

INDUCTION MOTOR-I (ASYNCHRONOUS MOTOR)

UNIT-III

Vinod Kumar
Department of ECE

LEARNING OUTCOMES

At the end of the unit, student should be able to:

- ❖ Understand the principle and the nature of 3 phase Induction machines.**
- ❖ Perform an analysis on induction machines which is the most rugged and the most widely used machine in industry.**

CONTENTS

1. Overview of 3 Phase Induction Motor
2. Constructional features

Lecture No. 1

OVERVIEW OF 3 PHASE INDUCTION MOTOR

- Induction motors are used worldwide in many residential, commercial, industrial, and utility applications.
- Induction Motors transform electrical energy into mechanical energy.
- It can be part of a pump or fan, or connected to some other form of mechanical equipment such as a winder, conveyor, or mixer.

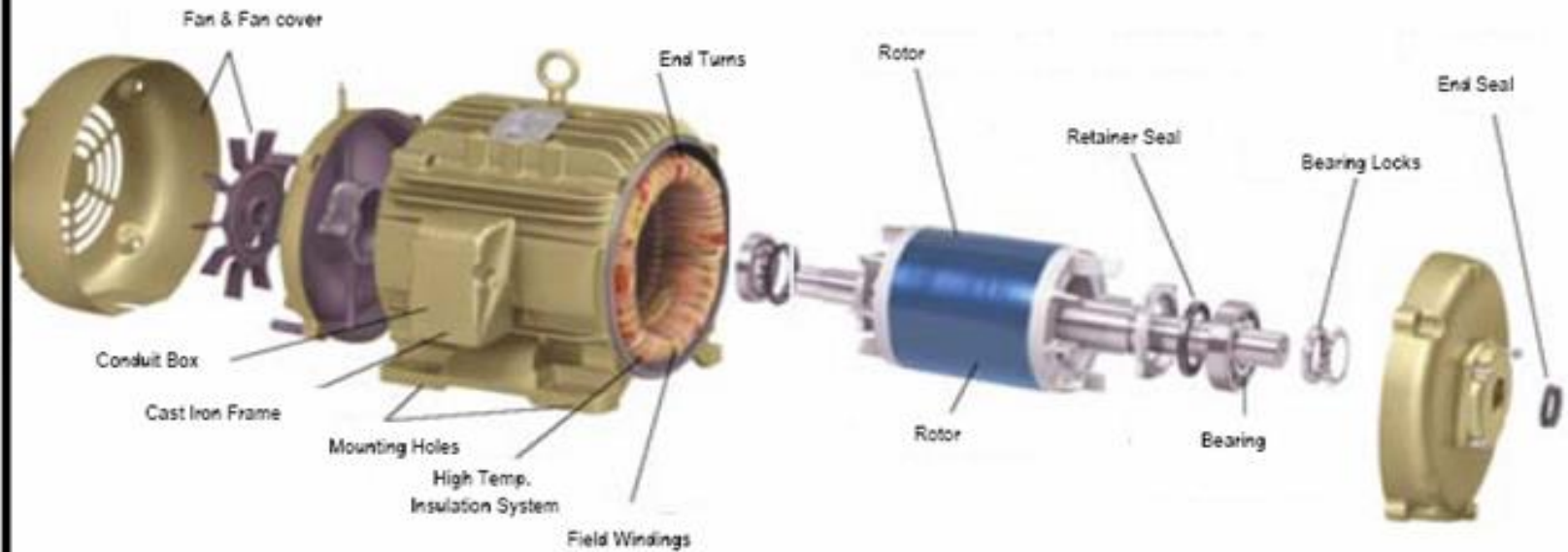
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General aspects

- An Induction Machine can be used as either a induction generator or an induction motor.
- Induction motors are popularly used in the industry.
- Focus on three-phase induction motor
- Main features: Cheap and low maintenance
- Main disadvantages: Speed control is not easy

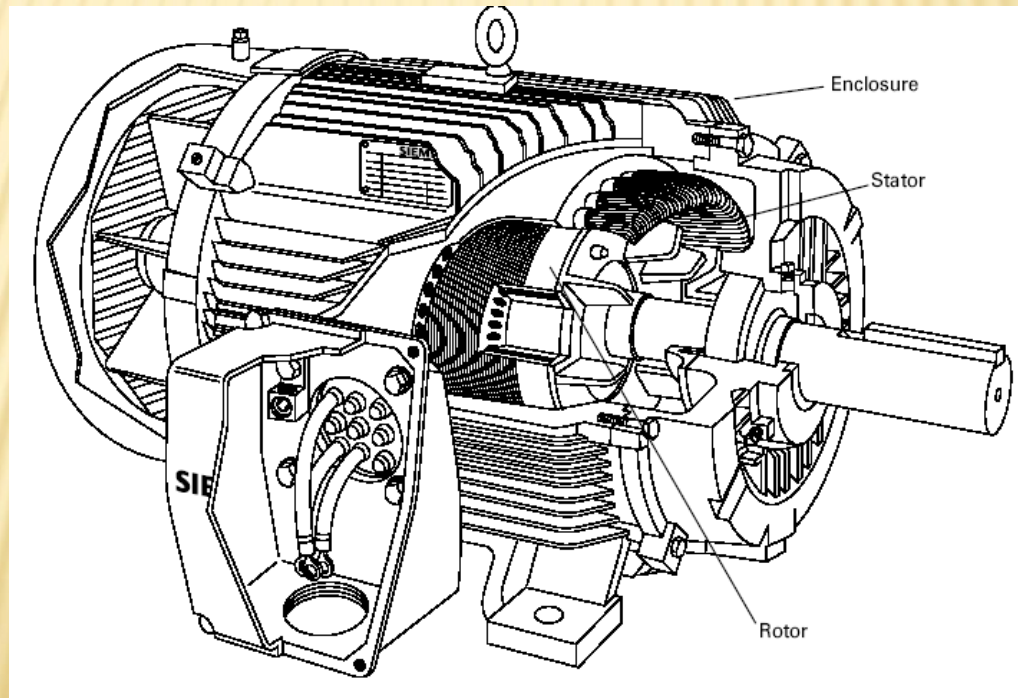
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Parts of AC Motor



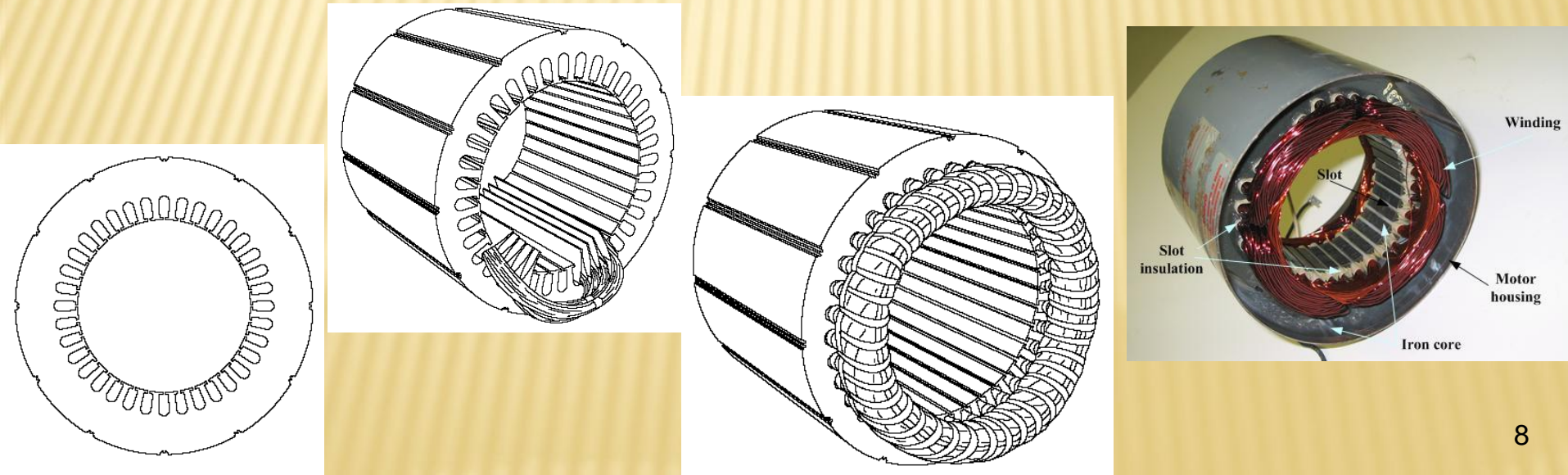
CONSTRUCTIONAL FEATURES

- The three basic parts of an AC motor are the **rotor**, **stator**, and **enclosure**.
- The stator and the rotor are electrical circuits that perform as **electromagnets**.



CONSTRUCTION (STATOR CONSTRUCTION)

- The stator is the **stationary electrical part of the motor**.
- The stator core of a National Electrical Manufacturers Association (NEMA) motor is made up of **several hundred thin laminations**.
- Stator laminations are **stacked together** forming a **hollow cylinder**. Coils of insulated wire are inserted into slots of the stator core.
- **Electromagnetism is the principle behind motor operation. Each grouping of coils**, together with the steel core it surrounds, form an **electromagnet**. The **stator windings** are **connected directly** to the power source.



CONSTRUCTION (ROTOR CONSTRUCTION)

- The rotor is the rotating part of the electromagnetic circuit.
- It can be found in two types:
 - ❖ Squirrel cage
 - ❖ Wound rotor
- However, the most common type of rotor is the “squirrel cage” rotor.

CONSTRUCTION (ROTOR CONSTRUCTION)

➤ **Types of 3 Phase Induction Motor:**

❖ **Squirrel cage type:**

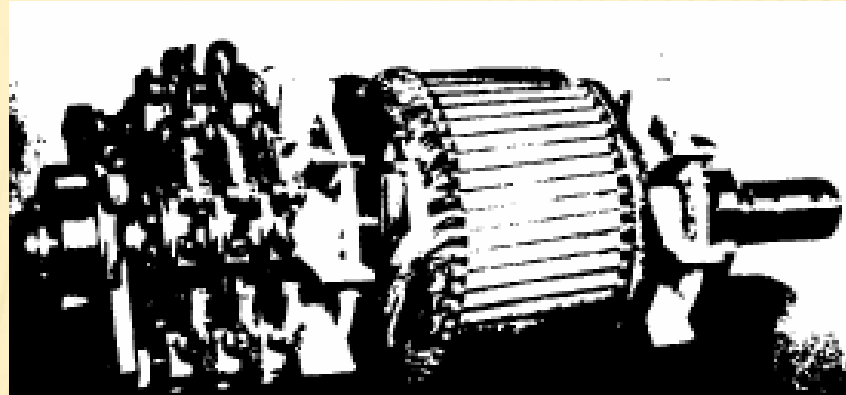
- Rotor winding is composed of copper bars embedded in the rotor slots and **shorted at both end by end rings**
- **Simple, low cost, robust, low maintenance**

❖ **Wound rotor type:**

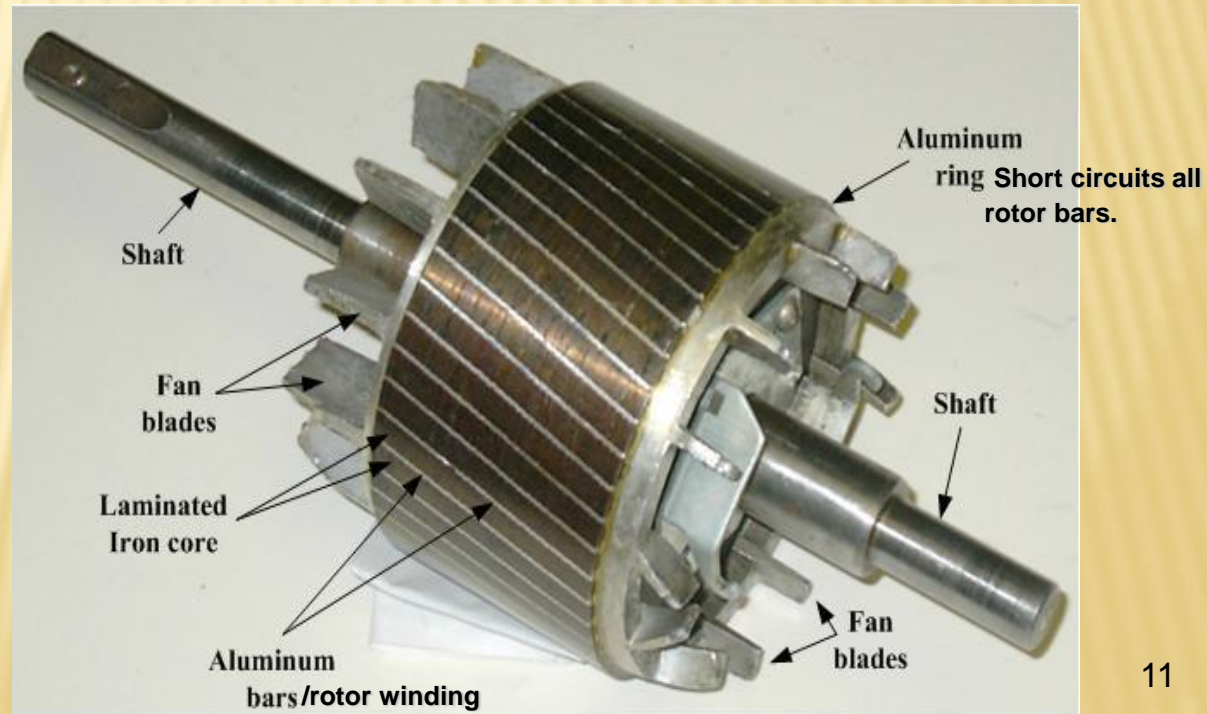
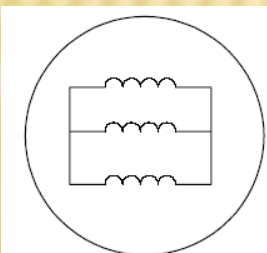
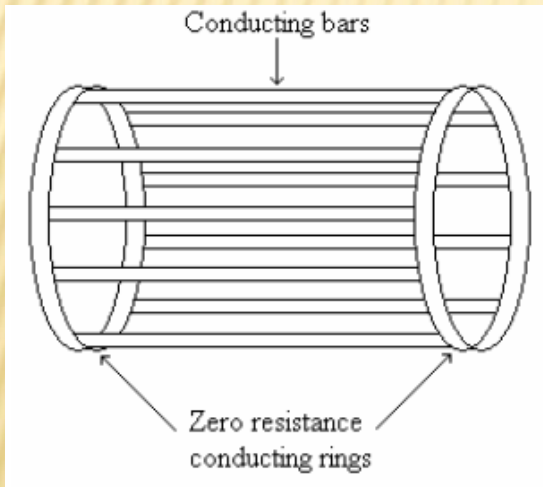
- **Rotor winding is wound by wires.** The winding terminals can be connected to external circuits through slip rings and brushes.
- **Easy to control speed, more expensive.**

CONSTRUCTION (ROTOR CONSTRUCTION)

Wound Rotor

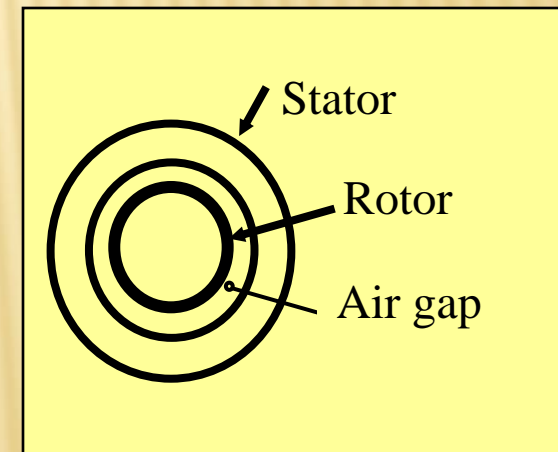


Squirrel-Cage Rotor

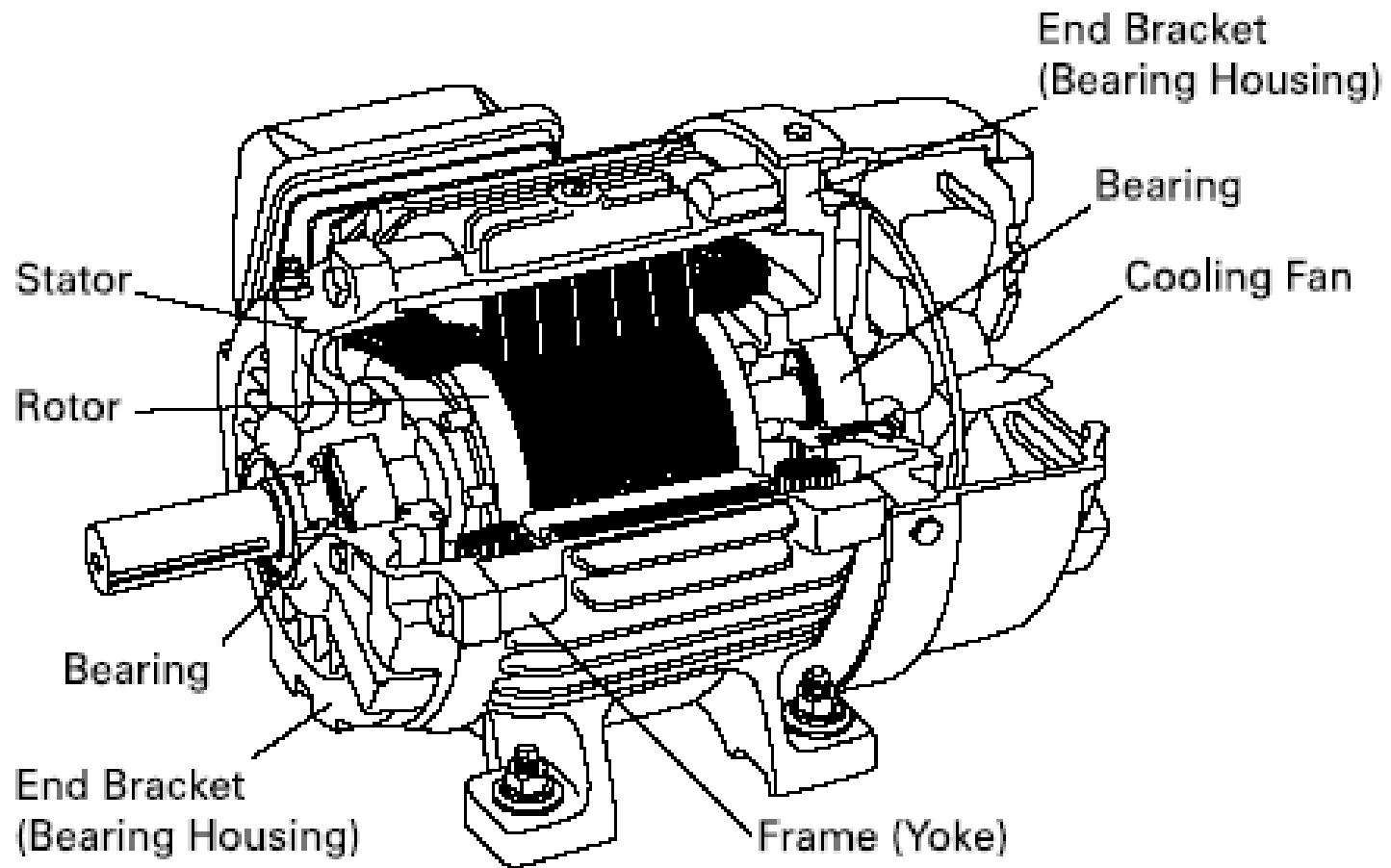


CONSTRUCTION (ENCLOSURE)

- The enclosure consists of a frame (or yoke) and two end brackets (or bearing housings). The stator is mounted inside the frame. **The rotor fits inside the stator with a slight air gap separating it from the stator. There is NO direct physical connection between the rotor and the stator.**
- The enclosure also **protects** the electrical and operating parts of the motor **from harmful effects of the environment** in which the motor operates. **Bearings, mounted on the shaft, support the rotor and allow it to turn. A fan, also mounted on the shaft, is used on the motor shown below for cooling.**



CONSTRUCTION (ENCLOSURE)



NAMEPLATE

SIEMENS									
PE•21 PLUS™					PREMIUM EFFICIENCY				
ORD.NO.	1LA02864SE41				E NO.				
TYPE	RGZESD				FRAME	286T			
H.P.	30.00				SERVICE FACTOR	1.15		3 PH	
AMPS	34.9				VOLTS	460			
R.P.M.	1765				HERTZ	60			
DUTY	CONT 40°C AMB.					DATE CODE			
CLASS INSUL	F	NEMA DESIGN	B	KVA CODE	G	NEMA NOM. EFF.	93,6		
SH. END BRG.	50BC03JPP3				OPP. END BRG.	50BC03JPP3			
MILL AND CHEMICAL DUTY QUALITY INDUCTION MOTOR									
Siemens Energy & Automation, Inc, Little Rock, AR							MADE IN U.S.A.		

51-770-642