

EFFECT OF USING SOLID BACK IRON DURING MAGNETIZATION

A back iron is used with the magnetizing fixture to achieve either radial or hybrid (radial-halbach) magnetizing profiles. A back iron helps to reduce the energy needed to saturate the magnet. For the back iron, laminated steel is preferred over solid steel as the use of solid steel leads to the generation of eddy current and its corresponding effects.



Back iron

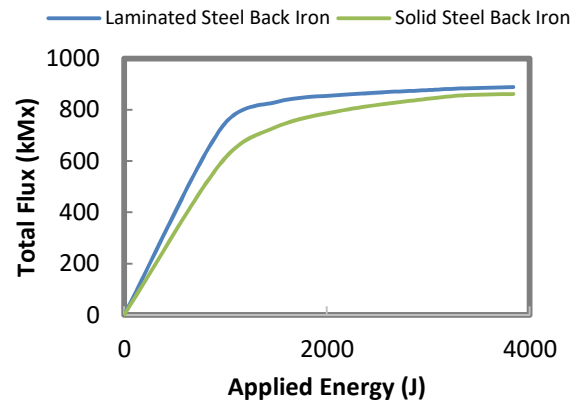
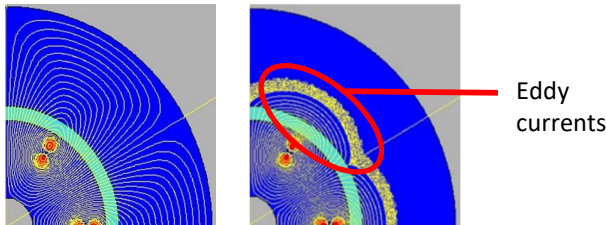
The effects of eddy current are:

- Need for higher energy to saturate the magnet
- Distortion of the flux orientation
- Higher thermal and mechanical stresses

Need for higher energy to saturate the magnet

Eddy currents generate an opposing field to the main field.

- Reduces the net field applied to the magnet
- May lead to partially saturated magnet



Distortion of the flux orientation

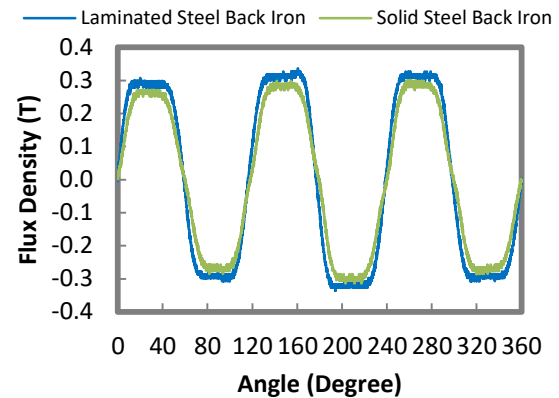
- Thicker primary transition zone region leads to:
 - Reduction in airgap flux
 - Lower motor efficiency and stall torque
 - Increased chance of magnet demagnetization under extreme load condition



- Unwanted secondary transition zones



- Reduced total flux
 - Peak flux density is reduced by 8.8%
 - Flux integral is reduced by 15.3%



Higher thermal and mechanical stresses

- Induces mechanical forces between magnetizing fixture and magnet
- Reduces fixture life time and durability as heat increases during operation
- Increases the magnetization cycle time in order to avoid fixture failure