View

- Certain types of electrical installations can involve specific conditions, equipment, hazards and environmental factors that are not present in the majority of general electrical installations.
- AS/NZS 3000:2018 requires that electrical installations in certain 'special situations' must comply with additional or varied installation requirements.
- Types and features of special installations include:
  - Transportable structures and their site supplies
    - installation characteristics:
      - exposure to the weather
      - separation from earth (e.g. by rubber tires)
      - increased risk of mechanical damage
      - moving vehicles
      - sites covering large areas resulting in voltage drop issues
      - disconnection and reconnection of supplies by unskilled persons
    - additional requirements:
      - *AS/NZS 3001:2008 Electrical installations – Transportable structures and vehicles including their site supplies*
  - Construction and demolition sites
    - installation characteristics:
      - frequent use of extension cords
      - exposure to the weather
      - increased risk of mechanical damage
      - increased risk of personal injury
    - additional requirements:
      - *AS/NZS 3012:2010 Electrical installations – Construction and demolition sites*
  - Marinas and recreational boats
    - installation characteristics:
      - exposure to the weather
      - presence of moisture
      - movement of structures
      - increased risk of corrosion
      - increased risk of mechanical damage
      - increased risk of electric shock
    - additional requirements:
      - *AS/NZS 3004.1:2014 Electrical installations – Marinas and boats Part 1: Marinas*
      - *AS/NZS 3004.2:2014 Electrical installations – Marinas and boats Part 2: Boat installations*
  - Medical treatment areas
    - installation characteristics:
      - use of medical electrical equipment
      - increased risk of electric shock
      - effects of electric shock may have more severe consequences for patients already requiring medical attention
    - additional requirements:
      - *AS/NZS 3003:2018 Electrical installations – Patient areas*
  - Shows and carnivals
    - installation characteristics:
      - exposure to the weather
      - use of extension cords
      - moving vehicles and rides

?

- temporary nature of the installation
- large volume of human traffic

▪ additional requirements:

- *AS/NZS 3002:2008 Electrical installations – Shows and carnivals*

○ High voltage (HV) installations in consumer's premises

▪ installation characteristics:

- increased risk of electric shock
- increased risk of fire and explosions
- strong electromagnetic fields

▪ additional requirements:

- *AS 2067:2016 Substations and high voltage installations exceeding 1 kV a.c.*

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 1.1 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 1.2 Learning Activity

Test your understanding of this topic by completing the quiz.

Topic 1 Content Quiz

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View

- Requirements for electrical installations in transportable structures and associated sites for their connection, can be found in:
  - AS/NZS 3001 Electrical installations – Transportable structures and vehicles including their site supplies
- Types of transportable structures covered by AS/NZS 3001 include:
  - vehicles offering accommodation
    - caravans
    - camper vans
    - motor homes
    - camper trailers
    - livestock and car transporters that provide accommodation
  - commercial and educational vehicles
    - retail food and drink vans and trailers
    - educational display caravans and trailers
    - mobile classrooms
    - TV and radio broadcast vans
  - transportable structures
    - relocatable homes
    - transportable huts
    - tents for accommodation
    - car and trailer annexes
  - facilities offered on construction and demolition sites
    - temporary site offices
    - cloakrooms
    - meeting/lunch rooms
    - dormitories
    - canteens
    - toilets
  - mobile display units not for accommodation
    - electronic scoreboards
    - advertising signs
    - traffic information signs
- Additional requirements and considerations for site supplies of camping sites and caravan parks include:
  - supply from generators or inverter systems
    - must be either isolated or RCD-protected
    - must be internally protected against overcurrent
  - calculation of maximum demand in accordance with appendix A
  - switchboards located to reduce the route length of service pillar circuits
  - service pillars
    - outbuilding arrangements
    - minimum IPX4
    - must be clearly identified
    - must provide a means to reduce the strain on connected supply leads
  - service pillar socket-outlets
    - provision of at least one socket-outlet per site
    - each socket-outlet to be supplied on a separate circuit
    - must be protected against overload
    - must be protected by an RCD that operates in all active and neutral conductors
    - minimum 15 A and IPX4 ratings

?

        - must be clearly identified
        - must be installed not more than 1.5 m above the ground
    - installation of wiring
        - increased protection for underground cables
        - increased clearances for overhead wiring
    - supply leads
        - minimum 15 A rating
        - maximum lengths as specified
- Additional requirements and considerations for installations in transportable structures include:
    - methods of connection to site supplies
        - detachable (e.g. flexible cord and plug)
        - fixed (e.g. junction box)
    - appliance inlets for detachable connections
        - minimum 15 A and IP24 ratings
        - must provide a means to reduce the strain on connected supply leads
    - protection in transportable structures
        - overcurrent protection of the supply must operate in all active and neutral conductors
        - all final subcircuits must be provided with overcurrent and RCD protection
    - wiring and equipment within transportable structures
        - only sheathed cables or flexible cords permitted
        - cables and cords must be minimum 1.0 mm^2 with at least 7 strands
        - protective earthing conductor must be isolated from all active and neutral conductors, and from the general mass of earth
        - all switches and overtemperature cut-out devices must operate in all active and neutral conductors

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 2.1 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 2.2 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 2.3 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 2.4 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 2.5 Learning Activity

Test your skills by completing the Skills Practice.

Topic 2.0 Skills Practice

Test your understanding of this topic by completing the quiz.

Topic 2 Content Quiz



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View

- Additional requirements for electrical installations on construction and demolition sites can be found in *AS/NZS 3012 Electrical installations – Construction and demolition sites*.
- AS/NZS 3012 covers construction and demolition work sites where a temporary site supply is required to undertake work, such as:
  - building work
  - excavation work
  - renovations
  - dredging or salvaging work
  - work on underground pipes and cables
  - earthmoving
  - land clearing
  - any work involving the use of explosives
- Some of the additional requirements for electrical installations on construction and demolition sites include:
  - switchboards
    - robust construction
    - minimum IP23
    - must be clearly identified
    - must provide a means to reduce the strain on connected extension cords
  - all circuits must be protected by a 30 mA RCD (some exceptions apply)
  - construction wiring must be suitably identified and installed separately from permanent installation wiring
  - extension cords must:
    - have heavy duty insulation
    - be uncoiled when in use
    - be supported off the ground (or otherwise suitably protected against damage)
    - not be used with double adaptors
    - not be 'piggy-backed'
    - not exceed given lengths
  - emergency lighting must provide a minimum of 20 lx for 60 minutes in the event of mains failure
  - portable equipment must be inspected and tested every 3 months
  - construction wiring and switchboards must be inspected and tested every 6 months
  - the operation of portable RCDs must be tested at least daily, and the trip-time tested every three months
  - the operation of fixed RCDs must be tested monthly, and the trip-time tested yearly

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 3.1 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

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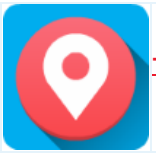

Topic 3.2 Learning Activity

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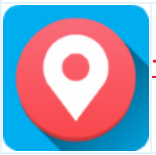

Topic 3.3 Learning Activity

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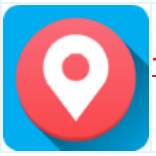

Topic 3.4 Learning Activity

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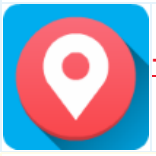

Topic 3.5 Learning Activity

Test your skills by completing the Skills Practice.

Topic 3.0 Skills Practice

Test your understanding of this topic by completing the quiz.

Topic 3 Content Quiz

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View

- Additional requirements for electrical installations in marinas can be found in AS/NZS 3004.1 Electrical installations – Marinas and boats Part 1: Marinas.
- Types of marina installations covered by AS/NZS 3004.1:2014 include:
  - wharfs
  - jetties
  - piers
  - floating pontoons
- Some additional requirements for electrical installations in marinas include:
  - arrangements for connection to boats
    - shore-mounted isolating transformer
      - boat equipotential earthing system not to be connected to the marina protective earthing system
    - on-board isolating transformer
      - boat equipotential earthing system not to be connected to the marina protective earthing system
    - no isolating transformer
      - boat protective earthing system to be connected to the marina protective earthing system
      - use of sacrificial anodes and galvanic isolators may be necessary on the boat
  - methods of connection to boats
    - by socket-outlet
    - by direct connection (e.g. junction box)
  - service pillars
    - maximum of six socket outlets per pillar
    - minimum IP45
    - must be clearly identified
  - service pillar connection points (socket outlets and direct connection facilities)
    - provision of at least one connection point per berth
    - must be individually protected against overcurrent
    - must be individually switched
    - must be provided with additional protection
      - by supply from an isolating transformer
      - by an RCD that operates in all active and neutral conductors
    - minimum 15 A rating for socket outlets
    - must be clearly identified
    - minimum IPX6 when the connection is in use
  - supply leads
    - maximum lengths as specified (Table 3.1)
    - installation considerations
      - Allowance for movement.
      - Obstruction of walkways.
      - Accidental disconnection.
      - Tracking of moisture.
      - Protection against damage or falling into the water.
  - acceptable wiring systems
    - thermoplastic or elastomer insulated and sheathed cables
      - in non-metallic conduit
      - in galvanised tube
    - served thermoplastic insulated and sheathed cables
    - served elastomer insulated and sheathed cables

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        - served MIMS cables
        - served armoured cables
    - prohibited wiring systems
        - aerials
        - catenary systems
        - aluminium conductors

- Additional requirements for electrical installations on recreational boats can be found in *AS/NZS 3004.2 Electrical installations – Marinas and boats Part 2: Boat installations.*
- AS/NZS 3004.2 covers boats up to 50 m in length that are designed for use on inland waters or at sea.
- Boat installations are a specialised field with extensive requirements, additional to those in AS/NZS 3000. Some additional requirements include:
    - on-board electrical power sources
        - battery system (with or without inverter)
        - d.c. generator (with or without inverter)
        - a.c. generator
    - boat supply inlets for detachable connections
        - minimum IP56
        - changeover switch required to prevent interconnection of shore and on-board supplies
        - system information and connection instructions must be provided with the boat owner's manual
    - equipotential bonding required on boats supplied via an isolating transformer
        - conductive parts in contact with the water
        - earth terminals of socket outlets
        - exposed conductive parts as per AS/NZS 3000
    - protective earthing required on boats supplied without an isolating transformer
        - earth terminals of socket outlets
        - exposed conductive parts as per AS/NZS 3000
    - wiring on boats
        - only stranded copper cables permitted
        - installation considerations
            - environmental conditions
            - mechanical strength
            - thermal effects
            - Segregation of a.c. and d.c. wiring.

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 4.1 Learning Activity

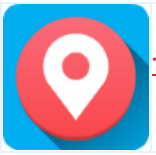
Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 4.2 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 4.3 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.



Topic 4.4 Learning Activity

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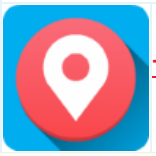

Topic 4.5 Learning Activity

Test your skills by completing the Skills Practice.

Topic 4.0 Skills Practice

Test your understanding of this topic by completing the quiz.

Topic 4 Content Quiz



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View

- Additional requirements for electrical installations in medical treatment areas can be found in *AS/NZS 3003 Electrical installations – Patient areas.*
- Some types of medical treatment areas include:
  - hospitals
  - medical centres
  - pathology labs
  - ultrasound rooms
  - x-ray and MRI rooms
  - dental surgeries
  - nursing homes
- Additional requirements and considerations for electrical installations in medical treatment areas include:
  - classification of patient areas
    - body-protected
    - cardiac protected
  - types of leakage protection devices (LPDs)
    - isolating transformer
    - Type I RCD
  - fixed medical electrical equipment in patient areas
    - requires a LPD
    - requires a line isolation monitor (LIM)
    - requires a supply indicator
    - requires an isolator that operates in all active and neutral conductors
  - socket-outlets in patient areas for the connection of medical electrical equipment
    - requires LPD
    - requires line isolation and overload monitor (LIOM)
    - requires supply indicator
  - location of controls and indicators for leakage protection and monitoring must be readily accessible within the patient area
  - cardiac-protected areas equipotential (EP) junction and nodes connections
    - socket-outlet earth terminals (exceptions apply)
    - earth terminals of permanently connected Class I equipment (exceptions apply)
    - metal parts of electrical and non-electrical equipment in contact with structural metallic building parts
    - applicable distribution board earth terminals
    - EP test facility (where required)
  - cardiac-protected areas EP system conductors
    - maximum permitted bonding conductor resistance of 0.1 Ω
    - minimum bonding conductor size of 4 mm^2
  - inspection and testing of patient areas is required at least once per year

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 5.1 Learning Activity

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Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 5.2 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 5.3 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 5.4 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 5.5 Learning Activity

Test your skills by completing the Skills Practice.

Topic 5.0 Skills Practice

Test your understanding of this topic by completing the quiz.

Topic 5 Content Quiz

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View

- Additional requirements for electrical installations for shows and carnivals can be found in *AS/NZS 3002 Electrical installations – Shows and carnivals*.
- AS/NZS 3002 applies to events with a maximum duration of four weeks, such as:
  - exhibitions
  - festivals
  - circuses
  - jamborees
  - army camps
- Additional requirements and considerations for shows and carnivals installations include:
  - methods of supply
    - generators
    - isolated or RCD-protected inverters
    - temporary distribution network connections
  - switchboards
    - robust construction
    - minimum IPX3
    - must be clearly identified
    - must provide a means to reduce the strain on terminating cables and cords
    - must be installed not more than 2.0 m above the ground
  - installation of wiring
    - must not obstruct walkways
    - must be suitably protected against mechanical damage
    - flexible cords must not exceed maximum lengths as specified
    - increased protection for underground cables
    - increased clearances for overhead wiring
  - connection facilities for concessions, tents, living quarters and other structures
    - minimum 15 A and IPX3 ratings
    - must be protected against overload
    - must be provided with an isolation device
    - acceptable types
      - plug
      - cord extension socket
      - cascadable reticulation unit
      - outlet box
      - portable outlet device
  - festoon lighting
    - increased clearances
    - minimum 0.75 mm^2 (flexible cord) conductors
    - maximum 15 A circuits
    - must be protected by an RCD that operates in all active and neutral conductors

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

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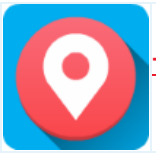

Topic 6.1 Learning Activity

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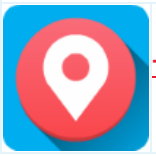
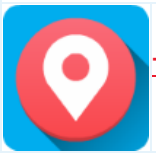


Topic 6.2 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.



Topic 6.3 Learning Activity

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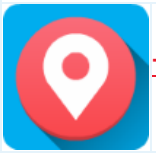

Topic 6.4 Learning Activity

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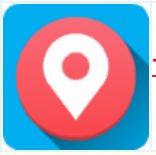

Topic 6.5 Learning Activity

Test your skills by completing the Skills Practice.

Topic 6.0 Skills Practice

Test your understanding of this topic by completing the quiz.

Topic 6 Content Quiz

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View

- Requirements for high voltage (HV) electrical installations in consumer's premises can be found in *AS 2067 Substations and high voltage installations exceeding 1 kV a.c.*
- Types of consumer installations that may contain wiring and equipment operating at high voltage include:
  - factories
  - manufacturing sites
  - industrial processing plants
  - large shopping centres
- Due to the hazardous nature of high voltage, there are extensive requirements, additional to those found in AS/NZS 3000.
- Requirements and considerations for HV installations in consumer's premises relate to:
  - selection of insulation levels
  - minimum clearances and creepage
  - methods of earthing
  - methods of protection against direct and indirect contact
  - methods of overcurrent protection
  - methods of overvoltage and undervoltage protection
  - methods of under-frequency protection
  - methods of switching
  - identification and marking
  - risk of fire and explosions
  - protective measures for equipment containing insulating liquids and SF_6 gas
  - provision of monitoring, metering and controls
  - overhead and underground cable installation methods
  - exposure to the weather
  - biological activity
  - limitation of noise
  - limitation of corona effects and electromagnetic interference (EFI)
  - limitation of electromagnetic fields (EMF)
  - resonance and harmonics
  - inspection, testing and maintenance
- Network providers requirements may contain further requirements, additional to those in AS/NZS 3000 and AS 2067.

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

Topic 7.1 Learning Activity

Undertaking the following Learner Activity will help you develop your knowledge of the topic content.

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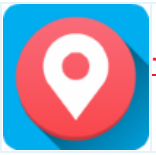

Topic 7.2 Learning Activity

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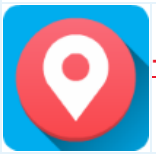

Topic 7.3 Learning Activity

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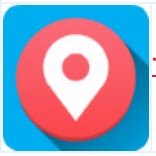

Topic 7.4 Learning Activity

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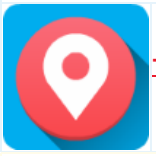

Topic 7.5 Learning Activity

Test your skills by completing the Skills Practice.

Topic 7.0 Skills Practice

Test your understanding of this topic by completing the quiz.

Topic 7 Content Quiz



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Topic Skills Practice Cover Sheet

Unit Name:	UEENEEG120A Select and arrange equipment for special LV electrical installations
Topic Title:	Transportable Structures and Sites

Skill Practice Number:	2.0
Skill Practice Name:	Caravan Park Installation Planning

Student Name:	
Student ID:	
College/Campus:	
Group:	

Results	
Planning:	
Carryout:	
Completion:	
Overall Results:	
Comments:	

Topic Skills Practice Cover Sheet

Documentation Checklist		
Section	**Documentation**	**Complete**
1.2.3	Mark-Up of the Installation Site Plan (Drawing A1.1)	☐
1.3.1	Installation Schedule – Main Switchboard	☐
1.3.1	Installation Schedule – Distribution Switchboard (one for each distribution switchboard)	☐
1.3.1	Installation Schedule – Service Pillar (one for each service pillar)	☐
2.2.1	Consumer's Mains and Submains – Wiring Systems and Arrangements	☐
2.2.1	Reception/Café Final Subcircuits – Wiring Systems and Arrangements	☐
2.2.1	Amenities Block Final Subcircuits – Wiring Systems and Arrangements	☐
2.3.1	Maximum Demand of Consumer's Mains	☐
2.3.2	Maximum Demand of Submains (one for each submain)	☐
2.3.3	Maximum Demand of Final Subcircuits – Amenities Distribution Board	☐
2.3.4	Maximum Demand of Final Subcircuits – Reception/Café Distribution Board	☐
2.4.1	Current Carrying Capacity of Consumer's Mains	☐
2.4.2	Voltage Drop in Consumer's Mains	☐
2.4.3	Current Carrying Capacity of Submains	☐
2.4.4	Voltage Drop in Submains	☐
2.4.5	Current Carrying Capacity of Final Subcircuits – Reception/Café Area	☐
2.4.6	Current Carrying Capacity of Final Subcircuits – Amenities Block	☐
2.4.7	Voltage Drop in Water Heater Final Subcircuit	☐
2.4.8	Voltage Drop in Lighting Final Subcircuit	☐
2.5.4	Fault Loop and Prospective Fault Current – Lighting Final Subcircuit	☐
2.5.5	Fault Loop and Prospective Fault Current – Service Pillar Socket-Outlet	☐

Topic Skills Practice 2.0

UEENEEG120A Select and arrange equipment for special LV electrical installations

KS01-EG120A Special electrical installations planning

Topic: 2. Transportable Structures and Sites

Skills Practice 2.0: Caravan Park Installation Planning

Task:

To select and arrange electrical wiring and equipment for a caravan park installation in accordance with AS/NZS 3000, AS/NZS 3001 and AS/NZS 3008.

Objectives:

At the completion of this skills practice, you should be able to:

- Identify electrical installation requirements in caravan parks.
- Identify suitable power distribution arrangements in caravan parks.
- Determine the maximum demand of consumer's mains, submains and final subcircuits for caravan parks.
- Select and arrange cables and wiring systems for consumer's mains, submains and final subcircuits in caravan parks.
- Select and arrange protection devices for consumer's mains, submains and final subcircuits in caravan parks.
- Select and arrange electrical equipment and accessories for caravan parks.
- Document the selection and arrangement of wiring and equipment in caravan parks.

Topic Skills Practice 2.0

1. Planning the Unit Skills Test

1.1 Research Caravan Park Installation Requirements

1.1.1 Research AS/NZS 3000 and AS/NZS 3001 requirements for the selection, arrangement and installation of electrical wiring and equipment in caravan parks.

The following reference material will include some useful information:

- Pethebridge, K. and Neeson, I., Electrical Wiring Practice. McGraw-Hill, Seventh Edition, Volume 2, 2012 (Chapter 8)
- Hampson, J., Electrotechnology Practical, Pearson Education, Third Edition, 2013 (Section 8)

1.1.2 Once you feel you have sufficient knowledge of the subject matter, obtain the following materials to assist you with carrying out this skills practice:

- AS/NZS 3000 *Wiring Rules*
- AS/NZS 3001 Electrical installations – Transportable structures and vehicles including their site supplies
- AS/NZS 3008.1.1 Electrical installations – Selection of cables
- Manufacturer's catalogues
- Pens/pencils
- Ruler

1.2 Caravan Park Electrical Specification

1.2.1 Scope	
1.2.1.1 General	This specification sets out the planning and design requirements for a caravan park low voltage general electrical installation. All facets of the caravan park installation design and planning shall comply with: • the provisions of this specification • the requirements of AS/NZS 3000 • the requirements of AS/NZS 3001 • the requirements of AS/NZS 3008
1.2.1.2 Definitions	The definitions used throughout this specification will be as per those used in AS/NZS 3000, AS/NZS 3001 and AS/NZS 3008.

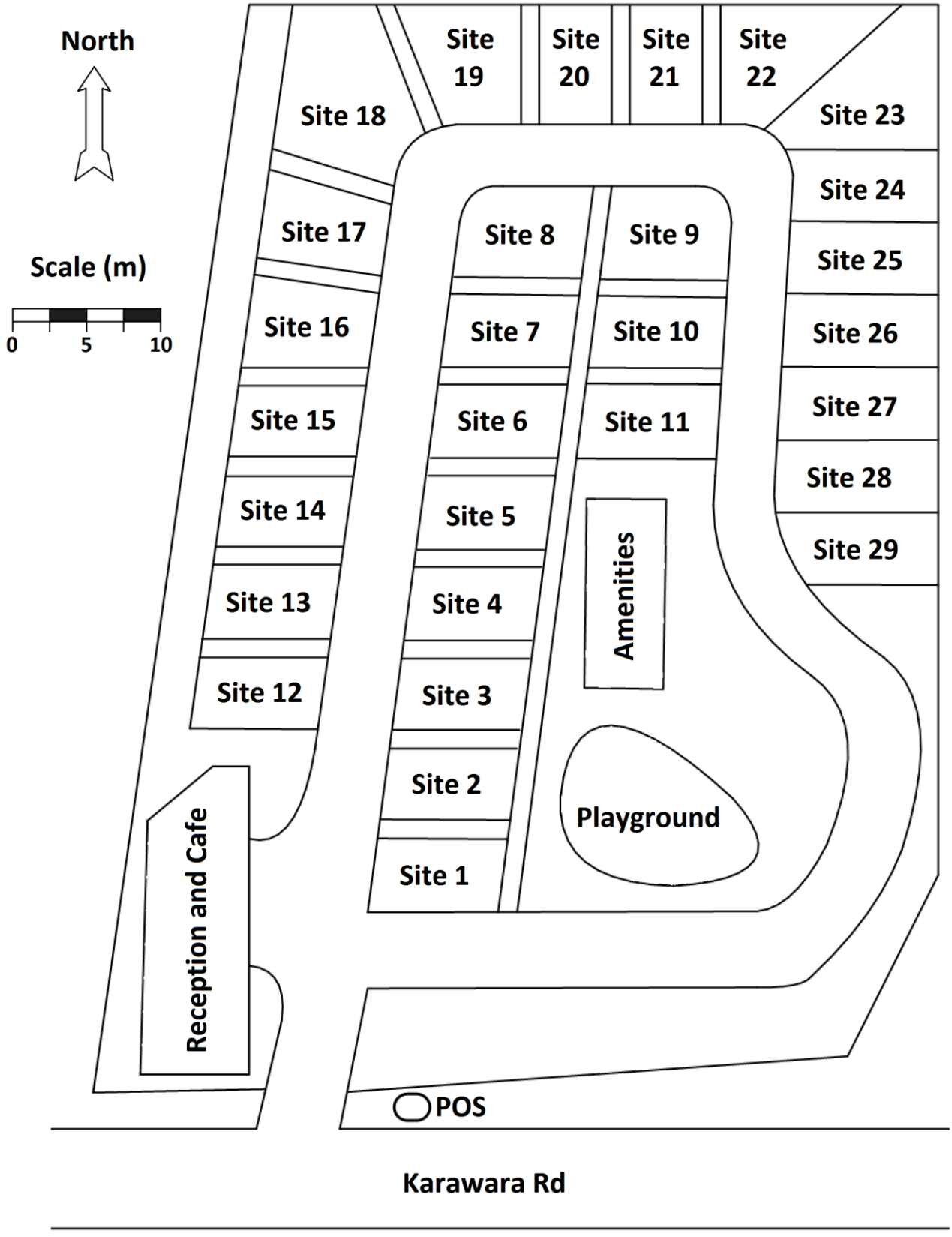
1.2.1.3 Inclusions	The scope of planning and design work extends to the provision of all non-essential low voltage electrical services, including wiring, switchboards, control and protection associated with: • connection to the electricity distribution network • provision of general lighting and power in the reception/café • provision of general lighting and power in the amenities block • provision of supplies to powered caravan sites
1.2.1.4 Exclusions	The scope of planning and design work excludes the provision of the following low voltage electrical services at the site: • outside lighting • escape lighting • fire safety services
1.2.2 Installation Arrangement	
1.2.2.1 Supply	The supply will be obtained from an unprotected distribution supply pillar located adjacent to the main entrance, at the southern side of the park on Karawara Road. The impedance of the external fault loop has been obtained from the distribution authority as being 0.118 Ω.
1.2.2.2 Consumer's Mains	Consumer's mains shall be selected to provide the most cost effective option at 150 % of the minimum required current carrying capacity. The type and size of cables shall be determined in accordance with the requirements of AS/NZS 3000, AS/NZS 3001 and AS/NZS 3008, taking into account that essential fire safety and escape services shall also be supplied at the site.
1.2.2.3 Switchboards	Switchboards shall be selected, installed and arranged in accordance with the requirements of AS/NZS 3000 and AS/NZS 3001.
1.2.2.4 Service Pillars	Service pillars shall be selected, installed and arranged in accordance with the requirements of AS/NZS 3000 and AS/NZS 3001. Service pillars shall be arranged to provide a 230 V, 15 A supply for sites 1 to 21 inclusive (see drawing A1.1), with no more than four sites being supplied from any one service pillar.

Topic Skills Practice 2.0

1.2.2.5 Reception and Café Area	General low voltage electrical supply, wiring and equipment shall be provided to the reception/café area for the supply of the following loads: • 28 x 230 V, 2 x 36 W T8 fluorescent light fittings • 26 x 230 V, 10 A general purpose socket-outlets • 1 x 230 V, 15 A single socket-outlet • 1 x 400 V, 16 kW fixed combi-steam oven • 1 x 400 V, 17 kW deep-fryer • 1 x 400 V, 24 kW instantaneous hot water heater Low voltage circuits, as listed above, shall be supplied from a dedicated reception/café area distribution switchboard. Notes: The reception/café building is of brick veneer construction with concrete strip footings and a tile and batten roof.
1.2.2.6 Amenities Block	General low voltage electrical supply, wiring and equipment shall be provided to the reception/café area for the supply of the following loads: • 18 x 230 V, 2 x 36 W T8 fluorescent light fittings • 6 x 230 V, 10 A general purpose socket-outlets • 8 x 400 V, 11 kW single point instantaneous hot water heaters Low voltage circuits, as listed above, shall be supplied from a dedicated amenities block distribution switchboard. Notes: The amenities block is of single brick construction with concrete slab roof and footing. Refer to AS/NZS 3000 Section 6 for specific safety requirements for electrical installations in damp situations.

Topic Skills Practice 2.0

1.2.3 Drawing A1.1 – Caravan Park Site Plan



Topic Skills Practice 2.0

1.3 Caravan Park Planning Documentation

1.3.1 The switchboard schedules on pages 8 to 10 are for the purpose of developing a progressive record of distribution and protection arrangements, to be completed as you progress through the various planning stages.

Note: You will need to make multiple copies of the schedules on pages 9 and 10 to complete documentation for each individual distribution switchboard and service pillar.

Installation Schedule – Main Switchboard			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Topic Skills Practice 2.0

Installation Schedule – Distribution Switchboard			
Distribution Board No:			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Topic Skills Practice 2.0

Installation Schedule – Service Pillar			
Service Pillar No:			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Topic Skills Practice 2.0

2. Carrying Out the Skills Practice

2.1 Divide the Installation into Circuits

2.1.1 Use the job specifications and applicable Australian Standards to plan out the required number and arrangement of switchboards and service pillars to supply the caravan park.

2.1.2 Identify the following items on the site plan (drawing A1.1) provided on page 7:

- the locations of all switchboards
- the locations of all service pillars
- the cable route for the consumer's mains
- the cable routes for each set of submains

2.1.3 Assign a unique identification number to each switchboard and service pillar you identified on the site plan. Create an installation schedule for each switchboard and service pillar by making copies of the installation schedules provided in Section 1.3.1, and complete the location data for each case.

2.1.4 Use manufacturer's catalogues to select suitable switchboards and service pillars for each installation location and complete the applicable sections in your installation schedules.

2.1.5 Identify the circuits and loads to be supplied from each switchboard and service pillar, and record details in your installation schedules.

2.2 Select Mains, Submains and Final Subcircuits Wiring Systems

2.2.1 Use Australian Standards to select wiring systems for the caravan park consumer's mains, submains and final subcircuits.

Use as many rows as necessary in the following tables to describe the wiring systems, installation methods, and any specific installation conditions and/or external influences affecting your selection.

- Use the table on page 12 to list details of wirings systems selected for mains and submains.

- Use the table on pages 13 to list details of wirings systems selected for final subcircuits in the reception café area.

- Use the tables on page 14 to list details of wirings systems selected for final subcircuits in the amenities block.

Topic Skills Practice 2.0

Consumer's Mains and Submains – Wiring Systems and Arrangements											
Mains / Submains	Consumer's Mains (CM)										
Originating From	Point of Supply (POS)										
Terminating At	Main Switchboard (MSB)										
Route Length											
Wiring System / Installation Methods											
Specific Installation Conditions and External Influences											

Topic Skills Practice 2.0

Reception/Café Final Subcircuits – Wiring Systems and Arrangements										
										Final Subcircuit
										Originating From
										Connected Load
										Route Length
										Wiring System / Installation Methods
										Specific Installation Conditions and External Influences

Topic Skills Practice 2.0

Amenities Block Final Subcircuits – Wiring Systems and Arrangements											
											Final Subcircuit
											Originating From
											Connected Load
											Route Length
											Wiring System / Installation Methods
											Specific Installation Conditions and External Influences

Topic Skills Practice 2.0

2.3 Determine Maximum Demand

2.3.1 Use applicable Australian Standards to determine the maximum demand of the installation consumer's mains. Record details of calculations in the following table, or where an alternative method of determining maximum demand is used, attach additional page(s) detailing the methods and reasoning used.

*remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Consumer's Mains					
AS/NZS 3000 Ref:		**AS/NZS 3001 Ref:**			
Load	**Load Group**	**Calculation**	**Demand**		
			A	**B**	**C**
Totals:					

Consumer's Mains Maximum Demand:	

Topic Skills Practice 2.0

2.3.2 Use applicable Australian Standards to determine the maximum demand of each installation submain. Record details of calculations in the following table, or where alternative methods of determining maximum demand are used, attach additional page(s) detailing the methods and reasoning used.

*make multiple copies of this page to record details of maximum demand calculations for each subsequent set of installation submains as determined in Section 2.1

**remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Submain No._____.					
AS/NZS 3000 Ref:		**AS/NZS 3001 Ref:**			
Load	**Load Group**	**Calculation**	**Demand**		
			A	**B**	**C**
Total(s):					

Submain No._____Maximum Demand:	

Topic Skills Practice 2.0

2.3.3 Use applicable Australian Standards to determine the maximum demand of each final subcircuit supplied from the amenities distribution board, and record details in the following table.

*repeated final subcircuit maximum demand calculations need only be shown once

**remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Final Subcircuits – Amenities Distribution Board					
AS/NZS 3000 Ref:		**AS/NZS 3001 Ref:**			
Final Subcircuit	**Load Group**	**Method of Determination**	**Maximum Demand**		
			A	**B**	**C**

Topic Skills Practice 2.0

2.3.4 Use applicable Australian Standards to determine the maximum demand of each final subcircuit supplied from the reception/café area distribution board, and record details in the following table.

*repeated final subcircuit maximum demand calculations need only be shown once

**remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Final Subcircuits – Reception/Cafe Distribution Board					
AS/NZS 3000 Ref:		**AS/NZS 3001 Ref:**			
Final Subcircuit	**Load Group**	**Method of Determination**	**Maximum Demand**		
			A	**B**	**C**

Topic Skills Practice 2.0

2.4 Select Cables for Mains, Submains and Final Subcircuits

2.4.1 Select cables for the caravan park consumer's mains, in accordance with the job specification and applicable Australian Standards. Use the following spaces to record details of your cable selections.

Current Carrying Capacity of Consumer's Mains				
Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
	Table	Column	Table	Column

2.4.2 Determine the voltage drop in the consumer's mains, and document all details and calculations in the following table.

Voltage Drop in Consumer's Mains							
Cable Size	Cable Type	Circuit Loading	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column
Working:							

Topic Skills Practice 2.0

2.4.3 Select suitable submains, as necessary, for the caravan park installation, in accordance with the job specification and applicable Australian Standards. Use as many rows as necessary in the following table to record details of your submain cable selections.

Current Carrying Capacity of Submains					
Submain No.	Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
		Table	Column	Table	Column

Topic Skills Practice 2.0

2.4.4 Determine the voltage drop in each of the installation submains. Document all details and calculations using as many rows as is necessary in the following table. Additional space for working if provided on the following page.

Voltage Drop in Submains							
Submain No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column

Working:

Topic Skills Practice 2.0

Working:

Topic Skills Practice 2.0

2.4.5 Select suitable conductors based on current carrying capacity, for each final subcircuit supplied from the reception/café area distribution board.

Use as many rows as necessary in the following table to record details of your final subcircuit cable selections.

Current Carrying Capacity of Final Subcircuits – Reception/Café Area					
Final Subcircuit	Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
		Table	Column	Table	Column

Topic Skills Practice 2.0

2.4.6 Select suitable conductors based on current carrying capacity, for each final subcircuit supplied from the amenities block distribution board.

Use as many rows as necessary in the following table to record details of your final subcircuit cable selections.

Current Carrying Capacity of Final Subcircuits – Amenities Block					
Final Subcircuit	Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
		Table	Column	Table	Column

Topic Skills Practice 2.0

2.4.7 Determine the voltage drop in the longest instantaneous water heater final subcircuit in the amenities block, for the circuit length provided below. Document all details and calculations in the following table. Attach additional pages to show working if required.

Voltage Drop in Water Heater Final Subcircuit							
Circuit No.	**Cable Size**	**Demand**	**Route Length**	**Voltage Drop**		**AS/NZS 3008.1.1**	
				Volts	**%**	**Table**	**Column**
			21 m				
Working:							

2.4.8 Determine the voltage drop in the lighting final subcircuit in the amenities block, for the circuit length provided below. Document all details and calculations in the following table. Attach additional pages to show working if required.

Voltage Drop in Lighting Final Subcircuit							
Circuit No.	**Cable Size**	**Demand**	**Route Length**	**Voltage Drop**		**AS/NZS 3008.1.1**	
				Volts	**%**	**Table**	**Column**
			30 m				
Working:							

Topic Skills Practice 2.0

2.5 Select Circuit Protection Devices

2.5.1 Calculate the fault level at each installation switchboard and service pillar based on your selection of cables, and complete the relevant data in your installation schedules (from section 1.3.1).

2.5.2 Select protection devices, in accordance with AS/NZS 3000 and AS/NZS 3001, to ensure that each installation submain and final subcircuit is protected, as required, against:

- Overloads
- Earth faults
- Short-circuit
- Earth leakage

2.5.3 Record details of your protection device selections in your installation schedules.

2.5.4 Calculate the fault loop impedance and prospective fault current for a fault of negligible impedance at the terminals of the furthest light fitting in the amenities block lighting final subcircuit.

Fault Loop and Prospective Fault Current – Lighting Final Subcircuit				
Cable Size	**Circuit Protection Device**	**Route Length**	**Fault Loop Impedance**	**Prospective Fault Current**
		30 m		
Working:				
Will the circuit protection operate in the required time?			**□ Yes**	**□ No**

Topic Skills Practice 2.0

2.5.5 Calculate the fault loop impedance and prospective fault current for a fault of negligible impedance at the outlet terminals of the furthest socket-outlet of the longest service pillar circuit.

Fault Loop and Prospective Fault Current – Service Pillar Socket-Outlet				
Cable Size	**Circuit Protection Device**	**Route Length**	**Fault Loop Impedance**	**Prospective Fault Current**
Working:				
Will the circuit protection operate in the required time?			**□ Yes**	**□ No**

3. Completing the Skills Practice

3.1 Skills Practice Review Questions

3.1.1 Answer the following questions after you have successfully completed all required sections and documentation from Section 2.

1. List three types of transportable structures covered under the scope of AS/NZS 3001.

_____

_____

_____

Topic Skills Practice 2.0

2. List the requirements for the provision of control and protection for service pillar socket-outlets in a caravan park. Provide AS/NZS 3000 and/or AS/NZS 3001 clauses to support your answers.

3. What is the maximum length for a 15 A supply lead intended for the connection of caravan to a caravan park service pillar? Provide AS/NZS 3000 and/or AS/NZS 3001 clauses to support your answer.

4. List three factors that directly affect the minimum cable size required for a given circuit.

5. What is the minimum degree of protection for a service pillar in a caravan park? Provide AS/NZS 3000 and/or AS/NZS 3001 clauses to support your answer.

Topic Skills Practice 2.0

6. What type of switch would be suitable for the control of a light in a caravan? Provide AS/NZS 3000 and/or AS/NZS 3001 clauses to support your answer.

_____

_____

7. What is the minimum rating for a socket-outlet that is used to connect a caravan to a site supply? Provide AS/NZS 3000 and/or AS/NZS 3001 clauses to support your answer.

_____

_____

8. What is the minimum height above ground for a service pillar socket-outlet? Provide AS/NZS 3000 and/or AS/NZS 3001 clauses to support your answer.

_____

_____

9. What type of overhead wiring systems are permitted to be installed in caravan parks? Provide AS/NZS 3000 and/or AS/NZS 3001 clauses to support your answer.

_____

_____

_____

	 *Feedback*	**Have your teacher/trainer check your answers**	**Teacher/Trainer Initials and Date**	√

Topic Skills Practice Cover Sheet

Unit Name:	UEENEEG120A Select and arrange equipment for special LV electrical installations
Topic Title:	Construction and Demolition Sites

Skill Practice Number:	3.0
Skill Practice Name:	Construction Site Installation Planning

Student Name:	
Student ID:	
College/Campus:	
Group:	

Results	
Planning:	
Carryout:	
Completion:	
Overall Results:	
Comments:	

Topic Skills Practice Cover Sheet

Documentation Checklist		
Section	**Documentation**	**Complete**
1.2.3	Mark-Up of the Installation Site Plan (Drawing A2.1)	☐
1.2.4	Mark-Up of the Temporary Lighting Plan (Drawing A2.2)	☐
1.3.1	Installation Schedule – Main Switchboard	☐
1.3.1	Installation Schedule – Distribution Switchboard (one for each distribution switchboard)	☐
2.2.1	Consumer's Mains and Submains – Wiring Systems and Arrangements	☐
2.2.1	ASOP and Lighting Final Subcircuits – Wiring Systems and Arrangements	☐
2.3.1	Maximum Demand of Consumer's Mains	☐
2.3.2	Maximum Demand of Submains (one for each submain)	☐
2.3.3	Maximum Demand of Final Subcircuits – ASOPs	☐
2.3.3	Maximum Demand of Final Subcircuits – Lighting	☐
2.4.1	Current Carrying Capacity of Consumer's Mains	☐
2.4.2	Voltage Drop in Consumer's Mains	☐
2.4.3	Current Carrying Capacity of Submains	☐
2.4.4	Voltage Drop in Submains	☐
2.4.5	Current Carrying Capacity of Final Subcircuits – ASOPs and Lighting	☐
2.4.6	Voltage Drop in Longest ASOP Final Subcircuit	☐
2.4.7	Voltage Drop in Longest Lighting Final Subcircuit	☐
2.5.4	Fault Loop and Prospective Fault Current – Longest ASOP Final Subcircuit	☐
2.5.5	Fault Loop and Prospective Fault Current – Longest Lighting Final Subcircuit	☐

Topic Skills Practice 3.0

UEENEEG120A Select and arrange equipment for special LV electrical installations

KS01-EG120A Special electrical installations planning

Topic: 3. Construction and Demolition Sites

Skills Practice 3.0: Construction Site Installation Planning

Task:

To select and arrange electrical wiring and equipment for a temporary electrical installation on a construction site, in accordance with AS/NZS 3000, AS/NZS 3012 and AS/NZS 3008.1.1.

Objectives:

At the completion of this skills practice, you should be able to:

- Identify electrical installation requirements for construction sites.
- Identify suitable power distribution arrangements for construction sites.
- Determine the maximum demand of consumer's mains, submains and final subcircuits for construction sites.
- Select and arrange cables and wiring systems for consumer's mains, submains and final subcircuits for construction sites.
- Select and arrange protection devices for consumer's mains, submains and final subcircuits for construction sites.
- Select and arrange electrical equipment and accessories for construction sites.
- Document the selection and arrangement of wiring and equipment for construction sites.

Topic Skills Practice 3.0

1. Planning the Unit Skills Test

1.1 Research Construction Site Installation Requirements

1.1.1 Research AS/NZS 3000 and AS/NZS 3012 requirements for the selection, arrangement and installation of electrical wiring and equipment for construction sites.

The following reference material will include some useful information:

- Pethebridge, K. and Neeson, I., Electrical Wiring Practice. McGraw-Hill, Seventh Edition, Volume 2, 2012 (Chapter 8)
- Hampson, J., Electrotechnology Practical, Pearson Education, Third Edition, 2013 (Section 8)

1.1.2 Once you feel you have sufficient knowledge of the subject matter, obtain the following materials to assist you with carrying out this skills practice:

- AS/NZS 3000 *Wiring Rules*
- AS/NZS 3012 Electrical installations – Construction and demolition sites
- AS/NZS 3008.1.1 Electrical installations – Selection of cables
- Manufacturer's catalogues
- Pens/pencils
- Ruler

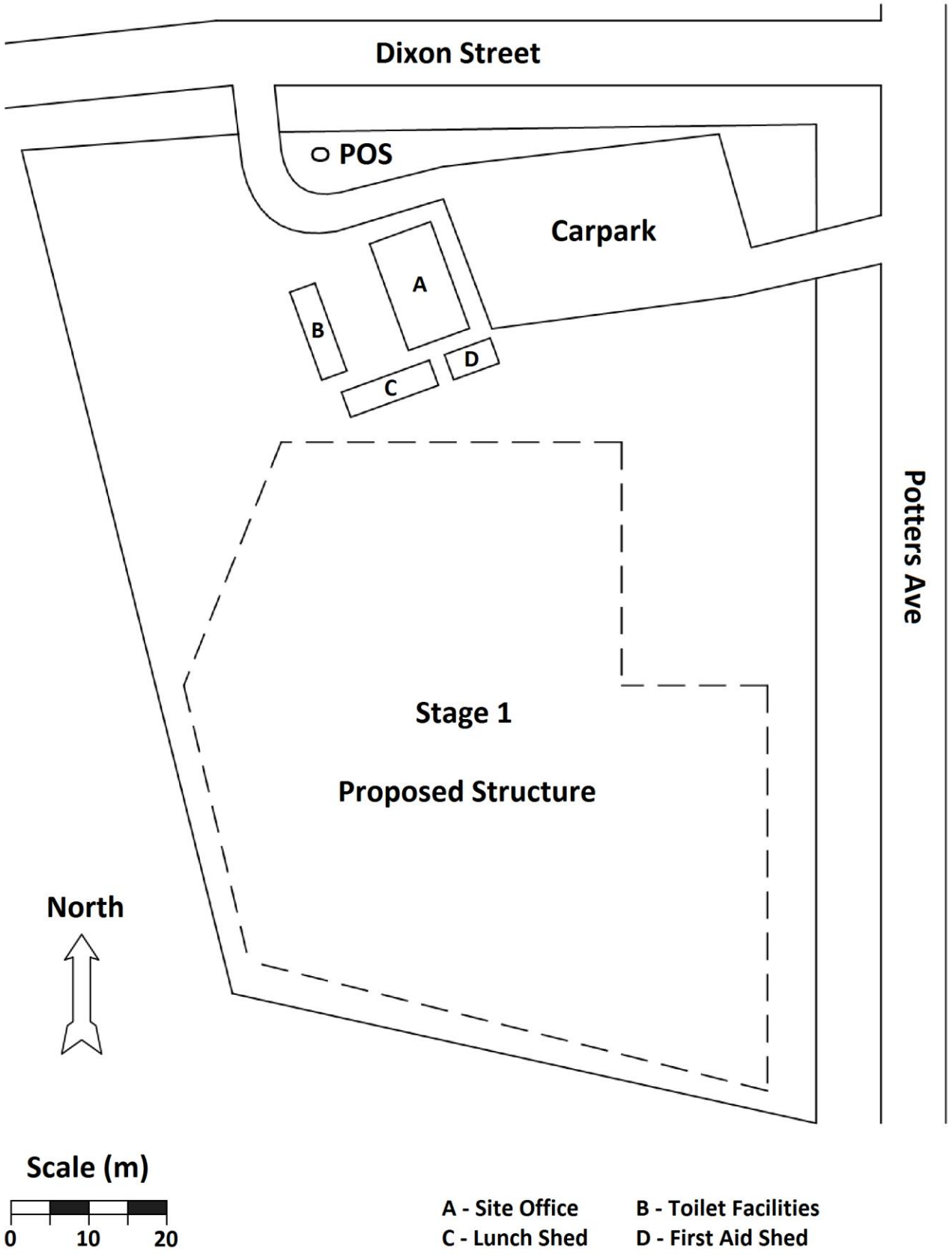
1.2 Construction Site Electrical Specification

1.2.1 Scope	
1.2.1.1 General	This specification sets out the planning and design requirements for the provision of site facilities and initial temporary lighting and power for the stage 1 construction of a small shopping centre. Stage 1 construction works will include: • excavation • laying of underground pipework • laying of underground cables • formwork and casting of ground and first floor slabs
1.2.1.2 Definitions	The definitions used throughout this specification will be as per those

	used in AS/NZS 3000, AS/NZS 3012 and AS/NZS 3008.1.1.
1.2.2 Installation Arrangement	
1.2.2.1 Supply	The supply shall be obtained from an unprotected distribution supply pole located adjacent to the north-western entry off Dixon Street. The impedance of the external fault loop has been obtained from the distribution authority as being 0.092 Ω.
1.2.2.2 Consumer's Mains	Three phase consumer's mains shall be selected to provide the most cost effective option for the required current carrying capacity. The voltage drop in the consumer's mains shall not exceed 1 %.
1.2.2.3 Switchboards	Switchboards shall be selected, installed and arranged in accordance with the requirements of AS/NZS 3000 and AS/NZS 3012. At least one 400 V, 32 A socket-outlet shall be provided on each distribution switchboard.
1.2.2.4 Site Sheds and Toilets	Submains shall be provided for the connection of demountable site sheds and toilet facilities (see drawing A2.1), as follows: • the site office (A) shall be provided with a 63 A supply • the toilet block (B) shall be provided with a 32 A supply • the lunch room (C) shall be provided with a 40 A supply • the first aid room (D) shall be provided with a 32 A supply
1.2.2.5 ASOPs	Auxiliary socket-outlet panels (ASOPs) shall be selected, installed and arranged, in accordance with AS/NZS 3000 and AS/NZS 3012. ASOPs shall be arranged so that at least 8 x 230 V socket-outlets can be accessed from within 25 m of any point within the boundaries of the site.
1.2.2.6 Lighting	The installation design is to include a plan for the provision of lighting underneath all stage 1 formwork for first floor slabs. Lighting shall provide an illumination of 160 lux under level 1 formwork, and shall maintain an illumination of at least 20 lux for a period of at least

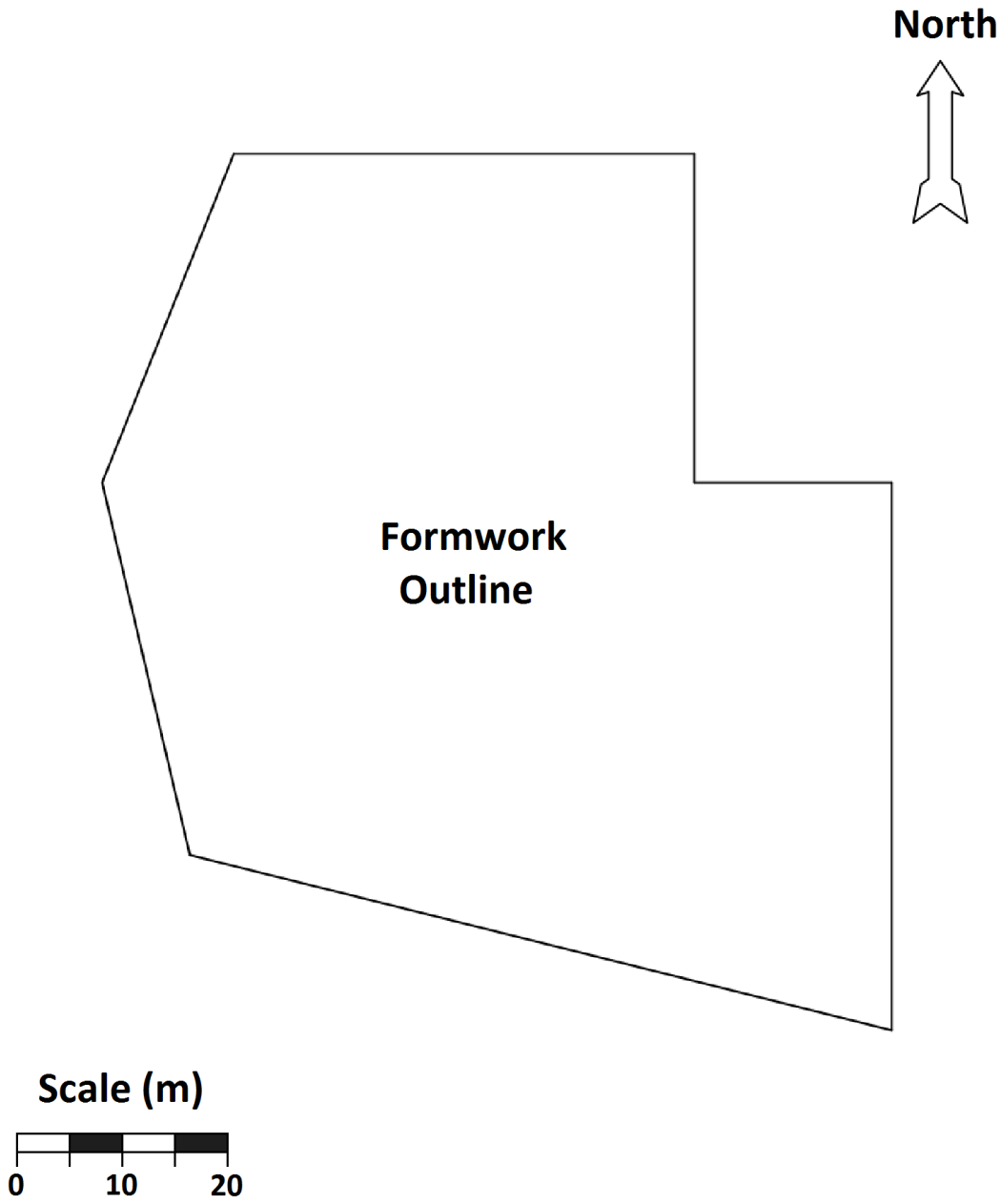
	60 minutes in the event of mains failure.

1.2.3 Drawing A2.1 – Construction Site Plan



1.2.4 Drawing A2.2 – Temporary Lighting Plan

Topic Skills Practice 3.0



1.3 Construction Site Planning Documentation

Topic Skills Practice 3.0

1.3.1 The switchboard schedules on pages 8 and 9 are for the purpose of developing a progressive record of distribution and protection arrangements, to be completed as you progress through the various planning stages.

Note: You may need to make multiple copies of the schedule on page 9 in order to complete documentation for each individual distribution switchboard.

Installation Schedule – Main Switchboard			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	**Max Demand**	**Overcurrent Protection**	**Additional Protection**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Topic Skills Practice 3.0

Installation Schedule – Distribution Switchboard			
Distribution Board No:			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

2. Carrying Out the Skills Practice

Topic Skills Practice 3.0

2.1 Divide the Installation into Circuits

2.1.1 Use the job specifications and applicable Australian Standards to plan out the required number and arrangement of switchboards and ASOPs to supply the construction site.

2.1.2 Identify the following items on the site plan (drawing A2.1) provided on page 6:

- the locations of all switchboards
- the locations of all ASOPs
- the cable route for the consumer's mains
- the cable routes for each set of submains
- the cable routes for each ASOP final subcircuit

2.1.3 Assign a unique identification number to each switchboard and ASOP you identified on the site plan. Create an installation schedule for each switchboard by making copies of the installation switchboard schedules provided in Section 1.3.1, and complete the location data for each case.

2.1.4 Use manufacturer's catalogues to select suitable switchboards and ASOPs for each installation location and complete the applicable sections in your installation switchboard schedules.

2.1.5 Identify the following items on the temporary lighting plan (drawing A2.2) on page 7:

- the locations of standard light fittings
- the locations of emergency light fittings
- the cable routes of lighting final sub-circuits

2.1.6 Identify the circuits and loads to be supplied from each switchboard and record details in your installation switchboard schedules.

2.2 Select Mains and Submains Wiring Systems

2.2.1 Use as many rows as necessary in the following tables to describe the wiring systems, installation methods, and any specific installation conditions and/or external influences affecting your selection.

- Use the table on page 11 to list details of wirings systems selected for mains and submains.
- Use the table on page 12 to list details of wirings systems selected for ASOP and lighting final subcircuits.

Consumer's Mains and Submains – Wiring Systems and Arrangements

Topic Skills Practice 3.0

Mains / Submains	Originating From	Terminating At	Route Length	Wiring System / Installation Methods	Specific Installation Conditions and External Influences
Consumer's Mains (CM)	Point of Supply (POS)	Main Switchboard (MSB)			

ASOP and Lighting Final Subcircuits – Wiring Systems and Arrangements

Topic Skills Practice 3.0

Final Subcircuit	Originating From	Connected Load	Route Length	Wiring System / Installation Methods	Specific Installation Conditions and External Influences

Topic Skills Practice 3.0

2.3 Determine Maximum Demand

2.3.1 Use applicable Australian Standards to determine the maximum demand of the installation consumer's mains. Record details of calculations in the following table, or where an alternative method of determining maximum demand is used, attach additional page(s) detailing the methods and reasoning used.

*remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Consumer's Mains			
AS/NZS 3000 Ref:		**AS/NZS 3012 Ref:**	

Load	Load Group	Calculation	Demand		
			A	B	C
		Totals:			

Consumer's Mains Maximum Demand:	

Topic Skills Practice 3.0

2.3.2 Use applicable Australian Standards to determine the maximum demand of each installation submain. Record details of calculations in the following table, or where alternative methods of determining maximum demand are used, attach additional page(s) detailing the methods and reasoning used.

*make multiple copies of this page to record details of maximum demand calculations for each subsequent set of installation submains as determined in Section 2.1

**remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Submain No._____.					
AS/NZS 3000 Ref:		**AS/NZS 3012 Ref:**			
Load	**Load Group**	**Calculation**	**Demand**		
			A	**B**	**C**
		Total(s):			

Submain No._____Maximum Demand:	

Topic Skills Practice 3.0

2.3.3 Use applicable Australian Standards to determine the maximum demand of each final subcircuit. Record details using as many rows as necessary in the following tables, or where alternative methods of determining maximum demand are used, attach additional page(s) detailing the methods and reasoning used.

*repeated final subcircuit maximum demand calculations need only be shown once

**remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Final Subcircuits – ASOPs				
AS/NZS 3000 Ref:		**AS/NZS 3012 Ref:**		
ASOP No.	**Load**	**Load Group**	**Calculation**	**Maximum Demand**

Maximum Demand of Final Subcircuits – Lighting				
AS/NZS 3000 Ref:		**AS/NZS 3012 Ref:**		
Circuit No.	**Load**	**Load Group**	**Calculation**	**Maximum Demand**

Topic Skills Practice 3.0

2.4 Select Cables for Mains, Submains and Final Subcircuits

2.4.1 Select cables for the construction site consumer's mains, in accordance with the job specification and AS/NZS 3008.1.1. Use the following spaces to record details of your cable selections.

Current Carrying Capacity of Consumer's Mains				
Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
	Table	Column	Table	Column

2.4.2 Determine the voltage drop in the consumer's mains, and document all details and calculations in the following table.

Voltage Drop in Consumer's Mains							
Cable Size	Cable Type	Circuit Loading	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column
Working:							

Topic Skills Practice 3.0

Voltage drop in the consumer's mains is no greater than 1%	**□ Yes**	**□ No**

2.4.3 Select suitable submains for the construction site installation, in accordance with the job specification and AS/NZS 3008.1.1. Use as many rows as necessary in the following table to record details of your submain cable selections.

Current Carrying Capacity of Submains					
Submain No.	**Minimum Cable Size**	**Current Carrying Capacity**		**Rating/Derating**	
		Table	**Column**	**Table**	**Column**

Topic Skills Practice 3.0

2.4.4 Determine the voltage drop in each of the installation submains. Document all details and calculations using as many rows as is necessary in the following table. Additional space for working if provided on the following page.

Voltage Drop in Submains							
Submain No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column

Topic Skills Practice 3.0

Working:

Topic Skills Practice 3.0

Working:

Topic Skills Practice 3.0

2.4.5 Select suitable conductors based on current carrying capacity, for each ASOP and lighting final subcircuit, in accordance with the job specification and AS/NZS 3008.1.1. Use as many rows as necessary in the following table to record details of your final subcircuit cable selections.

Current Carrying Capacity of Final Subcircuits – ASOPs and Lighting					
Final Subcircuit	Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
		Table	Column	Table	Column

Topic Skills Practice 3.0

2.4.6 Determine the voltage drop in the longest ASOP final subcircuit. Document all details and calculations in the following table. Attach additional pages to show working if required.

Voltage Drop in Longest ASOP Final Subcircuit							
Submain No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column
Working:							

2.4.7 Determine the voltage drop in the longest lighting final subcircuit. Document all details and calculations in the following table. Attach additional pages to show working if required.

Voltage Drop in Longest Lighting Final Subcircuit							
Submain No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column

Topic Skills Practice 3.0

Working:

2.5 Select Circuit Protection Devices

2.5.1 Calculate the fault level at each installation switchboard and complete the relevant data in your installation schedules (from section 1.3.1).

2.5.2 Select overcurrent protection devices, in accordance with AS/NZS 3000 and AS/NZS 3012, to ensure that each installation submain and final subcircuit is protected, as required, against:

- Overloads
- Short-circuit
- Earth faults
- Earth leakage

2.5.3 Record details of your protection device selections in your installation schedules.

2.5.4 Calculate the fault loop impedance and prospective fault current for a fault of negligible impedance at the terminals of the longest ASOP final subcircuit.

Fault Loop and Prospective Fault Current – Longest ASOP Final Subcircuit				
Cable Size	**Circuit Protection Device**	**Route Length**	**Fault Loop Impedance**	**Prospective Fault Current**

Topic Skills Practice 3.0

Working:		
Will the circuit protection operate in the required time?	**□ Yes**	**□ No**

2.5.5 Calculate the fault loop impedance and prospective fault current for a fault of negligible impedance at the terminals of the furthest light fitting of the longest lighting final subcircuit.

Fault Loop and Prospective Fault Current – Longest Lighting Final Subcircuit				
Cable Size	**Circuit Protection Device**	**Route Length**	**Fault Loop Impedance**	**Prospective Fault Current**

Topic Skills Practice 3.0

Working:		
Will the circuit protection operate in the required time?	□ **Yes**	□ **No**

3. Completing the Skills Practice

3.1 Skills Practice Review Questions

3.1.1 Answer the following questions after you have successfully completed all required sections and documentation from Section 2.

1. List three types of work associated with sites covered under the scope of AS/NZS 3012.

_____

_____

_____

2. List the requirements for the provision of control and protection auxiliary socket-outlet panels (ASOPs) on a construction site. Provide AS/NZS 3000 and/or AS/NZS 3012 clauses to support your answers.

_____

_____

_____

3. What is the maximum length for a 15 A extension cord with 2.5 mm^2 conductors, intended for use on a construction site? Provide AS/NZS 3000 and/or AS/NZS 3012 clauses to support your answer.

4. List three external influences likely to affect the selection of wiring systems for construction wiring.

5. What is the minimum degree of protection for a temporary switchboard on a construction site? Provide AS/NZS 3000 and/or AS/NZS 3012 clauses to support your answer.

6. Explain when a portable socket-outlet assembly should be used on a construction site.

7. What is the minimum rating for a socket-outlet provided on a temporary switchboard on a

construction site? Provide AS/NZS 3000 and/or AS/NZS 3012 clauses to support your answer.

_____

_____

8. What are the requirements for the mounting height of an auxiliary socket-outlet panel (ASOP) on a construction site? Provide AS/NZS 3000 and/or AS/NZS 3012 clauses to support your answer.

_____

_____

9. Explain the requirements for the protection of multiple lighting final subcircuits originating from a single temporary switchboard on a construction site. Provide AS/NZS 3000 and/or AS/NZS 3001 clauses to support your answer.

_____

_____

_____

_____

_____

	 *Feedback*	**Have your teacher/trainer check your answers**	**Teacher/Trainer Initials and Date**	✓

Topic Skills Practice Cover Sheet

Unit Name:	UEENEEG120A Select and arrange equipment for special LV electrical installations
Topic Title:	Marinas and Recreation Boats

Skill Practice Number:	4.0
Skill Practice Name:	Marina Installation Planning

Student Name:	
Student ID:	
College/Campus:	
Group:	

Results	
Planning:	
Carryout:	
Completion:	
Overall Results:	
Comments:	

Topic Skills Practice Cover Sheet

Documentation Checklist		
Section	**Documentation**	**Complete**
1.2.3	Mark-Up of the Installation Site Plan (Drawing A3.1)	☐
1.3.1	Installation Schedule – Main Switchboard	☐
1.3.1	Installation Schedule – Distribution Switchboard (one for each distribution switchboard)	☐
1.3.1	Installation Schedule – Service Pillar (one for each service pillar)	☐
2.2.1	Consumer's Mains and Submains – Wiring Systems and Arrangements	☐
2.2.1	Final Subcircuits – Wiring Systems and Arrangements	☐
2.3.1	Maximum Demand of Consumer's Mains	☐
2.3.2	Maximum Demand of Submains (one for each submain)	☐
2.3.3	Maximum Demand of Final Subcircuits – Office/Shop and Bollard Lighting	☐
2.4.1	Current Carrying Capacity of Consumer's Mains	☐
2.4.2	Voltage Drop in Consumer's Mains	☐
2.4.3	Current Carrying Capacity of Submains	☐
2.4.4	Voltage Drop in Submains	☐
2.4.5	Current Carrying Capacity of Final Subcircuits	☐
2.4.6	Voltage Drop at Furthest Bollard Light	☐
2.5.4	Fault Loop and Prospective Fault Current at Furthest Service Pillar Socket-Outlet	☐
2.5.5	Fault Loop and Prospective Fault Current at Furthest Bollard Light	☐

Topic Skills Practice 4.0

UEENEEG120A Select and arrange equipment for special LV electrical installations

KS01-EG120A Special electrical installations planning

Topic: 4. Marinas and Recreation Boats

Skills Practice 4.0: Marina Installation Planning

Task:

To select and arrange electrical wiring and equipment for a marina installation, in accordance with AS/NZS 3000, AS/NZS 3004 and AS/NZS 3008.

Objectives:

At the completion of this skills practice, you should be able to:

- Identify electrical installation requirements for marinas.
- Identify suitable power distribution arrangements for marinas.
- Determine the maximum demand of consumer's mains, submains and final subcircuits for marinas.
- Select and arrange cables and wiring systems for consumer's mains, submains and final subcircuits for marinas.
- Select and arrange protection devices for consumer's mains, submains and final subcircuits for marinas.
- Select and arrange electrical equipment and accessories for marinas.
- Document the selection and arrangement of wiring and equipment for marinas.

Topic Skills Practice 4.0

1. Planning the Unit Skills Test

1.1 Research Marinas Installation Requirements

1.1.1 Research AS/NZS 3000 and AS/NZS 3004 requirements for the selection, arrangement and installation of electrical wiring and equipment for marinas.

The following reference material will include some useful information:

- Pethebridge, K. and Neeson, I., Electrical Wiring Practice. McGraw-Hill, Seventh Edition, Volume 2, 2012 (Chapter 8)
- Hampson, J., Electrotechnology Practical, Pearson Education, Third Edition, 2013 (Section 8)

1.1.2 Once you feel you have sufficient knowledge of the subject matter, obtain the following materials to assist you with carrying out this skills practice:

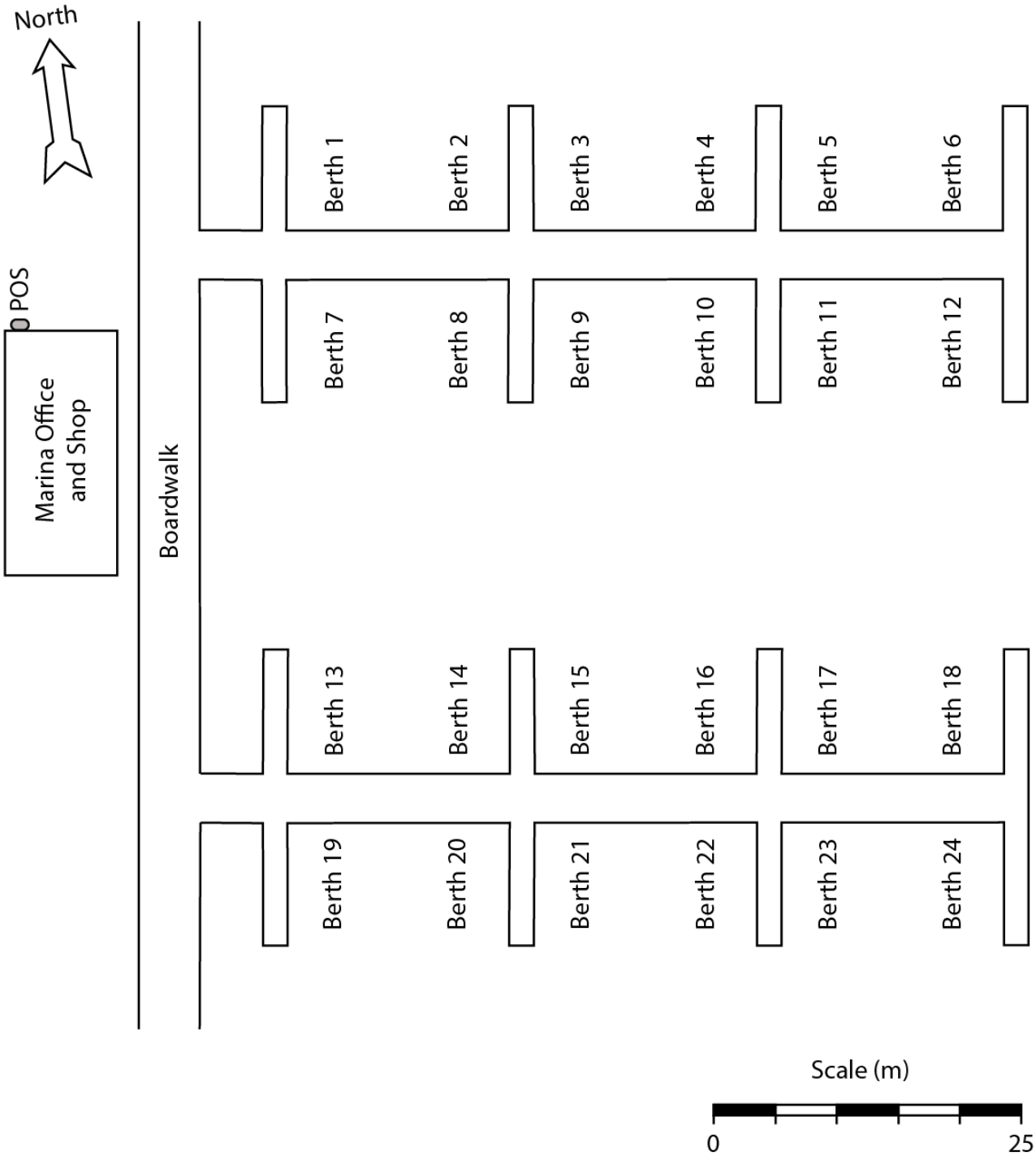
- AS/NZS 3000 *Wiring Rules*
- AS/NZS 3004.1 Electrical installations – Marinas and Boats – Marinas
- AS/NZS 3008.1.1 Electrical installations – Selection of cables
- Manufacturer's catalogues
- Pens/pencils
- Ruler

1.2 Marina Electrical Specification

1.2.1 Scope	
1.2.1.1 General	This specification sets out the requirements for the planning and design of a low voltage electrical installation in a marina. All facets of the marina design and planning shall comply with: • the provisions of this specification • the requirements of AS/NZS 3000 • the requirements of AS/NZS 3004 • the requirements of AS/NZS 3008
1.2.1.2 Definitions	The definitions used throughout this specification will be as per those used in AS/NZS 3000, AS/NZS 3004 and AS/NZS 3008.
1.2.1.3 Inclusions	The scope of planning and design work extends to the provision of low voltage electrical services, including wiring, switchboards, control and protection associated with:

	• connection to the electricity distribution network • provision of general lighting and power in the office/shop • provision of bollard lighting • provision of supplies to docking berths
1.2.2 Installation Arrangement	
1.2.2.1 Supply	Supply will be obtained by connection to unprotected overhead service lines terminating at a riser bracket located at roof level at the north-western corner of the marina office/shop (see drawing A3.1). The impedance of the external fault loop has been obtained from the distribution authority as being 0.127 Ω.
1.2.2.2 Consumer's Mains	Consumer's mains shall be selected to provide the most cost effective option at 120 % of the minimum required current carrying capacity. The type and size of cables shall be determined in accordance with the requirements of AS/NZS 3000, AS/NZS 3004.1 and AS/NZS 3008.
1.2.2.3 Service Pillars	Berths 1 to 12 inclusive shall each be provided with both a 400 V, 32 A supply and a 230 V, 15 A supply. Berths 13 to 24 inclusive shall be provided with a 230 V, 15 A supply only. No more than four sites being supplied from any one service pillar.
1.2.2.4 Office/Shop	Low voltage electrical supply, wiring and equipment shall be provided to the office/shop area for the supply of the following loads: • 18 x 230 V, 2 x 36 W fluorescent fittings • 8 x 230 V, 2 x 36 W vandal-proof (outdoor) fluorescent fittings • 22 x 230 V, 10 A general purpose double socket-outlets • 2 x 230 V, 15 A single socket-outlet • 1 x 400 V, 16 kW fixed combi-steam oven • 1 x 400 V, 24 kW instantaneous hot water heater Note: The marina office/shop is of double brick construction with concrete slab footing and a flat concrete slab roof.
1.2.2.5 Bollard Lighting	Bollard lighting is to be supplied along the boardwalk, with at least one bollard being positioned every 6 m.

1.2.3 Drawing A3.1 – Marina Site Plan



Topic Skills Practice 4.0

1.3 Marina Planning Documentation

1.3.1 The switchboard schedules on pages 7 to 9 are for the purpose of developing a progressive record of distribution and protection arrangements, to be completed as you progress through the various planning stages.

Note: You will need to make multiple copies of the schedules on pages 8 and 9 to complete documentation for each individual distribution switchboard and service pillar.

Installation Schedule – Main Switchboard			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Topic Skills Practice 4.0

Installation Schedule – Distribution Switchboard			
Distribution Board No:			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Topic Skills Practice 4.0

Installation Schedule – Service Pillar			
Service Pillar No:			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Topic Skills Practice 4.0

2. Carrying Out the Skills Practice

2.1 Divide the Installation into Circuits

2.1.1 Use the job specifications and applicable Australian Standards to plan out the required number and arrangement of switchboards and service pillars to supply the marina.

2.1.2 Identify the following items on the site plan (drawing A3.1) provided on page 6:

- the locations of all switchboards
- the locations of all service pillars
- the cable route for the consumer's mains
- the cable routes for each set of submains

2.1.3 Assign a unique identification number to each switchboard and service pillar you identified on the site plan. Create an installation schedule for each switchboard and service pillar by making copies of the installation schedules provided in Section 1.3.1, and complete the location data for each case.

2.1.4 Use manufacturer's catalogues to select suitable switchboards and service pillars for each installation location and complete the applicable sections in your installation schedules.

2.1.5 Identify the circuits and loads to be supplied from each switchboard and service pillar, and record details in your installation schedules.

2.2 Select Mains, Submains and Final Subcircuits Wiring Systems

2.2.1 Use Australian Standards to select wiring systems for the marina consumer's mains, submains and final subcircuits.

Use as many rows as necessary in the following tables to describe the wiring systems, installation methods, and any specific installation conditions and/or external influences affecting your selection.

- Use the table on page 11 to list details of wirings systems selected for mains and submains.

- Use the table on page 12 to list details of wirings systems selected for office/shop and bollard lighting final subcircuits

Topic Skills Practice 4.0

Consumer's Mains and Submains – Wiring Systems and Arrangements											
Mains / Submains	Consumer's Mains (CM)										
Originating From	Point of Supply (POS)										
Terminating At	Main Switchboard (MSB)										
Route Length											
Wiring System / Installation Methods											
Specific Installation Conditions and External Influences											

Topic Skills Practice 4.0

Final Subcircuits – Wiring Systems and Arrangements										
Final Subcircuit										
Originating From										
Connected Load										
Route Length										
Wiring System / Installation Methods										
Specific Installation Conditions and External Influences										

Topic Skills Practice 4.0

2.3 Determine Maximum Demand

2.3.1 Use applicable Australian Standards to determine the maximum demand of the installation consumer's mains. Record details of calculations in the following table, or where an alternative method of determining maximum demand is used, attach additional page(s) detailing the methods and reasoning used.

*remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Consumer's Mains					
AS/NZS 3000 Ref:		**AS/NZS 3004 Ref:**			
Load	**Load Group**	**Calculation**	**Demand**		
			A	**B**	**C**
Totals:					

Consumer's Mains Maximum Demand:	

Topic Skills Practice 4.0

2.3.2 Use applicable Australian Standards to determine the maximum demand of each installation submain. Record details of calculations in the following table, or where alternative methods of determining maximum demand are used, attach additional page(s) detailing the methods and reasoning used.

*make multiple copies of this page to record details of maximum demand calculations for each subsequent set of installation submains as determined in Section 2.1

**remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Submain No._____.					
AS/NZS 3000 Ref:		**AS/NZS 3004 Ref:**			
Load	**Load Group**	**Calculation**	**Demand**		
			A	**B**	**C**
Total(s):					

Submain No._____Maximum Demand:	

Topic Skills Practice 4.0

2.3.3 Use applicable Australian Standards to determine the maximum demand of each final subcircuit supplied from the amenities distribution board, and record details in the following table.

*repeated final subcircuit maximum demand calculations need only be shown once

**remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Final Subcircuits					
AS/NZS 3000 Ref:		**AS/NZS 3004 Ref:**			
Final Subcircuit	**Load Group**	**Method of Determination**	**Maximum Demand**		
			A	**B**	**C**

Topic Skills Practice 4.0

2.4 Select Cables for Mains, Submains and Final Subcircuits

2.4.1 Select cables for the marina consumer's mains, in accordance with the job specification and applicable Australian Standards. Use the following spaces to record details of your cable selections.

Current Carrying Capacity of Consumer's Mains				
Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
	Table	Column	Table	Column

2.4.2 Determine the voltage drop in the consumer's mains, and document all details and calculations in the following table.

Voltage Drop in Consumer's Mains							
Cable Size	Cable Type	Circuit Loading	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column
Working:							

Topic Skills Practice 4.0

2.4.3 Select suitable submains, as necessary, for the marina, in accordance with the job specification and applicable Australian Standards. Use as many rows as necessary in the following table to record details of your submain cable selections.

*where additional space is required, make multiple copies of this page

Current Carrying Capacity of Submains					
Submain No.	Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
		Table	Column	Table	Column

Topic Skills Practice 4.0

2.4.4 Determine the voltage drop in each of the installation submains. Document all details using as many rows as is necessary in the following table. Show working in the space provided on the following page.

*where additional space is required, make multiple copies of this page

Voltage Drop in Submains							
Submain No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column

Topic Skills Practice 4.0

Working:

Topic Skills Practice 4.0

2.4.5 Select suitable conductors based on current carrying capacity, for each installation final subcircuit.

Use as many rows as necessary in the following table to record details of your final subcircuit cable selections.

Current Carrying Capacity of Final Subcircuits					
Final Subcircuit	Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
		Table	Column	Table	Column

2.4.6 Determine the voltage drop at the furthest bollard light fitting. Document all details and calculations in the following table. Attach additional pages to show working if required.

Voltage Drop in Bollard Lighting Final Subcircuit							
Circuit No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column
Working:							

2.5 Select Circuit Protection Devices

2.5.1 Calculate the fault level at each installation switchboard and service pillar based on your selection of cables, and complete the relevant data in your installation schedules (from section 1.3.1).

2.5.2 Select protection devices, in accordance with AS/NZS 3000 and AS/NZS 3004, to ensure that each installation submain and final subcircuit is protected, as required, against:

- Overloads
- Earth faults
- Short-circuit
- Earth leakage

2.5.3 Record details of your protection device selections in your installation schedules.

2.5.4 Calculate the fault loop impedance and prospective fault current for a fault of negligible impedance at the terminals of the furthest service pillar socket.

Topic Skills Practice 4.0

Fault Loop and Prospective Fault Current at Furthest Service Pillar Socket-Outlet				
Cable Size	**Circuit Protection Device**	**Route Length**	**Fault Loop Impedance**	**Prospective Fault Current**
Working:				
Will the circuit protection operate in the required time?			**□ Yes**	**□ No**

2.5.5 Calculate the fault loop impedance and prospective fault current for a fault of negligible impedance at the terminals of the furthest bollard light.

Fault Loop and Prospective Fault Current at Furthest Bollard Light				
Cable Size	**Circuit Protection Device**	**Route Length**	**Fault Loop Impedance**	**Prospective Fault Current**
Working:				
Will the circuit protection operate in the required time?			**□ Yes**	**□ No**

Topic Skills Practice 4.0

3. Completing the Skills Practice

3.1 Skills Practice Review Questions

3.1.1 Answer the following questions after you have successfully completed all required sections and documentation from Section 2.

1. List three types of installations covered under the scope of AS/NZS 3004.1.

_____

_____

_____

2. List the requirements for the provision of control and protection for service pillar socket-outlets in marinas. Provide AS/NZS 3000 and/or AS/NZS 3004.1 clauses to support your answers.

_____

_____

_____

_____

_____

3. What is the maximum length for a 15 A supply lead intended for the connection of a boat to a service pillar socket-outlet in a marina? Provide AS/NZS 3000 and/or AS/NZS 3004 clauses to support your answer.

_____

_____

4. List two factors that directly affect the voltage drop in a given circuit.

_____

_____

Topic Skills Practice 4.0

5. What is the minimum degree of protection for a service pillar in a marina? Provide AS/NZS 3000 and/or AS/NZS 3004.1 clauses to support your answer.

_____

_____

6. List two characteristic external influences that directly affect the selection of wiring systems for marina installations. Provide AS/NZS 3000 and/or AS/NZS 3004.1 clauses to support your answer.

_____

_____

7. List three wiring systems that are suitable for use in a marina installation. Provide AS/NZS 3000 and/or AS/NZS 3004.1 clauses to support your answer.

_____

_____

_____

_____

8. What type of overhead wiring systems are permitted to be installed in marinas? Provide AS/NZS 3000 and/or AS/NZS 3004.1 clauses to support your answer.

_____

_____

_____

	 *Feedback*	**Have your teacher/trainer check your answers**	**Teacher/Trainer Initials and Date**	√

Topic Skills Practice Cover Sheet

Unit Name:	UEENEEG120A Select and arrange equipment for special LV electrical installations
Topic Title:	Medical Treatment Areas

Skill Practice Number:	5.0
Skill Practice Name:	Medical Centre Installation Planning

Student Name:	
Student ID:	
College/Campus:	
Group:	

Results	
Planning:	
Carryout:	
Completion:	
Overall Results:	
Comments:	

Topic Skills Practice Cover Sheet

Documentation Checklist		
Section	**Documentation**	**Complete**
1.2.3	Mark-Up of the Installation Plan – Power (Drawing A4.2)	☐
1.2.4	Mark-Up of the Installation Plan – Lighting (Drawing A4.3)	☐
1.2.5	Mark-Up of the Installation Plan – Earthing (Drawing A4.4)	☐
1.3.1	Installation Schedule – Main Switchboard	☐
1.3.1	Installation Schedule – Distribution Switchboard (where applicable)	☐
2.2.1	Mains and Submains – Wiring Systems and Arrangements	☐
2.2.1	Final Subcircuits – Wiring Systems and Arrangements	☐
2.3.1	Maximum Demand of Consumer's Mains	☐
2.3.2	Maximum Demand of Submains (where applicable)	☐
2.3.3	Maximum Demand of Final Subcircuits	☐
2.4.1	Current Carrying Capacity of Consumer's Mains	☐
2.4.2	Voltage Drop in Consumer's Mains	☐
2.4.3	Current Carrying Capacity of Submains (where applicable)	☐
2.4.4	Voltage Drop in Submains (where applicable)	☐
2.4.5	Current Carrying Capacity of Final Subcircuits	☐
2.4.6	Voltage Drop at Furthest Socket Outlet	☐
2.4.7	Voltage Drop at Furthest Lighting Point	☐
2.5.5	Fault Loop and Prospective Fault Current – Furthest Socket Outlet	☐
2.5.6	Fault Loop and Prospective Fault Current – Furthest Lighting Point	☐

Topic Skills Practice 5.0

UEENEEG120A Select and arrange equipment for special LV electrical installations

KS01-EG120A Special electrical installations planning

Topic: 5. Medical Treatment Areas

Skills Practice 5.0: Medical Treatment Areas Installation Planning

Task:

To select and arrange electrical wiring and equipment for a medical centre installation in accordance with AS/NZS 3000, AS/NZS 3003 and AS/NZS 3008.

Objectives:

At the completion of this skills practice, you should be able to:

- Identify electrical installation requirements in patient areas.
- Identify suitable power distribution arrangements in patient areas.
- Determine the maximum demand of consumer's mains, submains and final subcircuits for patient areas.
- Select and arrange cables and wiring systems for consumer's mains, submains and final subcircuits in patient areas.
- Select and arrange protection devices for consumer's mains, submains and final subcircuits in patient areas.
- Select and arrange electrical equipment and accessories for patient areas.
- Document the selection and arrangement of wiring and equipment in patient areas.

Topic Skills Practice 5.0

1. Planning the Unit Skills Test

1.1 Research Medical Centre Installation Requirements

1.1.1 Research AS/NZS 3000 and AS/NZS 3001 requirements for the selection, arrangement and installation of electrical wiring and equipment in medical treatment areas.

The following reference material will include some useful information:

- Pethebridge, K. and Neeson, I., Electrical Wiring Practice. McGraw-Hill, Seventh Edition, Volume 2, 2012 (Chapter 8)
- Hampson, J., Electrotechnology Practical, Pearson Education, Third Edition, 2013 (Section 8)

1.1.2 Once you feel you have sufficient knowledge of the subject matter, obtain the following materials to assist you with carrying out this skills practice:

- AS/NZS 3000 *Wiring Rules*
- AS/NZS 3003 Electrical installations – Patient areas
- AS/NZS 3008.1.1 Electrical installations – Selection of cables
- Manufacturer's catalogues
- Pens/pencils
- Ruler

1.2 Medical Centre Electrical Specification

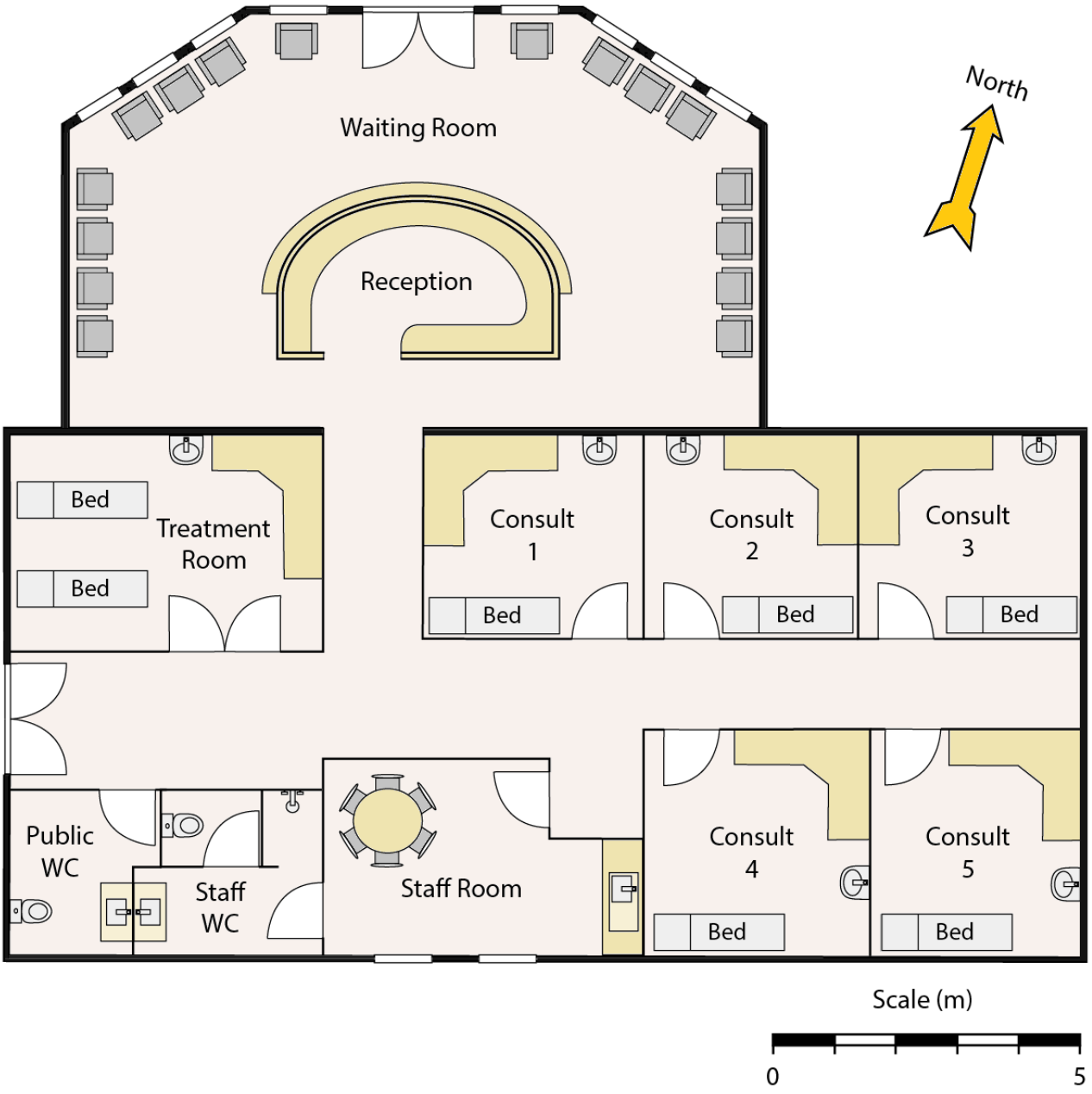
1.2.1 Scope	
1.2.1.1 General	This specification sets out the requirements for the planning and design of a medical centre low voltage electrical installation. All facets of the medical centre installation design and planning shall comply with: • the provisions of this specification • the requirements of AS/NZS 3000 • the requirements of AS/NZS 3003 • the requirements of AS/NZS 3008 • any applicable local service rules
1.2.1.2 Definitions	The definitions used throughout this specification are as per those used in AS/NZS 3000, AS/NZS 3003 and AS/NZS 3008.

1.2.1.3 Inclusions	The scope of planning and design work extends to the provision of low voltage wiring, switchboards, control and protection associated with lighting and power.
1.2.2 Installation Arrangement	
1.2.2.1 Supply	Supply will be obtained by connection to unprotected overhead service lines terminating at a riser bracket located at roof level at the north-eastern corner of the waiting room (POS). The impedance of the external fault loop has been obtained from the distribution authority as being 0.152 Ω.
1.2.2.2 Consumer's Mains	Consumer's mains shall be selected to provide the most cost effective option, based on the maximum demand of installation lighting and power, with an additional 80 % capacity provided for additional loads and future expansion. The type and size of cables shall be determined in accordance with the requirements of AS/NZS 3000, AS/NZS 3003 and AS/NZS 3008, taking into account that essential safety services are to be supplied at the site.
1.2.2.3 Main Switchboard	The main switchboard is to be suitably selected, located and installed in accordance with AS/NZS 3000.
1.2.2.4 Socket-Outlets	Each consultation room shall be provided with 8 x 230 V, 10 A sockets located at desk level, and 2 x 230 V, 10 A sockets located adjacent to the examination bed. The treatment room shall be provided with 10 x 230 V, 10 A sockets located at desk level, and 4 x 230 V, 10 A sockets located adjacent to the examination bed. The staff room shall be provided with 10 x 230 V, 10 A sockets, and 1 x 230 V, 15 A fridge socket. The reception desk shall be provided with 14 x 230 V, 10 A sockets located at desk level. 4 x 230 V, 10 A cleaner's sockets shall be provided throughout the waiting room and hallways to facilitate cleaning.

	Each bathroom shall be provided with at least 2 x 230 V, 10 A sockets. Note: Refer to AS/NZS 3000 Section 6 for specific safety requirements for electrical installations in damp situations.
1.2.2.5 Lighting	Lighting shall be selected and installed to provide the following average illuminance: • 500 lux in the reception/waiting room, staff room and bathrooms • 900 lux in consultation rooms and the treatment room Consultation and treatment room lighting, as a whole, is to be split across at least two lighting circuits.
1.2.2.6 Building Construction	The building is of cavity (double) brick construction with a slab footing and ceiling. A suspended ceiling is hung throughout at a height of 2.4 m. The ceiling cavity has a height of 600 mm.

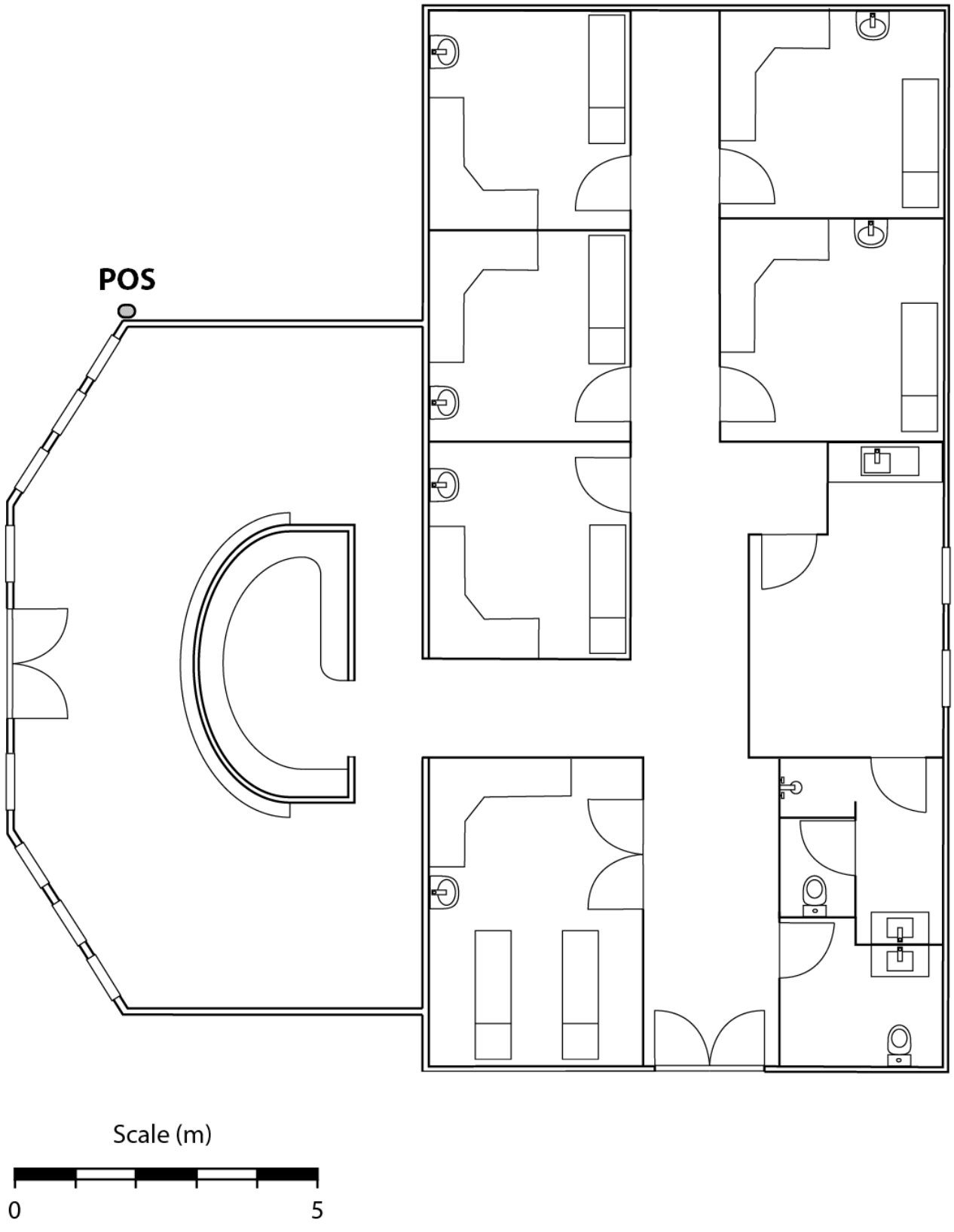
Topic Skills Practice 5.0

1.2.3 Drawing A4.1 – Medical Centre Floor Plan



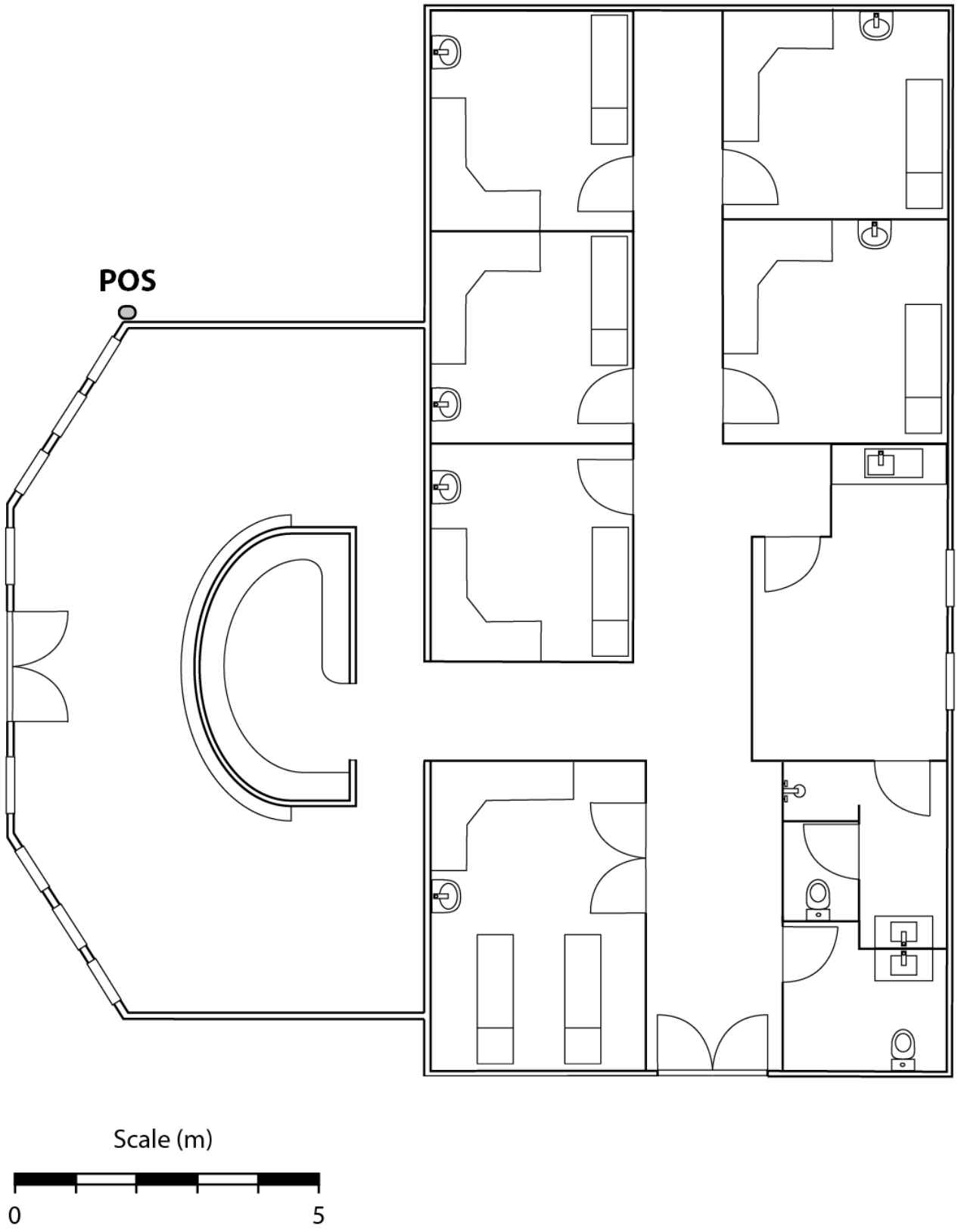
Topic Skills Practice 5.0

1.2.4 Drawing A4.2 – Medical Centre Power



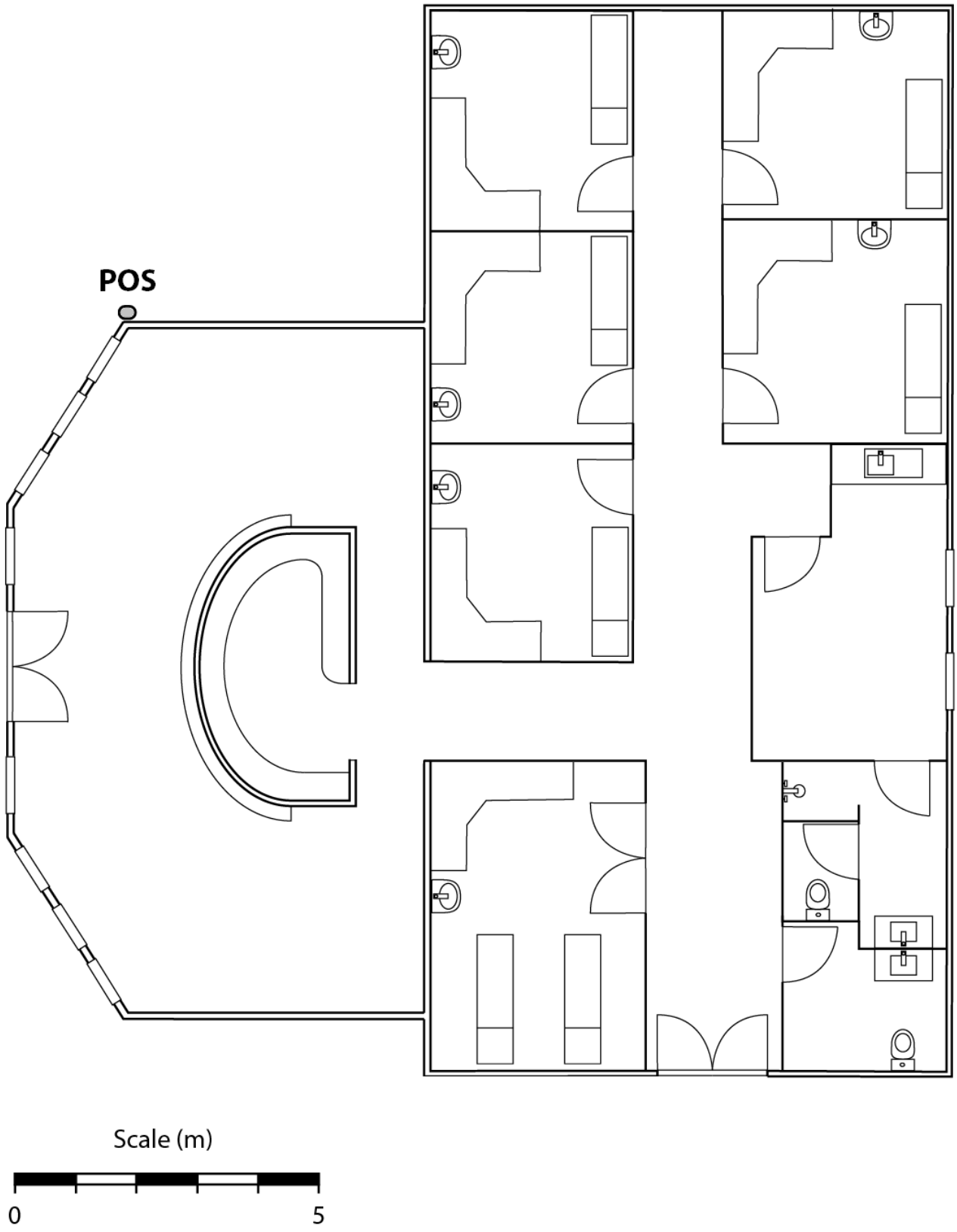
Topic Skills Practice 5.0

1.2.5 Drawing A4.3 – Medical Centre Lighting



Topic Skills Practice 5.0

1.2.5 Drawing A4.4 – Medical Centre Earthing Arrangements



Topic Skills Practice 5.0

1.3 Medical Centre Planning Documentation

1.3.1 The switchboard schedules on pages 11 and 12 are for the purpose of developing a progressive record of distribution and protection arrangements, to be completed as you progress through the various planning stages.

Installation Schedule – Main Switchboard			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				

Topic Skills Practice 5.0

Note: if your arrangement includes one or more distribution boards, you will need to make copies of this page, to complete documentation for each distribution board.

Installation Schedule – Distribution Switchboard			
Distribution Board No:			
Installation Location:			
Manufacturer:		**Part No:**	
Maximum Demand:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Circuits / Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Topic Skills Practice 5.0

2. Carrying Out the Skills Practice

2.1 Divide the Installation into Circuits

2.1.1 Use the job specifications and applicable Australian Standards to plan out the required number and arrangement of switchboards and final subcircuits to supply the medical centre.

2.1.2 Identify the following items on the drawing A4.2, provided on page 8:

- the location of the main switchboard and any distribution boards
- the locations of all socket-outlets
- the cable routes of consumer's mains, submains, and socket-outlets final subcircuits

2.1.3 Identify the following items on the drawing A4.3, provided on page 9:

- the location of the main switchboard and any distribution boards
- the locations of all light fittings
- the cable routes of consumer's mains, submains, and lighting final subcircuits

2.1.4 Assign a unique identification number to each switchboard, submain and final subcircuit you identified on the installation plans. Create an installation schedule for each switchboard using the installation schedules provided in Section 1.3.1, and complete the location data for each case.

2.1.5 Use manufacturer's catalogues to select suitable switchboards for each installation location and complete the applicable sections in your installation schedules.

2.1.6 Identify the circuits to be supplied from each switchboard and record details in your installation schedules.

2.2 Select Mains, Submains and Final Subcircuits Wiring Systems

2.2.1 Use Australian Standards to select wiring systems for the medical centre consumer's mains, submains and final subcircuits.

Use as many rows as necessary in the following tables to describe the wiring systems, installation methods, and any specific installation conditions and/or external influences affecting your selection.

- Use the table on page 14 to list details of wirings systems selected for mains and submains.

- Use the table on page 15 to list details of wirings systems selected for final subcircuits.

Topic Skills Practice 5.0

Consumer's Mains and Submains – Wiring Systems and Arrangements											
Mains / Submains	Consumer's Mains (CM)										
Originating From	Point of Supply (POS)										
Terminating At	Main Switchboard (MSB)										
Route Length											
Wiring System / Installation Methods											
Specific Installation Conditions and External Influences											

Topic Skills Practice 5.0

Final Subcircuits – Wiring Systems and Arrangements										
Final Subcircuit										
Originating From										
Connected Load										
Route Length										
Wiring System / Installation Methods										
Specific Installation Conditions and External Influences										

Topic Skills Practice 5.0

2.3 Determine Maximum Demand

2.3.1 Use applicable Australian Standards to determine the maximum demand of the installation consumer's mains. Record details of calculations in the following table, or where an alternative method of determining maximum demand is used, attach additional page(s) detailing the methods and reasoning used.

*remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Consumer's Mains					
AS/NZS 3000 Reference:					
Load	**Load Group**	**Calculation**	**Demand**		
			A	**B**	**C**
Totals:					

Consumer's Mains Maximum Demand:	

Minimum Current Carrying Capacity (as per job specification):	

Topic Skills Practice 5.0

2.3.2 Use applicable Australian Standards to determine the maximum demand of any installation submains. Record details of calculations in the following table, or where alternative methods of determining maximum demand are used, attach additional page(s) detailing the methods and reasoning used.

*make multiple copies of this page to record details of maximum demand calculations for each subsequent set of installation submains as determined in Section 2.1

**remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

***leave this page blank if the installation arrangement does not include any submains

Maximum Demand of Submain No._____.					
AS/NZS 3000 Reference:					
Load	**Load Group**	**Calculation**	**Demand**		
			A	**B**	**C**
		Total(s):			

Submain No._____Maximum Demand:	

Topic Skills Practice 5.0

2.3.3 Use applicable Australian Standards to determine the maximum demand of each installation final subcircuit, and record details in the following table.

*remember to fill in the applicable maximum demand fields in the installation schedules provided in Section 1.3.1

Maximum Demand of Final Subcircuits			
AS/NZS 3000 Reference:			
Final Subcircuit	**Load Group**	**Method of Determination**	**Maximum Demand**

Topic Skills Practice 5.0

2.4 Select Cables for Mains, Submains and Final Subcircuits

2.4.1 Select cables for the medical centre consumer's mains, in accordance with the job specification and applicable Australian Standards. Use the following spaces to record details of your cable selections.

Current Carrying Capacity of Consumer's Mains				
Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
	Table	Column	Table	Column

2.4.2 Determine the voltage drop in the consumer's mains, and document all details and calculations in the following table.

Voltage Drop in Consumer's Mains							
Cable Size	Cable Type	Circuit Loading	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column
Working:							

Topic Skills Practice 5.0

2.4.3 Select suitable submains (where applicable) for the medical centre installation. Use as many rows as necessary in the following table to record details of your submain cable selections.

Current Carrying Capacity of Submains					
Submain No.	Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
		Table	Column	Table	Column

2.4.4 Determine the voltage drop in each of the installation submains. Document all details and calculations using as many rows as is necessary in the following table. Additional space for working if provided on the following page.

Voltage Drop in Submains							
Submain No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column
Working:							

Topic Skills Practice 5.0

2.4.5 Select suitable conductors based on current carrying capacity, for each installation final subcircuit.

Use as many rows as necessary in the following table to record details of your final subcircuit cable selections.

Current Carrying Capacity of Final Subcircuits – Reception/Café Area					
Final Subcircuit	Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
		Table	Column	Table	Column

Topic Skills Practice 5.0

2.4.6 Determine the voltage drop at the terminals of the furthest installation socket-outlet. Show all details and calculations in the following table, and attach additional pages if required.

Voltage Drop at Furthest Socket-Outlet							
Circuit No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column
Working:							

2.4.7 Determine the voltage drop at the terminals of the furthest installation light fitting. Show all details and calculations in the following table, and attach additional pages if required.

Voltage Drop at Furthest Light Fitting							
Circuit No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column
Working:							

Topic Skills Practice 5.0

2.5 Select Circuit Protection Devices

2.5.1 Calculate the fault level at each installation switchboard and complete the relevant data in your installation schedules from section 1.3.1.

2.5.2 Select protection devices, in accordance with AS/NZS 3000 and AS/NZS 3003, to ensure that each installation submain and final subcircuit is suitably protected against:

- Overloads
- Earth faults
- Short-circuit
- Earth leakage

2.5.3 Record details of your protection device selections in your installation schedules.

2.5.4 Identify the following items on the drawing A4.4, provided on page 10:

- the location of the main switchboard and any distribution boards
- the locations of all EP junctions, nodes and test points
- the cable routes of all equipotential bonding conductors

2.5.5 Calculate the fault loop impedance and prospective fault current for a fault of negligible impedance at the terminals of the furthest installation socket-outlet.

Fault Loop and Prospective Fault Current at Furthest Socket-Outlet				
Cable Size	**Circuit Protection Device**	**Route Length**	**Fault Loop Impedance**	**Prospective Fault Current**
Working:				
Will the circuit protection operate in the required time?			**□ Yes**	**□ No**

Topic Skills Practice 5.0

2.5.6 Calculate the fault loop impedance and prospective fault current for a fault of negligible impedance at the outlet terminals of the furthest socket-outlet of the longest service pillar circuit.

Fault Loop and Prospective Fault Current at Furthest Light Fitting				
Cable Size	**Circuit Protection Device**	**Route Length**	**Fault Loop Impedance**	**Prospective Fault Current**
Working:				
Will the circuit protection operate in the required time?			**□ Yes**	**□ No**

3. Completing the Skills Practice

3.1 Skills Practice Review Questions

3.1.1 Answer the following questions after you have successfully completed all required sections and documentation from Section 2.

1. List three locations classified as 'body-protected' areas, and three locations classified as 'cardiac-protected' areas, as specified in AS/NZS 3003.

Topic Skills Practice 5.0

2. List the types of leakage protection devices (LPDs) permitted for use in classified patient areas. Provide AS/NZS 3000 and/or AS/NZS 3003 clauses to support your answers.

3. List the protection and control required for an item of fixed electrical equipment in a body-protected electrical area. Provide AS/NZS 3000 and/or AS/NZS 3003 clauses to support your answer.

4. List the protection and control required for a socket-outlet in a cardiac-protected electrical area. Provide AS/NZS 3000 and/or AS/NZS 3003 clauses to support your answer.

5. What is the minimum size and maximum resistance for an equipotential bonding conductor connected to exposed metal in an intensive care unit (ICU)? Provide AS/NZS 3000 and/or AS/NZS 3003 clauses to support your answer.

Topic Skills Practice 5.0

6. What are the requirements for the locations of LPD controls and indicators within patient areas? Provide AS/NZS 3000 and/or AS/NZS 3003 clauses to support your answer.

_____

_____

_____

7. List three parts that are required to be equipotentially bonded in cardiac-protected patient areas. Provide AS/NZS 3000 and/or AS/NZS 3003 clauses to support your answer.

_____

_____

_____

_____

	 *Feedback* Have your teacher/trainer check your answers	Teacher/Trainer Initials and Date	√

Topic Skills Practice Cover Sheet

Unit Name:	UEENEEG120A Select and arrange equipment for special LV electrical installations
Topic Title:	Shows and Carnivals

Skill Practice Number:	6.0
Skill Practice Name:	Music Festival Installation Planning

Student Name:	
Student ID:	
College/Campus:	
Group:	

Results	
Planning:	
Carryout:	
Completion:	
Overall Results:	
Comments:	

Topic Skills Practice Cover Sheet

Documentation Checklist		
Section	**Documentation**	**Complete**
1.2.3	Mark-Up of the Installation Site Plan (Drawing A5.1)	☐
1.3.1	Installation Schedule – Cascadable Reticulation Units (CRUs) (one for each CRU)	☐
1.3.1	Installation Schedule – Outlet Box (one for each outlet box)	☐
1.3.1	Installation Schedule – Electrical Portable Outlet Devices (EPODs) (one for each EPOD)	☐
2.2.1	Submains – Wiring Systems and Arrangements	☐
2.3.1	Current Carrying Capacity of Submains	☐
2.3.2	Voltage Drop in Submains	☐

Topic Skills Practice 6.0

UEENEEG120A Select and arrange equipment for special LV electrical installations

KS01-EG120A Special electrical installations planning

Topic: 6. Shows and Carnivals

Skills Practice 6.0: Music Festival Installation Planning

Task:

To select and arrange electrical wiring and equipment for a music festival, in accordance with AS/NZS 3000, AS/NZS 3002 and AS/NZS 3008.

Objectives:

At the completion of this skills practice, you should be able to:

- Identify electrical installation requirements for shows and carnivals.
- Identify suitable power distribution arrangements for shows and carnivals.
- Determine the maximum demand of submains for shows and carnivals.
- Select and arrange cables and wiring systems for shows and carnivals.
- Select and arrange protection devices for shows and carnivals.
- Select and arrange electrical equipment and accessories for shows and carnivals.
- Document the selection and arrangement of wiring and equipment for shows and carnivals.

Topic Skills Practice 6.0

1. Planning the Unit Skills Test

1.1 Research Music Festival Installation Requirements

1.1.1 Research AS/NZS 3000 and AS/NZS 3002 requirements for the selection, arrangement and installation of electrical wiring and equipment for a music festival.

The following reference material will include some useful information:

- Pethebridge, K. and Neeson, I., Electrical Wiring Practice. McGraw-Hill, Seventh Edition, Volume 2, 2012 (Chapter 8)
- Hampson, J., Electrotechnology Practical, Pearson Education, Third Edition, 2013 (Section 8)

1.1.2 Once you feel you have sufficient knowledge of the subject matter, obtain the following materials to assist you with carrying out this skills practice:

- AS/NZS 3000 *Wiring Rules*
- AS/NZS 3002 Electrical installations – Shows and carnivals
- AS/NZS 3001 Electrical installations – Transportable structures and vehicles including their site supplies
- AS/NZS 3008.1.1 Electrical installations – Selection of cables
- Manufacturer's catalogues
- Pens/pencils
- Ruler

1.2 Music Festival Electrical Specification

1.2.1 Scope	
1.2.1.1 General	This specification sets out the requirements for the planning and design of a temporary electrical installation to service a three day music festival. All facets of the installation design and planning shall comply with: • the provisions of this specification • the requirements of AS/NZS 3000 • the requirements of AS/NZS 3001 • the requirements of AS/NZS 3002 • the requirements of AS/NZS 3008
1.2.1.2 Definitions	The definitions used throughout this specification will be as per those used in AS/NZS 3000, AS/NZS 3001, AS/NZS 3002 and AS/NZS 3008.

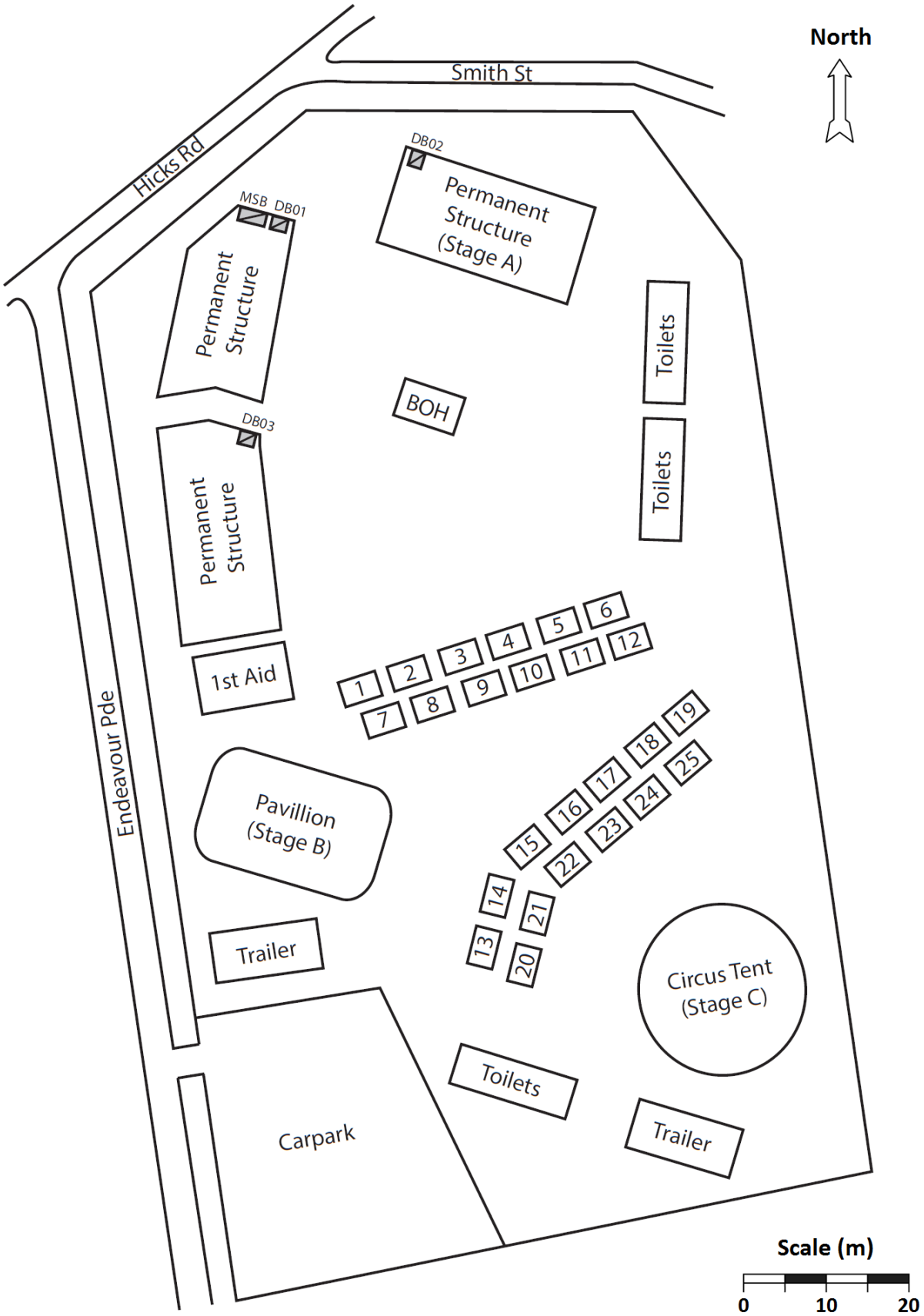
1.2.1.3 Inclusions	The scope of work extends to the design and selection of equipment for low voltage power distribution to: • 25 festival concessions • 3 temporary toilet blocks • 2 trailers • the first aid tent • the pavilion (stage B) • the circus tent (stage C)
1.2.1.4 Exclusions	The scope of work excludes the provision of any permanent electrical fixtures at the site. Each permanent structure and the back of house (BOH) (see drawing A5.1) are provided with a permanent electrical supply.
1.2.2 Installation Arrangement	
1.2.2.1 Supply	Supply to the temporary electrical installation will be obtained by direct connection to the permanent electrical installation, from one or more of the following: • DB01, CB07 (250 A four-pole MCCB) • DB02, CB13 (160 A four-pole MCCB) • DB03, CB04 (250 A four-pole MCCB)
1.2.2.2 Power Distribution	Power will be distributed across the site, in accordance with schedule 1 (below), and drawing A5.1 (page 6) by way of: • Cascadable Reticulation Units (CRUs) • Outlet Boxes • Electrical Portable Outlet Devices (EPODs)
1.2.2.3 Voltage Drop	The maximum voltage drop permitted across the temporary portion of the installation is 4 %.
1.2.2.4 Concessions	Each concession (numbers 1 to 25) (see drawing A5.1) shall be provided with individual connection facilities consisting of at least: • 4 x 230 V, 10 A socket-outlets
1.2.2.5 Toilet Blocks	Each toilet block shall be provided with a directly connected 230 V, 32 A supply.

Topic Skills Practice 6.0

1.2.2.6 Trailers	Each trailer shall be provided with a directly connected 230 V, 32 A supply.
1.2.2.7 First Aid Tent	The First Aid tent shall be provided with connection facilities consisting of at least: • 8 x 230 V, 10 A socket-outlets
1.2.2.8 The Pavilion (Stage B)	The pavilion shall be provided with connection facilities consisting of at least: • 3 x 400 V, 32 A socket-outlets • 1 x 230 V, 15 A socket-outlet • 12 x 230 V, 10 A socket-outlets
1.2.2.9 The Circus Tent (Stage C)	The circus tent shall be provided with connection facilities consisting of at least: • 3 x 400 V, 32 A socket-outlets • 1 x 230 V, 15 A socket-outlet • 12 x 230 V, 10 A socket-outlets

Topic Skills Practice 6.0

1.2.3 Drawing A5.1 – Music Festival Site Plan



Topic Skills Practice 6.0

1.3 Music Festival Planning Documentation

1.3.1 The schedules on pages 8 to 10 are for the purpose of developing a progressive record of distribution and protection arrangements, to be completed as you progress through the various planning stages.

Note: You will need to make multiple copies of the schedules on pages 8, 9 and 10 to complete documentation for each individual CRU.

Installation Schedule – Cascadable Reticulation Unit (CRU)			
CRU Number:			
Installation Location:			
Manufacturer:		**Part No:**	
Rated Voltage/Current:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Reticulation Outputs/Sockets-Outlets	Overcurrent Protection	Additional Protection
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Topic Skills Practice 6.0

Installation Schedule – Outlet Box			
Outlet Box No:			
Installation Location:			
Manufacturer:		**Part No:**	
Rated Voltage/Current:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Reticulation Outputs/Sockets-Outlets	Overcurrent Protection	Additional Protection
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Topic Skills Practice 6.0

Installation Schedule – Electrical Portable Outlet Device (EPOD)			
EPOD No:			
Installation Location:			
Manufacturer:		**Part No:**	
Rated Voltage/Current:		**IP Rating:**	
Overcurrent Protection:		**Fault Level:**	

	Sockets-Outlets	Overcurrent Protection	Additional Protection
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Topic Skills Practice 6.0

2. Carrying Out the Skills Practice

2.1 Divide the Installation into Circuits

2.1.1 Use the job specifications and applicable Australian Standards to plan out the required number and arrangement of cascadable reticulation units (CRUs), outlet boxes, and electrical portable outlet devices (EPODs).

2.1.2 Identify the following items on the site plan (drawing A5.1) provided on page 7:

- the locations of all CRUs
- the locations of all outlet boxes
- the locations of all EPODs
- the cable routes for all power reticulation cabling

2.1.3 Assign a unique identification number to each CRU, outlet box and EPOD you identified on the site plan. Create an installation schedule for each, using copies of the installation schedules provided in Section 1.3.1, and complete the location data for each case.

2.1.4 Use manufacturer's catalogues to select suitable CRUs, outlet boxes and EPODs for each installation location and complete the applicable sections in your installation schedules.

2.1.5 Identify the reticulation circuits and socket-outlets to be supplied from each CRU, outlet box and EPOD, and record details in your installation schedules.

2.2 Select Wiring Systems for Power Reticulation

2.2.1 Use Australian Standards to select wiring systems for the music festival power reticulation cabling.

Make copies of the table on page 12, as necessary, to record details of suitable wiring systems for the supply of all CRUs, outlet boxes, and direct connections.

Topic Skills Practice 6.0

Submains – Wiring Systems and Arrangements											
											Submains
											Originating From
											Terminating At
											Route Length
											Wiring System / Installation Methods
											Specific Installation Conditions and External Influences

Topic Skills Practice 6.0

2.3 Select Cables for Power Reticulation

2.3.1 Use AS/NZS 3000, AS/NZS 3002, and AS/NZS 3008 to select suitable cables for each submain identified for the music festival installation. Make copies of the following table, as necessary, to record details of each submain cable selection.

Current Carrying Capacity of Submains					
Submain No.	Minimum Cable Size	Current Carrying Capacity		Rating/Derating	
		Table	Column	Table	Column

Topic Skills Practice 6.0

2.3.2 Determine the voltage drop in each of the installation submains. Make copies of the following table, as necessary, to record details for each installation submain. Show your working on page 15, and attach additional sheets where necessary.

Voltage Drop in Submains							
Submain No.	Cable Size	Demand	Route Length	Voltage Drop		AS/NZS 3008.1.1	
				Volts	%	Table	Column

Topic Skills Practice 6.0

Working:

Topic Skills Practice 6.0

2.4 Fault Loop Impedance and Prospective Fault Current

2.4.1 Calculate the fault loop impedance, prospective fault current, and fault level, for a fault of negligible impedance at the supply terminals of each CRU, outlet box, EPOD and direct connection point, based on your cable selections, and the following impedance data:

- fault loop - supply transformer to DB01 = 0.19 Ω
- fault loop - supply transformer to DB02 = 0.31 Ω
- fault loop - supply transformer to DB03 = 0.36 Ω

Show your working in the spaces provided below and on the following page. Attach additional sheets if necessary, and remember to fill in the relevant data in your installation schedules.

Working:

Topic Skills Practice 6.0

Working:

Topic Skills Practice 6.0

3. Completing the Skills Practice

3.1 Skills Practice Review Questions

3.1.1 Answer the following questions after you have successfully completed all required sections and documentation from Section 2.

1. What is the maximum duration for an event to come under the scope of AS/NZS 3002? Provide AS/NZS 3000 and/or AS/NZS 3002 clauses to support your answers.

2. List the control and protection requirements for cascadable reticulation units (CRUs). Provide AS/NZS 3000 and/or AS/NZS 3002 clauses to support your answers.

3. What is the maximum length for a 16 A flexible cord having 2.5 mm^2 conductors intended for the connection of a load at a showground? Provide AS/NZS 3000 and/or AS/NZS 3002 clauses to support your answer.

4. List two factors that should be taken into consideration when determining the maximum demand of concessions for shows and carnivals. Provide AS/NZS 3000 and/or AS/NZS 3002 clauses to support your answer.

Topic Skills Practice 6.0

5. What is the minimum degree of protection for a socket-outlet mounted on a cascadable reticulation unit (CRU) for use at a show or carnival? Provide AS/NZS 3000 and/or AS/NZS 3002 clauses to support your answer.

_____

_____

6. In Australia, what type of switching is required for a socket-outlet mounted on an outlet box at a show or carnival? Provide AS/NZS 3000 and/or AS/NZS 3002 clauses to support your answer.

_____

_____

_____

7. What is the minimum current rating for a socket-outlet mounted on a cascadable reticulation unit (CRU) for use at a show or carnival? Provide AS/NZS 3000 and/or AS/NZS 3002 clauses to support your answer.

_____

_____

8. What is the minimum conductor size for flexible cord supplying decorative lighting at a show or carnival? Provide AS/NZS 3000 and/or AS/NZS 3002 clauses to support your answer.

_____

_____

	 *Feedback* Have your teacher/trainer check your answers	Teacher/Trainer Initials and Date	√

Topic Skills Practice Cover Sheet

Unit Name:	UEENEEG120A Select and arrange equipment for special LV electrical installations
Topic Title:	HV Installation in Consumer's Premises

Skill Practice Number:	7.0
Skill Practice Name:	High Voltage Installation Planning

Student Name:	
Student ID:	
College/Campus:	
Group:	

Results	
Planning:	
Carryout:	
Completion:	
Overall Results:	
Comments:	

Topic Skills Practice Cover Sheet

Documentation Checklist		
Section	**Documentation**	**Complete**
1.2.3	Mark-Up of the Installation Site Plan (Drawing A6.1)	☐
1.3.1	Installation Schedule – Power Transformer	☐
1.3.2	HV Distribution Single Line Diagram	☐
1.3.3	Main Substation Layout Sketch	☐
2.2.1	HV Feeders and Final Subcircuits – Wiring Systems and Arrangements	☐
2.2.1	LV Submains – Wiring Systems and Arrangements	☐
2.3.1	Maximum Demand of Consumer's Mains	☐

Topic Skills Practice 7.0

UEENEEG120A Select and arrange equipment for special LV electrical installations

KS01-EG120A Special electrical installations planning

Topic: 7. HV Installation in Consumer's Premises

Skills Practice 7.0: High Voltage Installation Planning

Task:

To select and arrange high voltage wiring and equipment for an industrial consumer installation in accordance with AS 2067 and local supply rules.

Objectives:

At the completion of this skills practice, you should be able to:

- Identify safety requirements for high voltage consumer installations.
- Identify suitable power distribution arrangements for high voltage consumer installations.
- Determine the maximum demand of consumer's mains for high voltage consumer installations.
- Select and arrange cables and wiring systems for circuits in high voltage consumer installations.
- Select and arrange electrical equipment and accessories for high voltage consumer installations.
- Document the selection and arrangement of wiring and equipment for high voltage consumer installations.

Topic Skills Practice 7.0

1. Planning the Unit Skills Test

1.1 Research HV Installation Requirements

1.1.1 Research AS 2067 and local supply requirements for the selection, arrangement and installation of high voltage wiring and equipment in consumer premises.

The following reference material will include some useful information:

- Pethebridge, K. and Neeson, I., Electrical Wiring Practice. McGraw-Hill, Seventh Edition, Volume 2, 2012 (Chapter 8)

1.1.2 Once you feel you have sufficient knowledge of the subject matter, obtain the following materials to assist you with carrying out this skills practice:

- AS 2067 Substations and HV installations exceeding 1 kV a.c.
- Local service and installation rules
- Manufacturer's catalogues
- Pens/pencils
- Ruler

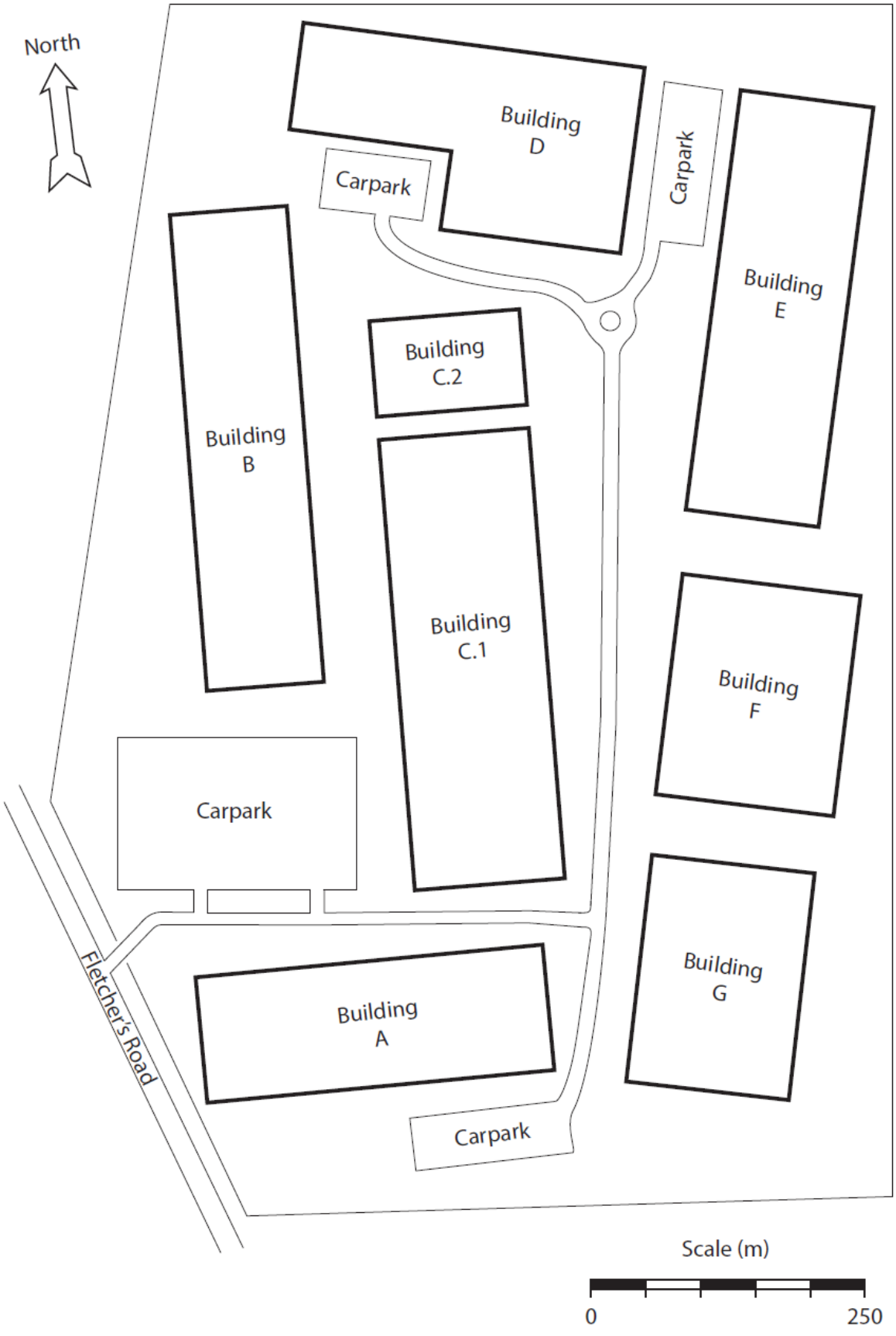
1.2 HV Installation Electrical Specification

1.2.1 Scope	
1.2.1.1 General	This specification sets out the planning and design requirements for high voltage distribution across a consumer installation, for the purpose of supplying high voltage and low voltage loads. The installation design and planning shall comply with: • the provisions of this specification • the requirements of AS 2067
1.2.1.2 Definitions	The definitions used throughout this specification will be as per those used in AS 2067.
1.2.1.3 Inclusions	The scope of planning and design work extends to the provision of a high/low voltage distribution system across the site to: • supply several HV motors • supply low voltage building services
1.2.1.4 Exclusions	The scope of work excludes the planning and design of low voltage final subcircuits.

1.2.2 Installation Arrangement	
1.2.2.1 Supply	A customer main substation shall be provided for connection of an 11 kV electricity distributor supply, located either on the western side of Building B, within and not more than 50 m from the site boundary.
1.2.2.2 Consumer's Mains	The type and size of cables shall be determined in consultation with the local electricity distributor, and in accordance with the requirements of AS 2067.
1.2.2.3 Transformers	Step-down transformers shall be selected, installed and arranged in accordance with the requirements of AS/NZS 3000 and AS 2067.
1.2.2.4 HV Motors	High voltage circuits shall be provided for the supply of the following HV motors: • 6 x 200 kW, 3.3 kV three phase squirrel-cage induction motors located at the southern end of Building E • 4 x 400 kW, 3.3 kV three phase squirrel-cage induction motors located at the northern end of Building F • 8 x 500 kW, 6.6 kW three phase squirrel-cage induction motors located at the eastern end of Building D
1.2.2.5 LV Distribution	Switchboards and submains shall be arranged so that a 400/230 V, 600A supply is provided to Buildings A, B, C.1, D, E, F, and G, and a 400/230 V, 400 A supply is provided to Building C.2.

Topic Skills Practice 7.0

1.2.3 Drawing A6.1 – HV Consumer Installation Site Plan



Topic Skills Practice 7.0

1.3 HV Installation Planning Documentation

1.3.1 The installation schedule provided below is for the purpose of developing a progressive record of HV distribution arrangements, to be completed as you progress through the various planning stages.

Note: You will need to make multiple copies of this installation schedule to complete documentation for each installation HV transformer.

Installation Schedule – Step-Down Transformer			
Transformer ID:			
Installation Location:			
Manufacturer:		**Part No:**	
Impedance (%):		**Fault Level:**	
Power Rating:		**Insulation Class:**	
Primary Voltage:		**Secondary Voltage:**	
Primary Current:		**Secondary Current:**	

	Connected Loads	Max Demand	Overcurrent Protection	Additional Protection
1				
2				
3				
4				
5				
6				

Topic Skills Practice 7.0

1.3.2 Complete a single line diagram of your high voltage distribution arrangement in the space provided on this page.

High Voltage Distribution – Single Line Diagram

Topic Skills Practice 7.0

1.3.3 Sketch the layout of your main substation in the space provided on this page. Show the locations and clearances between all high voltage components and equipment.

Main Substation Layout Sketch

Topic Skills Practice 7.0

2. Carrying Out the Skills Practice

2.1 Arrange the Installation Power Distribution

2.1.1 Use the job specifications and applicable Australian Standards to plan out the required number and arrangement of transformers and switchboards to supply the installation.

2.1.2 Identify the following items on the site plan (drawing A6.1) provided on page 6:

- the locations of all transformers
- the locations of all switchboards
- the cable routes for all HV circuits
- the cable routes for all LV submains

2.1.3 Assign a unique identification number to each transformer and switchboard you identified on the site plan. Create an installation schedule for each transformer by making copies of the installation schedule provided on page 7, and complete the location data for each case.

2.1.4 Use manufacturer's catalogues to select suitable transformers for each installation location and complete the applicable sections in your installation schedules.

2.1.5 Identify the switchboards and HV loads to be supplied from each transformer and record details in your installation schedules.

2.1.6 Use the space provided on page 8 to draw a single line diagram of the HV distribution system, using Australian Standard symbols and drawing conventions.

2.1.7 Use the space provided on page 9 to sketch the layout of the main installation substation showing the locations, arrangement and clearances between high voltage equipment.

2.2 Select HV Wiring Systems

2.2.1 Select wiring systems for the installation HV feeders, in accordance with Australian Standards and local supply rules.

Use as many rows as necessary in the following tables to describe the wiring systems, installation methods, and any specific installation conditions and/or external influences affecting your selection.

- Use the table on page 11 to list details of wirings systems selected for HV feeders and final subcircuits.
- Use the table on pages 12 to list details of wirings systems selected for LV submains.

Topic Skills Practice 7.0

HV Feeders and Final Subcircuits – Wiring Systems and Arrangements										
										High Voltage Circuits
										Originating From
										Terminating At
										Route Length
										Wiring System / Installation Methods
										Specific Installation Conditions and External Influences

Topic Skills Practice 7.0

Low Voltage Submains – Wiring Systems and Arrangements										
										Low Voltage Submains
										Originating From
										Connected Load
										Route Length
										Wiring System / Installation Methods
										Specific Installation Conditions and External Influences

Topic Skills Practice 7.0

2.3 Determine Maximum Demand

2.3.1 Use applicable Australian Standards to determine the maximum demand of the installation consumer's mains. Record details of calculations in the following table, or where an alternative method of determining maximum demand is used, attach additional page(s) detailing the methods and reasoning used.

Maximum Demand of Consumer's Mains				
Load	**Determination**	**Demand**		
		A	**B**	**C**
Totals:				

Consumer's Mains Maximum Demand:	

Topic Skills Practice 7.0

3. Completing the Skills Practice

3.1 Skills Practice Review Questions

3.1.1 Answer the following questions after you have successfully completed all required sections and documentation from Section 2.

1. List three types of consumer's premises in which a HV installation might typically be required.

_____

_____

_____

2. List the definition of 'high voltage'. Provide AS/NZS 3000 and/or AS 2067 clauses to support your answer.

_____

_____

3. List two neutral earthing methods used in HV installations. Provide AS 2067 clauses to support your answer.

_____

_____

4. List four types of protection that are required in HV installations. Provide AS 2067 clauses to support your answer.

_____

_____

_____

_____

_____

Topic Skills Practice 7.0

5. List five external influences and/or installation conditions, characteristic of HV installations, that are likely to affect the selection and arrangement of HV wiring and equipment. Provide AS 2067 clauses to support your answer.

6. List the three functional requirements for a high voltage switching device. Provide AS 2067 clauses to support your answer.

7. What are the minimum depths in ground for high voltage cables installed underground, with and without mechanical protection? Provide AS 2067 clauses to support your answers.

	 *Feedback*	Have your teacher/trainer check your answers	Teacher/Trainer Initials and Date	√