

Unit 31: Electrical Systems and Fault Finding

Unit code A/615/1500

Unit level 4

Credit value 15

Introduction

Electrical systems can be found in a very wide range of locations such as in manufacturing facilities, airports, transport systems, shopping centres, hotels and hospitals; people will come across them every day in their work place and at home. The system must take the electrical supply from the national grid, convert it to a suitable voltage and then distribute it safely to the various system components and uses such as electric motors, lighting circuits and environmental controls.

This unit introduces students to the characteristics and operational parameters of a range of electrical system components that are used in a variety of applications; and how to fault find when they go wrong.

On successful completion of this unit students will be able to follow electrical system circuit diagrams, understand the operation of the various components that make up the system and select the most suitable fault finding technique. Therefore, students will develop skills such as critical thinking, analysis, reasoning, interpretation, decision-making, information literacy, information and communication technology literacy, innovation, creativity, collaboration, and adaptability, which are crucial skills for gaining employment and developing academic competence for higher education progression.

Learning Outcomes

By the end of this unit students will be able to:

1. Investigate the constructional features and applications of electrical distribution systems.
2. Examine the types and applications of electrical motors and generators.
3. Analyse the types of lighting circuits available in the industry by assessing their practical application.
4. Explain the operating characteristics of electrical safety components.

Essential Content

LO1 Investigate the constructional features and applications of electrical distribution systems

Operating principles:

Three-phase, single-phase distribution methods and connections

Earthing system connections

Transformer constructional features:

Construction, application, characteristics of transformers such as step up/down, isolating, shell and core, windings, connections, efficiency

Electrical circuit symbols and layout diagrams

Fault finding techniques and test equipment:

Input/output, half split

Meters, insulation testers

Typical faults found

LO2 Examine the types and applications of electrical motors and generators

Types and applications:

Construction, application, characteristics, and testing

Types of electric motors and generators

Practical applications

Generation methods

Starting methods

Voltages, power, speed, torque, inertia

EMI, efficiency

Cooling and protection devices

LO3 Analyse the types of lighting circuits available in the industry by assessing their practical application

Types available and applications:

Construction, application, characteristics and testing of lighting circuits

Types of lights available (high-intensity discharge lamps (HID lamps) such as metal-halide and sodium, fluorescent, light emitting diode (LED) and halogen)

Practical applications

Voltages, energy usage, lumen output, efficiency, recycling

Safety requirements for use in hazardous zones

Heat and protection devices

Lighting design:

Quality of light, control of glare, luminance, internal/external lighting for visual tasks, emergency lighting, use in hazardous environments

LO4 Explain the operating characteristics of electrical safety components

Electrical safety standards:

Approved codes of practice

Component types available and applications:

Construction, application, characteristics and testing of: distribution boards, circuit breakers, residual current devices (RCDs), fuses, thermal devices, relays, contactors, switch gear, emergency stop buttons, interlocks, disconnectors, earth connections, Insulation Protection (IP) rating

Learning Outcomes and Assessment Criteria

Pass	Merit	Distinction
L01 Investigate the constructional features and applications of electrical distribution systems		D1 Analyse the operation of single and three-phase techniques in electrical distribution systems
P1 Describe the features of an electrical distribution system P2 Review the electrical component symbols used in circuit diagrams P3 Explain the different methods of single and three phase connections	M1 Summarise the methods of safe fault finding on an electrical distribution system	
L02 Examine the types and applications of electrical motors and generators		D2 Justify the selection of a motor for a specific industrial application
P4 Explain the types of electrical motors and generators available P5 Select suitable motors for various industrial applications P6 Review the different methods of starting induction motors and synchronous machines	M2 Outline the efficiency of motors and generators	

Pass	Merit	Distinction
LO3 Analyse the types of lighting circuits available in the industry by assessing their practical application		D3 Evaluate the practical application of a specific type of lighting circuit
<p>P7 Examine the types and construction of lighting devices</p> <p>P8 Explore a suitable lighting type for a specific application, considering its characteristics</p>	M3 Analyse the efficiency of lighting circuit designs	
LO4 Explain the operating characteristics of electrical safety components		D4 Validate the selection of suitable electrical safety devices for a specific industrial application
<p>P9 Describe the operation, types and uses of electrical safety devices</p> <p>P10 List suitable safety components for a specific application</p>	M4 Determine the practical application of electrical safety devices in an industrial situation	

Recommended Resources

Textbooks

HUGHES, A. (2013) *Electric Motors and Drives: Fundamentals, Types and Applications*. 4th Ed. Newnes.

Websites

<https://ocw.mit.edu/> MIT open courseware
Electric Machines
(Tutorials)

Links

This unit links to the following related units:

Unit 19: Electrical and Electronic Principles

Unit 21: Electrical Machines

Unit 22: Electronic Circuits and Devices