



Australian Government

UEPOPS442B Monitor and coordinate the operation of a combined cycle gas turbine unit

Release 2

UEPOPS442B Monitor and coordinate the operation of a combined cycle gas turbine unit

Modification History

Release	Action	Core/Elective	Details	Points
2	Edit		Correct pre-requisite code to reflect title UEPOPS340B Operate and monitor a steam turbine	

Unit Descriptor

Unit Descriptor

1) Scope:

1.1) Descriptor

This unit deals with the skills and knowledge required to simultaneously operate and monitor a Combined Cycle Plant for the safe and effective management of energy production to meet demand on combined cycle gas turbine electricity generating unit.

Application of the Unit

Application of the Unit 2)

A Combined Cycle Plant consisting of a Gas Turbine and associated generator, Heat Recovery Steam Generator, Steam Turbine and associated generator.

This unit is intended to augment formally acquired competencies.

Licensing/Regulatory Information

License to practice 3)

The skills and knowledge described in this unit are subject

License to practice

3)

to regulations directly related to Occupational Health and Safety. Individuals may require a licence to practise in the workplace depending on the requirements of the various State OHS regulations.

Pre-Requisites

Prerequisite Unit(s)

4)

Competencies

4.1)

Granting of competency in this unit shall be made only after competency in the following unit(s) has/have been confirmed.

Where pre-requisite pathways have been identified. All competencies in the Common Unit Group must have been completed.

Common Unit Group

Unit Code	Unit Title
UEPOPS314B	Operate and monitor fuel firing plant (gas or oil)
UEPOPS333B	Operate and monitor H.R.S.G. hot gas control system
UEPOPS336B	Operate and monitor gas turbine unit
UEPOPS340B	Operate and monitor a steam turbine

Literacy and numeracy skills

4.2)

Participants are best equipped to achieve this unit if they have reading, writing and numeracy skills indicated by the following levels. A description of what each level entails is provided in Section 2.3.1 Language, Literacy and Numeracy.

Reading 4 Writing 4 Numeracy 4

Employability Skills Information

Employability Skills 5)

The required outcomes described in this unit of competency contain applicable facets of Employability Skills. The Employability Skills Summary of the qualification in which this unit of competency is packaged will assist in identifying Employability Skill requirements.

Elements and Performance Criteria Pre-Content

6) Elements describe the essential outcomes of a competency standard unit
Performance Criteria describe the required performance needed to demonstrate achievement of the element.
Assessment of performance is to be consistent with the Evidence Guide.

Elements and Performance Criteria

ELEMENT	PERFORMANCE CRITERIA
1 Plan for plant operation	1.1 Safety issues are identified to comply with enterprise/site requirements 1.2 Work, plant and resource requirements are identified from relevant information and documentation 1.3 Pre-operational checks are carried out in accordance with enterprise and site requirements
2 Operate Heat Recovery Steam Generator	2.1 Gas turbine exhaust gas flow and power output are adjusted to achieve required steam flow and conditions, observing operating requirements 2.2 Supplementary Firing System (if provided) is placed into and out of service as required to maintain design steam flow and steam conditions.

ELEMENT	PERFORMANCE CRITERIA
	2.3 Plant is operated within limits of plant design, enterprise or site requirements 2.4 Plant is operated, monitored and observed to detect deviations from required operating conditions 2.5 Corrective action is taken to rectify abnormalities in accordance with manufacturer's and enterprise/site procedures
3 Operate generator and excitation system	3.1 System is operated in accordance with enterprise/site and manufacturer's operating procedures 3.2 Synchronising requirements are assessed, evaluated and achieved to ensure machine/system stability during synchronising 3.3 System is monitored and observed to detect deviations from normal operating conditions 3.4 Corrective actions are taken to rectify abnormalities in accordance with manufacturer's and enterprise/site procedures 3.5 Where appropriate, the teams and individuals roles and responsibilities within the team are identified and, where required, assist in the provision of the on-the-job training
4 Control generation of electrical energy	4.1 Generator output is adjusted to meet demand whilst observing operating requirements 4.2 Reactive power generation and voltage regulation requirements are assessed and the system is controlled to achieve the desired output 4.3 Generator stabilities and operating limits are assessed and the system is controlled to maintain those limits in accordance with enterprise/site and manufacturer's procedures 4.4 Generator cooling systems and limits are monitored and assessed, excitation system is controlled to maintain those limits in accordance

ELEMENT	PERFORMANCE CRITERIA
5 Coordinate unit operations	with enterprise/site and manufacturer's procedures
	5.1 Systems are operated to meet requirements whilst observing plant limitations
	5.2 Systems are monitored and observed to detect deviations from normal operating conditions
	5.3 Causes of abnormal operating conditions are identified by analysing the technical and operational information
	5.4 Corrective actions taken to rectify system abnormalities are in accordance with enterprise and site requirements
	5.5 System integrity, personnel safety and continuity of supply are maintained throughout
	5.6. Consultation with appropriate personnel is undertaken as required in accordance with site requirements
6 Monitor system/plant	5.7 Systems are operated at optimum efficiency
	6.1 System/plant to be monitored is physically identified
	6.2 System/plant is monitored for normal operation or to detect deviations
	6.3 Corrective action taken is in accordance with enterprise/site procedures
7 Test system/plant operation	6.4 Appropriate personnel are notified when defects and abnormal operating conditions are detected
	7.1 Tests are performed in accordance with defined procedures applicable to the operational test
	7.2 System/plant is observed for correct operational response
	7.3 Correct action is taken when response is not in accordance with documentation, plant/system integrity or personnel safety requirements

ELEMENT	PERFORMANCE CRITERIA
8 Analyse system/plant faults	7.4 System/plant is returned to required operational status upon completion of test
	8.1 Causes of abnormal system operating conditions are identified by analysing the technical and operational information in a logical and sequential manner
	8.2 Actions necessary to rectify fault are correctly determined
	8.3 System/plant integrity and personnel safety are maintained through consultation with appropriate personnel, and reference to plant, technical and operational documentation
9 Complete documentation	8.4 Appropriate personnel are arranged for local investigation of identified operational abnormalities
	9.1 Documentation is updated and plant problems, movements, abnormalities and status are reported and logged in accordance with enterprise/site procedures

Required Skills and Knowledge

REQUIRED SKILLS AND KNOWLEDGE

8) This describes the essential skills and knowledge and their level, required for this unit.

Evidence shall show that knowledge has been acquired monitoring and coordinating the operation of a combined cycle gas turbine unit.

All knowledge and skills detailed in this unit should be contextualised to current industry practices and technologies.

The extent of the Essential Knowledge and Associated Skills required follows:

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T1 Evidence shall show that knowledge has been acquired for safe working practices of:

- Relevant environmental, occupational health and safety legislation and regulations
- Enterprise procedures
- Plant drawings and manufacturers manuals
- Introduction to and typical arrangements of power production plant
- Relevant plant and equipment, its location and operating parameters
- Relevant state and territory regulations
- Electric motor types and characteristics
- Pump and compressor types and characteristics
- Valve, damper and actuator types and characteristics
- Switchgear types and characteristics
- Electrical protection types and characteristics
- Electrical principles
- Process control principles
- Plant process control systems
- Fan types and characteristics
- a.c. generators types and characteristics
- Transformers types and characteristics
- Generator excitation and cooling systems, types and characteristics
- Gas turbine principle of operation
- Gas turbine air intake, types and characteristics
- Gas turbine air inlet cooling and heating systems, types and characteristics
- Gas turbine exhaust, types and characteristics
- Gas turbine lubrication systems, types and characteristics
- Gas turbine control oil systems, types and characteristics
- Gas turbine water wash systems, types and characteristics
- Gas turbine cooling systems, types and characteristics
- Gas turbine water/steam injection systems, types and characteristics

REQUIRED SKILLS AND KNOWLEDGE

- Gas turbine combustion system, types and characteristics
- The principles of control of steam temperature and pressure throughout the full range of heat recovery steam generation operation up to and including maximum continuous rating
- Heat recovery steam generator efficiency
- The arrangement of the heat recovery steam generator gas path and water and steam circuits
- Fuel conditioning and supplementary firing equipment
- The heat recovery steam generator system components and their interaction with other plant and equipment external to that covered by this competency.
- a.c. and d.c. electrical distribution systems
- Duct burners types and characteristics
- Heat recovery steam generator construction and principles
- Thermodynamics
- Properties of Matter
- Steam turbine power and control oil systems, types and characteristics
- Compressed air systems, types and characteristics
- Steam turbine life expenditure and control
- Steam turbine bypass system types and characteristics
- Vacuum raising and turbine gland sealing systems;
- Steam Turbine types and characteristics
- Steam turbine lubrication systems types and characteristics
- Steam turbine condensate and feedwater systems
- Feedwater heating types and characteristics
- Drainage systems, types and characteristics
- Steam turbine circulating water system, types and characteristics
- Steam turbine condenser systems, types and characteristics
- Plant status
- Control and data acquisition systems
- Computers and software
- Supervisory, alarm, protection and control equipment
- Principles of generator and system stability
- The systems components and interactions
- Principles of electricity generation
- Lubrication and bearings
- Liquid pumping systems
- Power plant cycle
- Fuel type and properties
- Fuel conditioning and fuel firing equipment
- Air extraction systems
- High voltage systems

REQUIRED SKILLS AND KNOWLEDGE

- High voltage switching procedures

T2 Specific skills needed to achieve the Performance Criteria:

- Interpret plant drawings and manufacturers manuals
- Apply relevant state and territory regulations
- Apply enterprise recording procedures
- Identify plant status
- Prepare plant/equipment for operation
- Organise resources
- Coordinate power generation
- Apply diagnostic and testing techniques
- Identify and respond to abnormal plant operating conditions
- Plan and prioritise work
- Use relevant hand tools
- Communicate effectively
- Apply data analysis techniques and tools
- Coordinate the operation of interacting systems
- Coordinate the operation of plant and equipment
- Maintain generator unit integrity
- Apply principles of electrical generation.

Evidence Guide

EVIDENCE GUIDE

9) This provides essential advice for assessment of the competency standard unit and must be read in conjunction with the Performance Criteria and the Range Statement of the unit and the Training Package Assessment Guidelines.

The Evidence Guide forms an integral part of this competency standard unit and shall be used in conjunction with all components parts of this unit and, performed in accordance with the Assessment Guidelines of this Training Package.

Overview of Assessment

9.1)

Longitude competency development approaches to assessment, such as Profiling, require data to be reliably gathered in a form that can be consistently interpreted over time. This approach is best utilised in Apprenticeship programs and reduces assessment intervention. It is the Industry preferred model for apprenticeships.

However, where summative (or final) assessment is used it is to include the application of the competency in the normal work environment or, at a minimum, the application of the competency in a realistically simulated work environment. It is recognised that, in some circumstances, assessment in part or full can occur outside the workplace. However, it must be in accord with Industry and regulatory policy.

Methods chosen for a particular assessment will be influenced by various factors. These include the extent of the assessment, the most effective locations for the assessment activities to take place, access to physical resources, additional safety measures that may be required and the critical nature of the competencies being assessed.

The critical safety nature of working with electricity, electrical equipment, gas or any other hazardous substance/material carries risk in deeming a person competent. Hence, sources of evidence need to be 'rich' in nature so as to minimise error in judgment.

Activities associated with normal every day work have a bearing on the decision as to how much and how detailed the data gathered will contribute to its 'richness'. Some skills are more critical to safety and operational requirements while the same skills may be more or less frequently practised. These points are raised for the assessors to consider when choosing an assessment method and developing assessment instruments. Sample assessment instruments are included in the Assessment Guidelines of this Training Package.

Critical aspects of evidence required to demonstrate competency in this unit 9.2)

Before the critical aspects of evidence are considered all pre-requisites shall be met.

Evidence for competence in this unit shall be considered holistically. Each element and associated Performance Criteria shall be demonstrated on at least two occasions in accordance with the "Assessment Guidelines – UEP12". Evidence shall also comprise:

- A representative body of work performance demonstrated within the timeframes typically expected of the discipline, work function and industrial environment. In particular this shall incorporate evidence that shows a candidate is able to:

- Implement Occupational Health and Safety workplace procedures and practices including the use of risk control measures as specified in the Performance Criteria and Range Statement
- Apply sustainable energy principles and practices as specified in the Performance Criteria and Range Statement
- Demonstrate an understanding of the essential knowledge and associated skills as described in 6) Essential Knowledge and Associated Skills of this unit
- Demonstrate an appropriate level of employability skills
- Conduct work observing the relevant Anti-Discrimination legislation, regulations, policies and workplace procedure
- Demonstrated performance across a representative range of contexts from the prescribed items below:
 - The knowledge and application of relevant sections of: Occupational Health and Safety legislation; Statutory legislation; Enterprise/site safety procedures; Enterprise/site emergency procedures
 - The preparation and planning of work
 - The operation of generator and excitation systems
 - Coordination of unit operations
 - Analysing plant faults
 - Monitoring plant operation
 - Controlling system energy generation
 - The knowledge of generator and system stability principles
 - Dealing with an unplanned event by drawing on essential knowledge and skills to provide appropriate solutions incorporated in the holistic assessment with the above listed items.

Context of and specific resources for assessment 9.3)

This unit should be assessed as it relates to normal work practice using procedures, information and resources typical of a workplace. This should include:

- OHS policy and work procedures and instructions.
- Suitable work environment, facilities, equipment and materials to undertake actual work as prescribed by this unit.

Competency Standards should be assessed in the workplace or simulated workplace and under the normal range of workplace

conditions.

Assessment of this unit will be supported with documentary evidence, by means of endorsement stating type and application of work.

In addition to the resources listed above in Context of assessment', evidence should show competency working in limited spaces with different types of plant and equipment as well as different structural/construction types and methods and in a variety of environments.

**Method of
assessment**

9.4)

This unit shall be assessed by methods given in Section 1.3.00 Assessment Guidelines.

Note:

Competent performance with inherent safe working practices is expected in the Industry to which this unit applies. This requires that the specified essential knowledge and associated skills are assessed in a structured environment which is primarily intended for learning/assessment and incorporates all necessary equipment and facilities for learners to develop and demonstrate the essential knowledge and skills described in this unit.

**Concurrent
assessment and
relationship with
other units**

9.5)

There are no recommended concurrent assessments with this unit, however in some cases efficiencies may be gained in terms of learning and assessment effort being concurrently managed with allied competency standard units where listed.

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Range Statement

RANGE STATEMENT

10) This relates to the competency standard unit as a whole, providing the range of contexts and conditions to which the Performance Criteria apply. It allows for different work environments and situations that will affect performance.

Systems, plant and equipment may include generator cooling systems; fuel delivery systems; generator and generator auxiliary plant; generator seal oil system; generation fire protection system; boiler, turbine and unit coordinated control systems; generator circuit breaker/transformer; unit auxiliary switchboards; electricity market auto loading systems; generator excitation systems which may include- d.c. pilot exciters and amplidyne(s) control, a.c. pilot exciters and thyristor control, brushless systems, static systems, associated supervisory, control and protection equipment; Circuit breakers, field, excitor, flashing, associated supervisory, control and protection equipment; Transformers, excitation, earthing and neutral, voltage and current; and automatic voltage regulator (AVR) system.

Safety standards may include relevant sections of Occupational Health and Safety legislation, enterprise safety rules, national standards for plant, relevant State and federal legislation and Australian standards.

Information and documentation sources may include verbal or written communications; enterprise safety rules documentation; enterprise operating instructions; equipment and alarm manuals; dedicated computer equipment; enterprise standing instructions and plant notes; enterprise log books; market load profile forecasts; electricity market bidding information; and manufacturer's operation and maintenance manuals.

Technical and operational indicators may include stimuli (audio, smell, touch, visual), remote or local indicators and recorders, computers and alarms (visible and/or audible).

Communications may be by means of telephone, two way radio, pager, computer (electronic mail) and operating logs (written or verbal).

Tests may include supply change-over tests, "black" start tests and capability tests.

Appropriate personnel to consult, give or receive direction may include supervisor/team leader or equivalent; other coordinators of energy production; other operating staff; technical and engineering officers or equivalent; maintenance personnel; and contractor staff.

Operating environment may be remote from plant and equipment being operated; where operation is assisted by remote indicators of plant status and other parameters monitored; during night periods; during inclement or otherwise harsh weather conditions; and in wet/noisy/dusty areas.

Unit operations (systems requirements) may include normal generating models and system auto frequency control mode.

Faults and abnormal operating conditions may include unit trip; market distribution network disturbances; loss of station a.c. supplies; spurious abnormal fuel condition,

RANGE STATEMENT

operations; generator hydrogen cooling/sealing system malfunctions; generator cooling system malfunctions; generator excitation/transformer; CB faults/malfunctions; and unit coordinated controls malfunctions.

Generic terms are used throughout this Training Package for vocational standard shall be regarded as part of the Range Statement in which competency is demonstrated. The definition of these and other terms are given in Section 2.1 Preliminary Information and Glossaries.

Unit Sector(s)

Not applicable.

Competency Field

Competency Field	11)
	Operations