Cause of Failure Report for 40 HP Unico DC Motor
Job Number: 369035

Dreisilker Electric Motors, Inc.

The armature of this motor failed during inspection. During the initial test run, it cogged indicating a problem. The armature was found to have a partial turn to turn short during growl test. During the growl test the magnetic field strength was increased and the failure was evident. To discover the a cause of failure for the armature, it was necessary to strip the windings. After stripping the windings there were two findings of improper rewind techniques causing an absence of necessary electrical insulation.

Findings:

1. The insulating enamel on the copper wire was stripped too far back from the riser connection end (Figure One and Two). Wire insulating enamel is only needed to be stripped enough so that the armature coils can connect in the commutator riser slots via solder. There was varnish and sleeving present however there were some bare spots with poor varnish coverage on the wires and sleeving (Figure Two). The sleeving alone does not provide the same insulating strength as the combination of sleeving, varnish, and wire enamel.
2. After removing insulating tape from the commutator v-ring behind the riser from the previous rewind, there were two findings:
   A. The insulating mica had been removed from behind the riser exposing the steel of the commutators v-ring (Figures Three and Four).
   B. There was visible evidence of a burnt spot at the bottom of three commutator bars on the riser side (Figure Four and Five).

   The absence of insulation between the commutator riser and the v-ring caused a short between coils. In addition, the use of insulating tape and lack of mica on the steel of the v-ring could have trapped dirt causing it to arc between commutator turns or short to ground via the uninsulated steel v-ring. A proper commutator should have the insulation materials to prevent short to ground or short between commutator bars. Note in Figures Six to Eleven, the commutator has been rebuilt and insulation covers the steel.

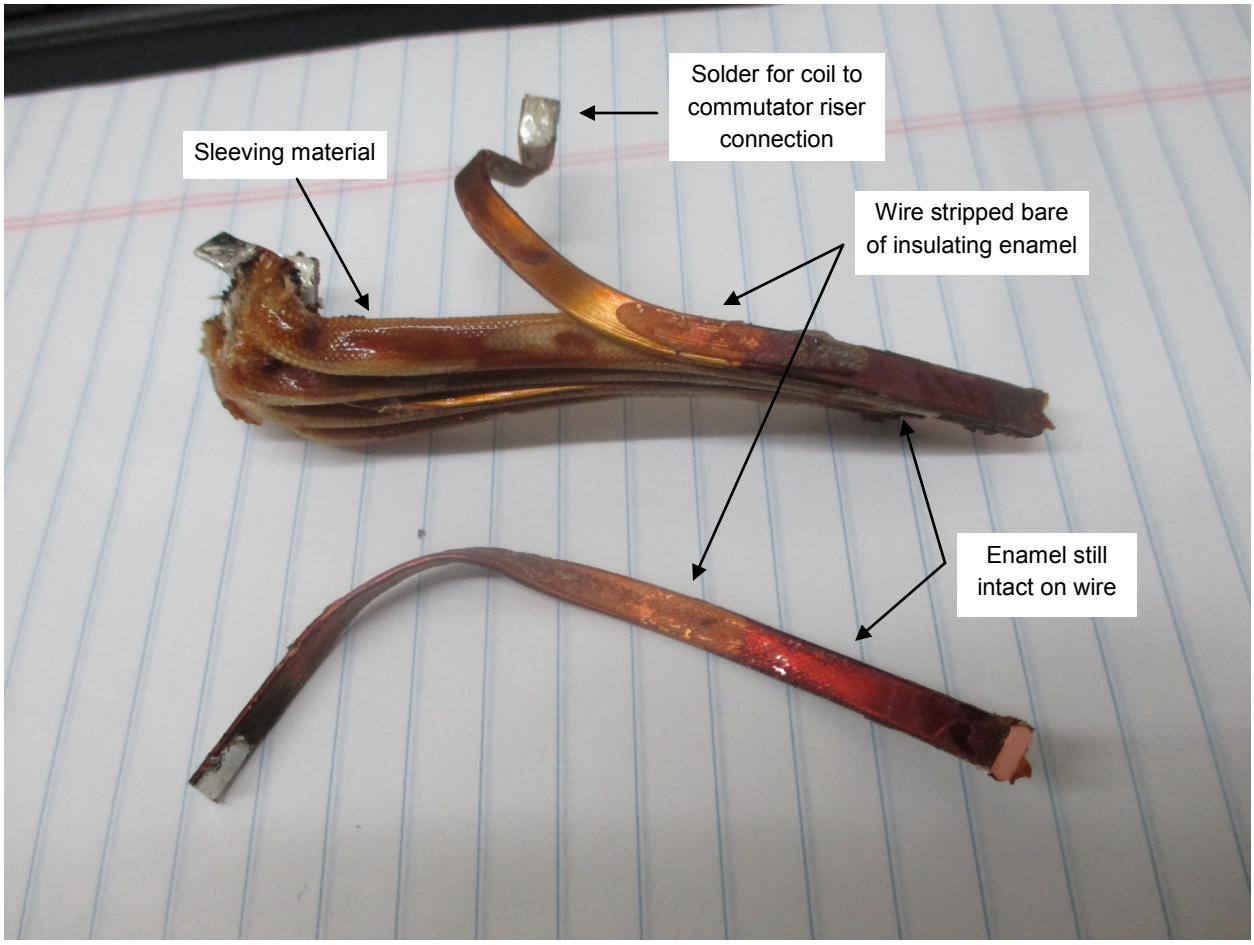

Figure One: Showing Grouping of Stripped Wires from Armature

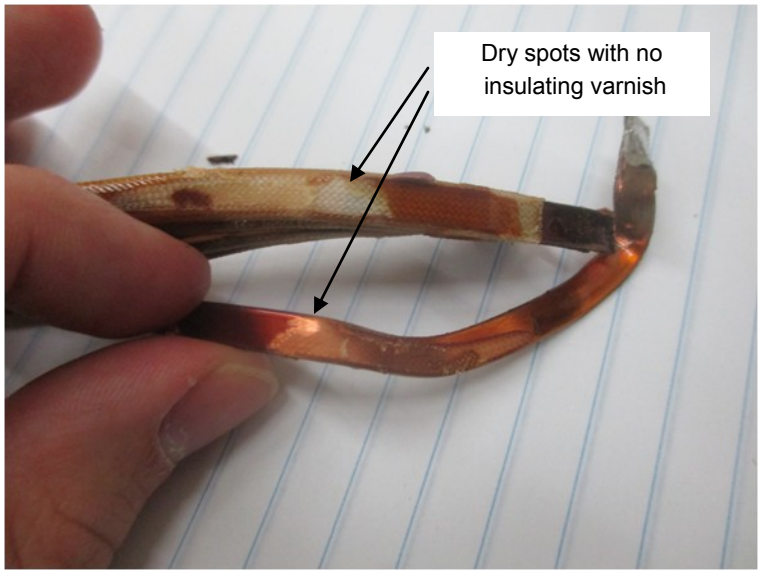

Figure Two: Separated Wire from Grouping Showing Poor Varnish and Insulation Coverage

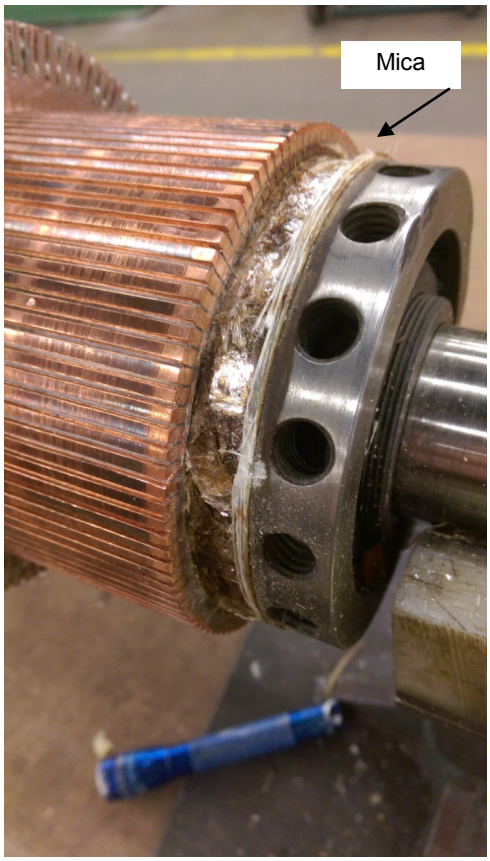

Figure Three: Tape/Banding from previous rewind removed to see if mica insulation was in place

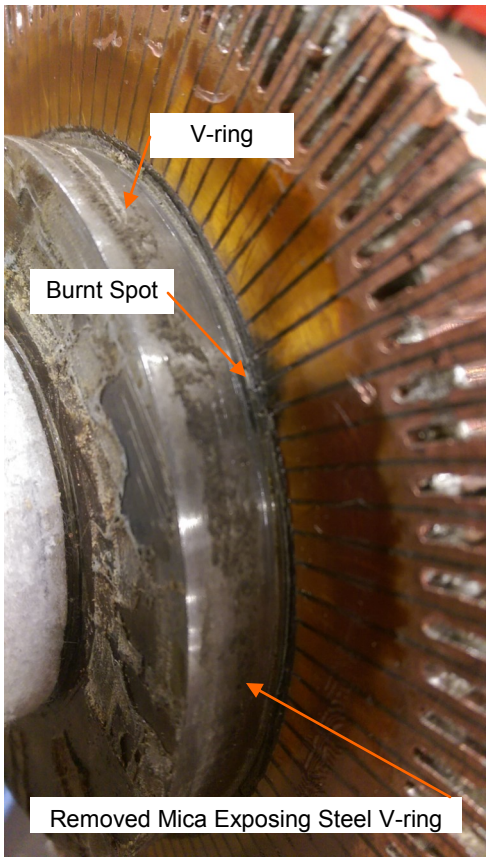

Figure Four: After removing banding, the mica insulation was found to have been removed and a burnt spot is visible where the commutator bars meet the steel spool at the bottom of the riser

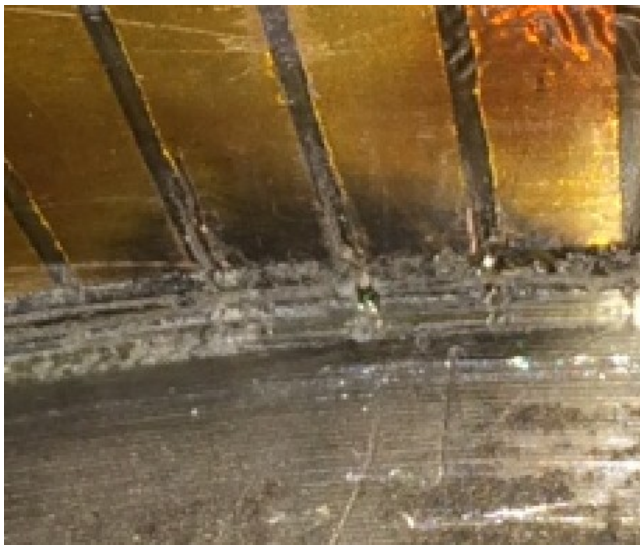

Figure Five: Close up of the burnt spot on the commutator riser

Figure Six: Rebuilt commutator, angular view of riser

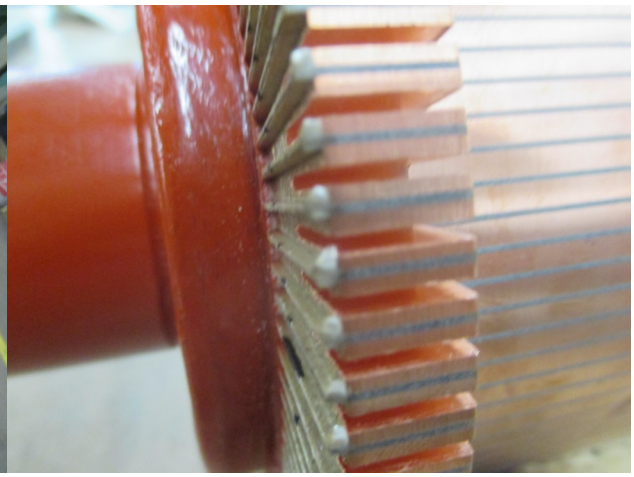

Figure Seven: Rebuilt commutator, top view of new insulation

Figure Eight: Rebuilt commutator, angular view of front with new insulation

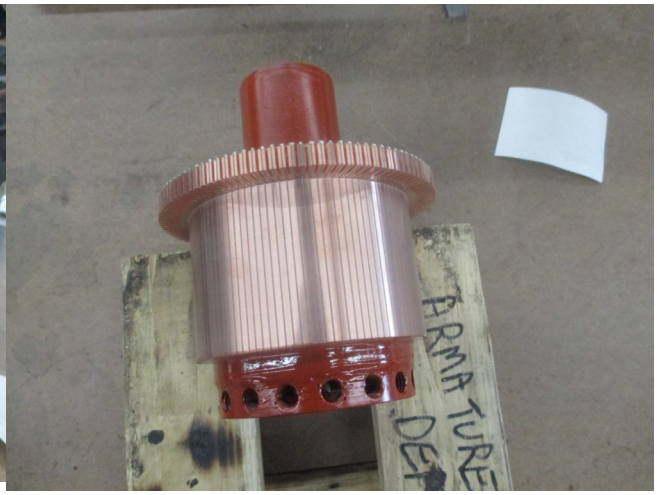

Figure Nine: Rebuilt commutator, top view

Figure Ten: Rebuilt commutator, view behind riser

Figure Eleven: Rebuilt commutator, view of front of spool and commutator