

Winding Failures of Electrical Motors

If an electric motor is subject to improper operating conditions, either electrical, mechanical or environmental, the winding life will be significantly reduced.

The pictures given below show what can happen to the electric motor winding and it can help to identify the causes for the failures so that preventative actions can be taken.

The defects shown in pictures 6, 7, 8, 10, 11, 12, 13 and 14 are originated from incorrect use. Therefore, not considered as warranty.



**WINDING SHORTED
TURN-TO-TURN**



**WINDING WITH
SHORTED COIL**

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**WINDING GROUNDED
AT THE EDGE OF SLOT**

4



**WINDING GROUNDED
AT THE SLOT**

5



**SHORTED
CONNECTION**

6



**WINDING DAMAGED
DUE TO OVERLOAD**

7



**DAMAGE CAUSED BY
LOCKED ROTOR**

8



**WINDING DAMAGED
BY VOLTAGE SURGE**

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Certificate Number : 8707QMS001

Physical Address: 298 Soutter Street, Pretoria West

Tel: 083 454 6949, +27 12 327 1729 Fax: +27 (0)12 327 1733 Toll Assist: 0860 10 30 41

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**WINDING SHORTED
PHASE-TO-PHASE**

10



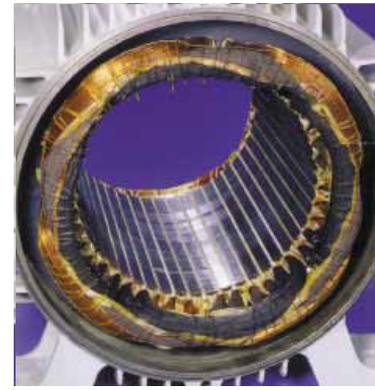
**WINDING SINGLE
PHASED (Y-connected)**

11



**WINDING
SINGLE PHASED
(Δ -connected)**

12



**PHASE DAMAGE DUE
TO UNBALANCED
SUPPLY VOLTAGE**

13



DAMAGED

14



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Picture number 1, 2, 3, 4, 5 and 9:

These pictures show insulation defects caused by contaminants, abrasion or voltage fluctuation.

Picture number 6:

The complete insulation burning out on all phases of the three-phase winding is caused by motor overload. Under or overvoltages cause the same type of failure.

Picture number 7:

The complete insulation burn out on all phases is normally caused by high currents in the stator winding due to locked rotor. This can also occur due to excessive starts and reversions.

Picture number 8:

Insulation defects such as this are normally caused by voltage peaks that often occur in the power circuit commutation, atmospheric discharge, semi-conductors power devices and capacitor discharge.

Pictures number 10 and 11:

The winding single-phase defect is a consequence of an interruption in one power supply phase. This defect is normally caused by a burnt fuse, open contactor, one power supply interrupted or poor connection.

Picture number 12:

The insulation burn out in one phase of the stator winding can be a result of uneven voltage between phases. Uneven voltages are usually caused by unbalanced loads in the power supply originated by poor connections at motor terminals or by bad contact. 1% of voltage unbalance can cause a current unbalance from 6% to 10%.

Picture number 13:

The auxiliary coil or starting burn out is normally caused by the non-opening of the centrifugal and stationary switch set where this coil remains switched on longer than the specified time. Foreign bodies that might penetrate into the motor can cause this defect.

Picture number 14:

An overload causes a complete insulation burnout of the single-phase winding main coil. Undervoltages, overvoltages or even when the auxiliary coil is not duly connected during the starting cause the same type of failure.

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