can vary in width and colour. Caused by atmospheric conditions (humidity, oil vapour or other gases) or insufficient load.</p>
	<p><b>PITCH BAR BURNING</b> 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.</p>
	<p><b>GROOVING</b> 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.</p>

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## ***COPPER DRAG***

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.

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