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## Typical Causes of Winding Failures in Three-Phase Stator Windings

### Good Stator Winding

Unfavorable operating conditions—electrical, mechanical or environmental—can dramatically shorten the life of a three-phase stator winding. The winding failures illustrated below typify what can happen in such circumstances. They are shown here to help you identify the causes of failure, so that, where possible, you may take preventive measures. Compare the new stator winding (right) with the failed windings pictured below.

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(Click photo for closer view.)



**Note:** To obtain printed copies of EASA's brochure *Failures in Three-Phase Stator Windings*, see EASA's [Price List](#) or contact EASA Headquarters by e-mail ([easainfo@easa.com](mailto: easainfo@easa.com)), telephone (314-993-2220) or Fax (314-993-1269).

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### 1 Winding Single-Phased (Wye-Connected)

A single-phased winding failure is the result of an open in one phase of the power supply to the motor. The open is usually caused by a blown fuse, an open contactor, a broken power line or bad connections.

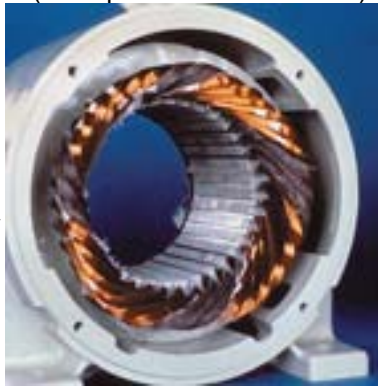
(Click photo for closer view.)



## 2 Winding Single-Phased (Delta-Connected)

A single-phased winding failure is the result of an open in one phase of the power supply to the motor. The open is usually caused by a blown fuse, an open contactor, a broken power line or bad connections.

(Click photo for closer view.)



## 3 Winding Shorted Phase-to-Phase

This type of insulation failure is typically caused by contaminants, abrasion, vibration or voltage surge.

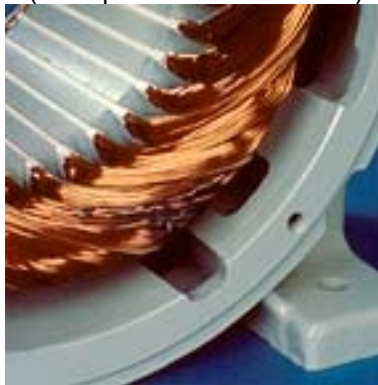
(Click photo for closer view.)



## 4 Winding Shorted Turn-to-Turn

This type of insulation failure is typically caused by contaminants, abrasion, vibration or voltage surge.

(Click photo for closer view.)



## 5 Winding With Shorted Coil

This type of insulation failure is typically caused by contaminants, abrasion, vibration or voltage surge.

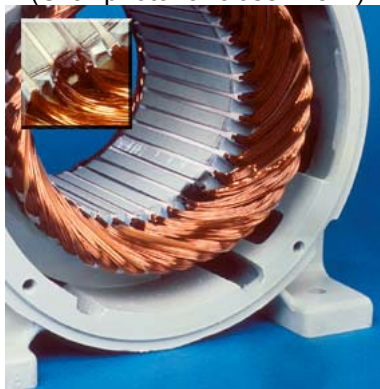
(Click photo for closer view.)



## 6 Winding Grounded at Edge of Slot

This type of insulation failure is typically caused by contaminants, abrasion, vibration or voltage surge.

(Click photo for closer view.)



## 6 A Winding Grounded at Edge of Slot

This type of insulation failure is typically caused by contaminants, abrasion, vibration or voltage surge.

(Click photo for closer view.)



## 7 Winding Grounded in the Slot

This type of insulation failure is typically caused by contaminants, abrasion, vibration or voltage surge.

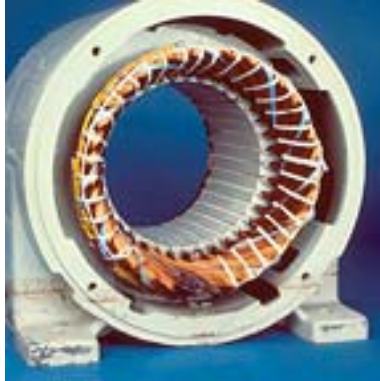
(Click photo for closer view.)



## 8 Shorted Connection

This type of insulation failure is typically caused by contaminants, abrasion, vibration or voltage surge.

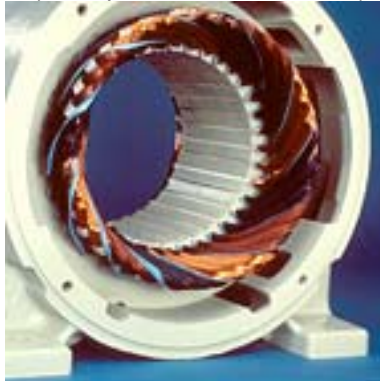
(Click photo for closer view.)



## 9 Phase Damage Due to Unbalanced Voltage

Thermal deterioration of insulation in one phase of the stator winding can result from unequal voltage between phases. Unequal voltages usually are caused by unbalanced loads on the power source, a poor connection at the motor terminal, or a high resistance contact (weak spring).

(Click photo for closer view.)



**Note:** A one-percent voltage unbalance may result in a six- to ten-percent current unbalance.

## 10 Winding Damaged Due to Overload

Thermal deterioration of the insulation in all phases of the stator winding typically is caused by load demands exceeding the rating of the motor.

**Note:** Under-voltage and over-voltage (exceeding NEMA standards) will result in the same type of insulation deterioration.

(Click photo for closer view.)



## 11 Damage Caused by Locked Rotor

Severe thermal deterioration of the insulation in all phases of the motor normally is caused by very high currents in the stator winding due to a locked rotor condition. It may also occur as a result of excessive starts or reversals.

(Click photo for closer view.)



## 12 Winding Damaged by Voltage Surge

Insulation failures like this usually are caused by voltage surges. Voltage surges are often the result of switching power circuits, lightning strikes, capacitor discharges and solid-state power devices.

(Click photo for closer view.)

