

1. Module details**Module name****High Voltage Switching - Techniques****Module duration**

It is expected that students with the appropriate entry knowledge and skills will successfully complete this module in 54 – 60 hours.

Module code

NUE228

Discipline code

0703130

2. Module purpose

This module is designed to supply the knowledge and skills required by electrical supply industry workers to carry out high voltage switching operations including isolation, proving dead, earthing and operation of associated protection and metering equipment. High voltage switching operations for transformers, sub-station equipment, overhead lines and underground cables to provide a safe working environment for maintenance or construction of electrical systems. All procedures and practices comply in accordance with electricity supply industry standards, Supply Authority regulations, relevant Australian Standards and OH&S regulations.

3. Prerequisites

NUE207 Powerline Safety Practices.
NUE205 Power System Components.

4. Relationship to competency standards

This module addresses Units 3.5 and 3.10 of the E.S.I. National Competency Standards for Overhead Line Work and Cable Jointing and Unit 7.2 of the Electrical Contracting Industry Award Standard (Volume 8).

5. Content**High Voltage Switching procedures****Restriction pertaining to HV Switching equipment****Isolation of HV transmission and distribution systems****Proving dead and installing main and working earths theory and practical****Use and operation of the following equipment used in association with HV Overhead and Substation switching**

test instruments

sticks

interrupters

arc stranglers

Procedure for the following HV overhead switching or indicating devices

fuses
disconnect fuses
load switching
live line indicators
capacitors
reclosers
sectionalisers
air breaks
disconnects
live line clamps
phasing sticks
phasing tester

Protection systems and substation equipment

relays – overcurrent (reclosing, earth fault)
transformer protection (Bucholtz relay, OLTC, regulators)
zone leakage
directional overcurrent
distance impedance
annunciators
control panels
underfrequency protection
telephone dialling units
power factor correction
methods
general substation procedures
switchyard devices
circuit breakers
regulators
target reading

Equipment used in association with HV underground switching

arc strangles
switch operation
load break elbows
switching cubicles
canister fuses
bayonet fuses
F & G switching cubicles
voltage indicators
phasing testers

HV Transmission and Distribution System symbols and feeder plans

	<p>The preparation of switching sheets system switching local switching programs and emergency switching programs, using approved switching terminology.</p> <p>Mobile radio procedures</p> <p>Double isolation procedures</p>
<p>6. Assessment strategy</p>	
<p>Assessment methods</p>	<p>Short answer questions (written, oral or graphic or computer based). Suitable practical exercises which assess the skills required of each learning outcome.</p>
<p>Conditions of assessment</p>	<p>Theory room for written tests together with practical field observation.</p>
<p>7. Learning outcome details</p>	
<p>Learning outcome 1</p>	<p>Describe the role, responsibilities, skills and knowledge required of a HV switching operator.</p>
<p>Assessment criteria</p>	<p>1.1 Define the role and responsibilities of a HV switching operator in the Electrical Supply Industry.</p> <p>1.2 Outline the appropriate dress required in a High Voltage environment.</p> <p>1.3 Recall general HV operating terms and common abbreviations.</p> <p>1.4 Communicate effectively with personnel involved in switching operations.</p>
<p>Learning outcome 2</p>	<p>Prepare switching requests related to HV transmission, distribution and substation systems.</p>
<p>Assessment criteria</p>	<p>2.1 Describe HV electrical supply system layout, and identify and interpret single line diagram symbols.</p> <p>2.2 Identify HV apparatus, its application and basic function in a HV electrical supply system.</p> <p>2.3 Prepare a switching request demonstrating sound knowledge of switching terminology and procedures.</p>

Learning outcome 3

Identify and operate switching apparatus.

Assessment criteria

- 3.1 List the types and categories of HV switchgear used in electricity supply systems.
- 3.2 State the application, function and operating capabilities of switchgear used in HV electrical supply systems.
- 3.3 Define hazards associated with HV switchgear operation and the need for a planned, systematic and defensive approach when operating.
- 3.4 Describe basic arc extinction principles and arc quenching devices used in HV switchgear.
- 3.5 Demonstrate safe operating procedures of HV switching apparatus.

Learning outcome 4

State the effective earthing practices and procedures to be followed when earthing HV electrical apparatus for access.

Assessment criteria

- 4.1 List the reasons for attachment of “Operational” and additional work party “on-site” earths prior to working on HV conductors.
- 4.2 List the factors determining the location and effectiveness of “Operational” earthing.
- 4.3 State the accepted HV industry procedures and practices to be followed, hazards to the operator and protective safety equipment to be used when attaching “Operational” earths to HV distribution line apparatus.

Learning outcome 5

State the procedures to operate HV distribution transformers.

Assessment criteria

- 5.1 Explain the principle governing factors for transformer ratings, operating limitations and the relationship between transformer and HV fuse rating.
- 5.2 State the purpose and principle operation of HV distribution transformer tap changers.
- 5.3 State HV distribution transformer and transformer - cable combination switching practices, paralleling requirements and isolation and earthing procedures for access.
- 5.4 Identify common distribution transformer and associated electrical apparatus faults.

Learning outcome 6

Describe the purpose, preparation and procedure for use of operational forms, access authorities and permits associated with HV switching.

Assessment criteria

- 6.1 Identify operational forms, access authorities and permits associated with HV apparatus, operation access and work in the vicinity of HV apparatus.
- 6.2 Describe the purpose of and procedure for usage of the operational forms, access authorities and permits used when accessing HV apparatus.
- 6.3 Prepare operational forms, access authorities and permits.

Learning outcome 7

Identify the requirements of routine and fault switching on a HV electrical supply system.

Assessment criteria

- 7.1 Identify electrical fault types, their primary causes and effects on a HV system.
- 7.2 List the main components, types and categories of protective devices used, and their application and function in HV systems.
- 7.3 Describe the basic principle of operation of HV system protection devices, protection co-ordination and protection “zoning”.
- 7.4 State the need for and the nature of work requiring HV feeder auto-reclose suppression.
- 7.5 Describe the circuit condition requirements and switching considerations when paralleling and separating HV feeders.

Learning outcome 8

List HV SWER system components and explain the layout and principle of operation, isolation and earthing requirements.

Assessment criteria

- 8.1 Describe the application and function of SWER system components, circuit arrangement and principle of operation.
- 8.2 Describe the hazards and procedures associated with faulty SWER earth systems.
- 8.3 Describe the hazards and procedures associated with faulty SWER earth systems.

Learning outcome 9	8.4 State the procedure to isolate, energise and commission SWER substations.
Assessment criteria	<p>Describe function and operation of Distribution Feeder Automation (DFA) systems.</p> <p>9.1 List the functions of a DFA system and the main components.</p> <p>9.2 State the procedure and operate a gas switch from a local “slave” control station.</p> <p>9.3 List the functions of “System Control and Data Acquisition” (SCADA) systems and its main components.</p> <p>9.4 Describe SCADA system security interlocks and access restrictions.</p> <p>9.5 Describe SCADA system operation when switching apparatus or retrieving data via the Remote Access Terminal (RAT), Dial Up Voice Annunciated System and Local Control Station.</p> <p>9.6 State the function of the main components of a gas switch local control system.</p> <p>9.7 Operate a gas switch using SCADA systems via a Remote Access Terminal (RAT), Dial Up Annunciated System and Local Control Station.</p>
8. Delivery of the module	
Delivery strategy	<p>Delivery strategies must be suitable for both theoretical and/or practical learning and module purpose.</p> <p>It is recommended that learning and assessment be facilitated in a holistic manner which may require a learning sequence other than indicated in the body of this module descriptor.</p>
Resource requirements	<p>Enterprise construction manuals</p> <p>Relevant Australian standards</p> <p>Enterprise work manuals and standing instructions</p> <p>Switching charts</p> <p>Relevant manufacturers’ equipment manuals</p>
Occupational health and safety requirements	<p>Students should be made aware of Occupational Health and Safety issues in all situations and be expected to demonstrate safe working practices at all times. Electrical safety must be emphasised for both the individual doing the switching and the operatives for whom the switching is being done.</p>

