

1. Module details**Module name****Motor Control and Protection (DC)****Module duration**

Half module

It is anticipated that a student possessing the skills and knowledge developed in the prerequisites will achieve the module purpose in 18 to 20 hours.

Module code

NUE136

Discipline code

0703125

2. Module purpose

To gain knowledge and understanding of the methods used in the controlling of motor starting, braking and speed of DC motors. Students will also learn the need for motor protection and the various methods employed to protect DC motors.

3. Learning pathway**Intended use in the structured learning program**

It would be intended that students would have a sound knowledge of rotating machine principles and protection methods and devices.

Recommended prerequisites

Applied Electromagnetism – NUE045

Electrical Installation Protection Methods and Devices – NUE400

4. Relationship to competency standards

This module provides part of the underpinning knowledge and skills in the 'Evidence Guide' of specific units of competency in the National Electrotechnology Training Package and provides similar support, where mapped, to equivalent units in the National Metals and Engineering Competency Standards. For details refer to the module to unit maps, available from EE-Oz Training Standards.

5. Content

1. DC Motor Starting

- Revise operating principles of motors and the equivalent circuit
- Need for current limitation
- Principles of motor starting
- Manual motor starters
- Automatic motor starters
- Fault finding on motor starter circuits

2. DC Motor Protection

- Revise motor construction (surface area and thermal mass)
- Needs for motor protection

	<ul style="list-style-type: none"> • Overload and Short Circuit protection • Over-speed Protection • Under-voltage Protection
	3. DC Motor Reversal and Braking <ul style="list-style-type: none"> • Reversal of motors • Braking methods of motors • Applications
	4. Motor Speed Control <ul style="list-style-type: none"> • Principles of speed control • Field control • Rheostatic control • Voltage control • Solid State control methods
6. Assessment strategy	
Assessment methods	Short-answer questions Assignments Practical exercises
Conditions of assessment	Learning and assessment will take place in an integrated way in an environment that is conducive to a learner's development.
7. Learning outcome details	On completion of this module the learner will be able to:
Learning outcome 1	Explain the need for DC motor starters and describe the operation of the common types.
Assessment criteria	1.1 State the requirements for the limitation of starting current for DC motors. 1.2 Using simple diagrams and calculations, describe how a DC motor starter limits the initial inrush current. 1.3 Describe operating principles of manual DC motor starters such as face-plate starters, drum controllers and cam controllers. 1.4 Describe the operating principles of automatic DC motor starters such as time limit, current limit and back emf type starters. 1.5 Diagnose and rectify faults in automatic DC motor starter circuits

Learning outcome 2	Explain the need for DC motor protection and the various methods employed to protect the motor from overloads, short circuit currents, over-speed and under-voltage.
Assessment criteria	<ul style="list-style-type: none">2.1 Describe the need for protection of DC motors.2.2 State the methods used to for overload protection and short circuit protection and the operating principles of each method.2.3 State the methods used for over-speed protection and the operating principles of each method.2.4 State the methods used for under-voltage protection and the operating principles of each method.
Learning outcome 3	Explain the methods employed for changing the motor direction of rotation and motor braking.
Assessment criteria	<ul style="list-style-type: none">3.1 Describe the methods used to change the direction of rotation of a DC motor.3.2 Explain the methods used to brake a DC motor and the operating principles of each method.3.3 List common applications where braking methods are employed on DC motors
Learning outcome 4	Explain the need for DC motor speed control methods and describe the operation of the most common methods employed by industry.
Assessment criteria	<ul style="list-style-type: none">4.1 Explain the principle of motor speed control of a DC motor.4.2 Describe the principle and operation of field control used on DC motors.4.3 Describe the principle and operation of rheostatic control used on DC motors.4.4 Describe the principle and operation of voltage control used on DC motors.4.5 Describe the basic principle of operation, advantages and disadvantages of using solid-state voltage control methods (phase control and choppers) on DC motors.

8. Delivery of the module

Delivery strategy

Delivery strategies must be suitable for both theoretical and/or practical learning and module purpose.

It is recommended that learning and assessment be facilitated in a holistic manner, which may require a learning outcome sequence other than that indicated in the body of this module.

Also an integrated theory/practice approach should be used where students learn by experimentation and through research and laboratory reports.

Resource requirements

A range DC motors, control equipment and testing instruments. Resources should be sufficient for students to carry out practical exercises on an individual basis.

Useful references include:

Jenneson, J.R. 2003, *Electrical Principles for the Electrical Trades, 5th Ed.* McGraw-Hill, Sydney.
ISBN 0 07 452107

Where this module is used in an approved Traineeship or Apprenticeship program learners should be advised to obtain, where available, respective EE-Oz Training Standards¹ *User Guides* (these outline in detail what training and work performance the Learner is required to undertake for the program).

Occupational health and safety requirements

A safe and healthy environment will be provided for students in regards to classroom and laboratory safety.

¹ www.ee-oz.com.au