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What is cogging?

Cogging is when a motor has trouble starting because the rotor gets stuck due to magnetic forces between the rotor and stator teeth.

In a three-phase induction motor, cogging is a condition where the motor fails to start or starts very slowly, even when rated voltage is applied. It happens due to magnetic locking between the stator and rotor teeth.

A locking effect happens when the slots in the stator and rotor teeth line up. This prevents the rotor from turning, and the motor gets stuck in one position. As a result, the motor cannot develop enough starting torque and fails to rotate.

Why Does Cogging Occur?

It mainly occurs due to:

1. Same number of stator and rotor slots

If the stator and rotor have an equal number of slots, their magnetic fields align perfectly, causing locking.

2. Low supply voltage

Low voltage reduces the starting torque, making the locking effect stronger.

3. High load during starting

If the motor is loaded heavily at the start, it may not overcome the magnetic locking.

Effects

- Motor fails to start
- Motor produces humming sound
- Rotor vibrates but does not rotate
- Excess heating due to high currents
- Can damage motor if not corrected

How to Reduce or Prevent Cogging

1. Skewing of Rotor Slots

Rotor bars are placed slightly slanted (skewed).
This is the most common and effective solution.

2. Changing the Number of Slots

Using unequal stator and rotor slots prevents alignment and avoids locking.

3. Proper Voltage Supply

Using the correct rated voltage helps the motor produce enough starting torque.

4. Reducing Load at Start

Ensuring the motor starts with minimal load can prevent it.

FAQs

Why Skewing Helps?

Skewing breaks the direct magnetic alignment between stator and rotor teeth. This removes the magnetic locking effect and ensures smooth, noise-free starting.

How do I identify cogging in a motor?

You can identify it when the motor hums, vibrates slightly, but does not rotate even though power is supplied.

Is cogging harmful to the motor?

Yes. If the motor remains stuck due to it, it may overheat and draw high current, which can damage the windings.

Does cogging occur in all induction motors?

It mainly occurs in motors where the stator and rotor slot combination is poor. Modern motors are designed with skewed rotors to avoid this issue.

What is the difference between cogging and crawling?

Cogging: Motor does not start due to magnetic locking.

Crawling: Motor runs at a very low speed (about 1/7th of synchronous speed) due to harmonic effects.

Related Terms:

Crawling in Three Phase Induction Motor