



Defence Awarding
Organisation

Qualification Handbook

DAO Level 4 Diploma in Nuclear
Submarine Engineering Management

QN: 601/6432/3

The Qualification

Overall Objective for the Qualifications

This handbook relates to the following qualification:

- Level 4 Diploma in Nuclear Submarine Engineering Management

This Level 4 Diploma provides the standards that must be achieved by individuals that are part of the Royal Navy Submarine School.

Pre-entry Requirements

Learners who are taking this qualification will need to working in the role within the Royal Navy Submarine School or on-board operating at sea.

Unit Content and Rules of Combination

This qualification is made up of a total of 7 mandatory units. To be awarded this qualification the candidate must achieve a total of 45 credits as shown in the table below.

Mandatory Units					
Unit Reference Number	Unit Title	Level	Credit Value	GLH	TQT
F/507/3100	The reactor primary & secondary systems	4	6	55	
Y/507/3099	The reactors electrical systems	4	6	58	
R/507/3098	The propulsion plant operation	4	6	56	
J/507/3101	Nuclear power plant performance	4	6	55	
L/507/3102	Nuclear power plant start up and close down in all modes of operation	5	8	74	
R/507/3103	Reactor materials, physics, chemistry & associated hazards	5	8	74	
Y/507/3104	Management of Ship's Safety - Officer of the Day	4	5	48	

Age Restriction

This qualification is available to learners aged 18 years and over.

Opportunities for Progression

This qualification creates a number of opportunities for progression to higher education and degrees

Exemption

No exemptions have been identified.

Qualification Units

URN:	F/507/3100
Title:	The reactor primary & secondary systems (mechanical)
Level:	4
Credit value:	6
GLH	55
TQT	
Learning outcomes	Assessment criteria
<i>The learner will:</i>	<i>The learner can:</i>
1. Understand the concepts of propulsion plant mechanical systems	1.1 Explain the function of propulsion plant mechanical system in all operating modes 1.2 Explain the dependencies of propulsion plant mechanical systems in all operating conditions 1.3 Explain the contribution of propulsion plant mechanical systems to overall plant operation in critical and shutdown conditions 1.4 Define reactor power states 1.5 Describe the basic layout of the primary circuit and its parameters 1.6 Explain the Full Operating Zone (FOZ) diagram and pressure and temperature transients 1.7 Describe the barriers to fission product release 1.8 Explain the various containment states and the containment required for the various plant states 1.9 Describe the tunnel doors and containment system operation 1.10 Describe containment audits and tests
2. Understand the function of propulsion plant primary systems mechanical	2.1 Explain the function of the primary circuit 2.2 Explain the function of the pressurising and pressure relief system 2.3 Explain the function of the emergency cooling/high pressure decay heat removal system 2.4 Explain the function of the coolant treatment and sampling systems 2.5 Explain the function of the coolant make-up and discharge systems 2.6 Explain the function of the valve operating and reactor air/reactor gas system 2.7 Explain the function of the reactor cooling fresh water/low pressure decay heat removal/alternative core reactor cooling

	<p>systems</p> <p>2.8 Explain the function of the shielding and pressurised water reactor</p> <p>2.9 Explain the emergency cooling and leak protection systems</p>
<p>3. Understand the function of propulsion plant secondary systems mechanical</p>	<p>3.1 Explain the purpose and layout of secondary systems</p> <p>3.2 Explain the function of the shafting systems</p> <p>3.3 Explain the function of steam systems</p> <p>3.4 Explain the function of the main and reserve feed systems</p> <p>3.5 Explain the function of the circulating water systems</p> <p>3.6 Explain the function of the ships fresh water cooling systems</p> <p>3.7 Explain the function of the lubricating oil systems</p> <p>3.8 Explain the function of the diesel generator system</p> <p>3.9 Explain the function of the freon and chilled water plants</p> <p>3.10 Explain the function of the control oil systems</p>
Additional information about the unit	
Unit purpose and aim(s)	This unit is about understanding the concepts of propulsion plant mechanical, the primary and secondary systems and their function on board a submarine
Unit expiry date	2019
Assessment requirements specified by a sector or regulatory body (if appropriate)	Assessed must be conducted in the workplace, in a training environment. Simulation is not permitted for this unit
Name of the organisation submitting the unit	Defence Awarding Organisation
Availability for use	Restricted

URN:	Y/507/3099	
Title:	The reactors electrical systems	
Level:	4	
Credit Value:	6	
GLH	58	
TQT		
Learning outcome	Assessment criteria	
<i>The learner will:</i>	<i>The learner can:</i>	
1. Understand the function of propulsion plant systems electrical	1.1 Explain the function of the propulsion plant electrical systems 1.2 Explain the purpose of the major components of the electrical system 1.3 Explain the principles of the power transfer 1.4 Explain the types and purpose of the shore supplies 1.5 Explain the types and purpose of the low voltage supplies	
Additional information about this unit		
Unit purpose and aim(s)	This unit is about understanding the function of the propulsion plant systems (electrical) on board a submarine	
Unit expiry date	2019	
Assessment requirements specified by a sector or regulatory body (if appropriate)	Assessed must be conducted in the workplace, in a training environment. Simulation is not permitted for this unit	
Name of the organisation submitting the unit	Defence Awarding Organisation	
Availability for use	Restricted	

URN:	R/507/3098
Title:	The propulsion plant operation
Level:	4
Credit Value:	6
GLH	56
TQT	
Learning outcome	Assessment criteria
<i>The learner will:</i>	<i>The learner can:</i>
1. Understand the principles of propulsion plant operation in all modes	1.1 Explain the procedures for responding to reactor protection emergencies 1.2 Explain the types and recoveries of rod control emergencies 1.3 Explain the power states and processes for normal operation at sea 1.4 Explain the principles of abnormal operation
2. Understand the principles of propulsion plant operation in emergency situations	2.1 Explain the principles of emergency operations 2.2 Explain the procedures for responding to steam leaks 2.3 Explain the procedures for responding to conductivity emergencies 2.4 Explain the procedures for responding to coolant leaks 2.5 Explain the procedures for responding to flow and heat sink emergencies 2.6 Explain the procedures for responding to ship emergencies 2.7 Explain the procedures for responding to feed system emergencies 2.8 Explain the procedures for responding to cooling system emergencies 2.9 Explain the procedures for responding to miscellaneous emergencies

Additional information about this unit	
Unit purpose and aim(s)	This unit is about understanding the function of the propulsion plant in all modes and actions to take in an emergency on board a submarine
Unit expiry date	2019
Assessment requirements specified by a sector or regulatory body (if appropriate)	Assessed must be conducted in the workplace, in a training environment. Simulation is not permitted for this unit
Name of the organisation submitting the unit	Defence Awarding Organisation
Availability for use	Restricted

URN:	J/507/3101	
Title:	Nuclear power plant performance	
Level:	4	
Credit Value:	6	
GLH	55	
TQT		
Learning outcome	Assessment criteria	
<i>The learner will:</i>	<i>The learner can:</i>	
1. Understand the principles of nuclear power plant performance	1.1 Explain the principles of basic operation and set points in a Pressurised Water Reactor (PWR) 1.2 Explain the principles of heat transfer in the PWR 1.3 Explain the limitations on maximum reactor power output 1.4 Explain the characteristics of plant dynamics	
2. Understand the circumstances of nuclear power plant failures	2.1 Explain the principles of reactor plant safety justification 2.2 Explain the concept of failure studies 2.3 Explain the types and consequences of reactor failures	
Additional information about this unit		
Unit purpose and aim(s)	This unit is about understanding the principles of nuclear power plant performance and the circumstances that causes failures in the plant system	
Unit expiry date	2019	
Assessment requirements specified by a sector or regulatory body (if appropriate)	Assessed must be conducted in the workplace, in a training environment. Simulation is not permitted for this unit	
Name of the organisation submitting the unit	Defence Awarding Organisation	
Availability for use	Restricted	

URN:	L/507/3102	
Title:	Nuclear power plant start up and close down in all modes of operation	
Level:	5	
Credit Value:	8	
GLH	74	
TQT		
Learning outcome	Assessment criteria	
<i>The learner will:</i>	<i>The learner can:</i>	
1. Understand officer responsibilities for nuclear power plant operation	1.1 Explain the purpose of the technical documentation relating to start up and close down 1.2 Compare the responsibilities of the different officers in relation to nuclear safety	
2. Understand the procedures for plant shut down	2.1 Explain the procedures for shutting down the plant 2.2 Explain the procedures and contingencies for operation with the plant shut down	
3. Understand the procedures for plant start up	3.1 Explain the procedures for plant start-up 3.2 Explain the procedures for preparation for sea	
Additional information about this unit		
Unit purpose and aim(s)	This unit is about understanding Officer responsibilities in relation to nuclear power plant operations, the shut down and start up procedures on board a submarine	
Unit expiry date	2019	

Assessment requirements specified by a sector or regulatory body (if appropriate)	Assessed must be conducted in the workplace, in a training environment. Simulation is not permitted for this unit
Name of the organisation submitting the unit	Defence Awarding Organisation
Availability for use	Restricted

URN:	R/507/3103
Title:	Reactor materials, physics, chemistry & associated hazards
Level:	5
Credit Value:	8
GLH	74
TQT	
Learning outcome	Assessment criteria
<i>The learner will:</i>	<i>The learner can:</i>
1. Understand the principles of the Pressurised Water Reactor (PWR) construction	1.1 Define the characteristics of core materials and primary circuit materials used in a PWR 1.2 Explain the features of PWR core construction 1.3 Summarise the strengths and limitations of materials used in the reactor pressure vessel
2. Understand the chemistry of a nuclear power plant	2.1 Explain the principles of chemistry in a nuclear power plant 2.2 Explain water radiolysis and activation 2.3 Explain primary circuit chemistry 2.4 Explain secondary plant chemistry
3. Understand the physics of the reactor core	3.1 Explain the principles of nuclear reaction 3.2 Explain the core layout including radiation detectors 3.3 Explain the behaviour of the reactor in its different operating states 3.4 Explain the physics of incidents and accidents in relation to reactivity
4. Understand the origins and impact of radiological hazards	4.1 Explain the systems for radiological protection 4.2 Define the properties of radiation 4.3 Summarise the biological effects of radiation 4.4 Quantify radiation risk and dose limits 4.5 Evaluate the impact of the external radiation hazard 4.6 Explain the procedures for response to radiation emergencies
5 Understand the procedures for responding to radiological hazards	5.1 Explain the nature of the external hazard 5.2 Explain the facilities for radiation monitoring 5.3 Explain the nature of the internal contamination hazard 5.4 Explain the methods for control of the internal hazard 5.5 Explain the facilities for contamination monitoring 5.6 Explain the submarine health physics procedures

	5.7 Explain the response requirements for submarine reactor accidents
Additional information about this unit	
Unit purpose and aim(s)	This unit is about understanding the principles of the pressurised water reactor construction, the chemistry and physics of the power plant. The impact of radiological hazards and the procedures to follow during a radiological incident.
Unit expiry date	2019
Details of the relationship between the unit and relevant National Occupational Standards or other professional standards or curricula (if appropriate)	N/A
Assessment requirements specified by a sector or regulatory body (if appropriate)	Assessed must be conducted in the workplace, in a training environment. Simulation is not permitted for this unit
Endorsement of the unit by a sector or other appropriate body (if required)	Skills for Justice
Location of the unit within the subject/sector classification system	Public Service
Name of the organisation submitting the unit	Defence Awarding Organisation
Availability for use	Restricted

URN:	Y/507/3104
Title:	Management of Ship's Safety (Officer of the Day - OOD)
Level:	4
Credit Value:	5
GLH	48
TQT	
Learning outcome	Assessment criteria
<i>The learner will:</i>	<i>The learner can:</i>
1. Understand Officer of the Day OOD responsibilities for logs and publications	1.1 Explain the purpose of relevant logs and publications required during OOD duties 1.2 Explain OOD responsibilities with respect to signing of logs 1.3 Explain the role of others in signing logs 1.4 Check logs and publications for accuracy during duty as OOD 1.5 Sign logs and publications during duty as OOD
2. Understand the importance of water tight integrity and effective control as Officer of the Day (OOD)	2.1 Explain the importance of the OOD's role in positive control of all hatches, watertight doors and hull openings 2.2 Check draught marks periodically throughout the duty and know the implications and consequent actions required 2.3 Explain the actions required by the OOD with respect to management of a significant change in the weather conditions
3. Understand the primary responsibilities of an Officer of the Day (OOD)	3.1 Explain the primary responsibilities of an OOD 3.2 Explain the relationship between the roles of OOD and Officer of the Watch (OOW)
4. Understand routines for assuming duty as an Officer of the Day (OOD)	4.1 Explain the requirements for internal and external rounds when assuming OOD duty 4.2 Explain the procedures for formal handover of OOD duty 4.3 Explain the requirements for ceremonial duties 4.4 Explain dockyard authorities permissions required for additional routines
5. Supervise other duty watch members during Officer of the Day (OOD) duty	5.1 Explain the roles and responsibilities of all other key members of the duty watch 5.2 Supervise duty watch routines and rounds 5.3 Confirm duty watch members carry out their duties as required 5.4 Confirm other duty watch members complete relevant duty

	logs 5.5 Check ventilation line ups personally
6. Understand requirements of a Damage Control Officer (DCO) when acting as Officer of the Day (OOD)	6.1 Explain the responsibilities of a DCO as required when acting as an OOD 6.2 Explain failures and emergencies that a DCO is required to respond to 6.3 Explain required responses for failures and emergencies 6.4 Explain the range and purpose of evolutions and exercises 6.5 Explain the command and control decisions made by DCO 6.6 Explain requirements for acting as a Local Commander (LC) during emergency stations and failures 6.7 Explain requirements for completing emergency and standard operating procedures
7. Act as a DCO when acting as Officer of the Day (OOD)	7.1 Carry out actions required as a LC 7.2 Coordinate and monitor responses to failures and emergencies 7.3 Supervise duty watch to carry out required emergency operating procedures 7.4 Direct support parties 7.5 Make command and control decisions 7.6 Give briefs for evolutions as required and make pipes for evolutions 7.7 Inform relevant others of actions taken 7.8 Make decisions to evacuate submarine as required during failures and emergencies
8. Understand the purpose and rules defining the ship's protection policy	8.1 Explain the potential threat from saboteurs and hostile forces to a submarine berthed alongside 8.2 Explain the responses and legal ramifications of an incident alongside 8.3 Explain the roles and responsibilities of the deterrent and response forces and the OOD authority in arming these teams 8.4 Explain the relationship between the OOD and shore authorities in the event of a security incident onboard
9. Understand the role of Specialist User Officer (SUO) for onboard explosives and pyrotechnics	9.1 Explain the purpose of the OOD in their role as the SUO for the charge and custody of explosive stores alongside
10. Understand the OOD responsibilities for the welfare of the ship's company and visitors	10.1 Explain the role as the Captain's representative for welfare issues and emergent compassionate cases involving the ship's company or visitors.
11. Understand the constraints defining outside communication with shore authorities	11.1 Explain the importance of the OOD's role in screening of all external communications from the submarine alongside
12. Understand the control required of external contractors and work on board	12.1 Explain the importance of close working relationships with all contractors and sub contractor's to ensure the integrity of ship's safety at all times

Additional information about this unit	
Unit purpose and aim(s)	This unit is about understanding the primary responsibilities of the Officer of the Day (OOD) their duties and supervision of duty staff. Supporting the ships company on welfare and controlling external contractors. The issue of explosives and pyrotechnics. The importance constraints and maintaining protocols in communications
Unit expiry date	2019
Assessment requirements specified by a sector or regulatory body (if appropriate)	Assessed must be conducted in the workplace, in a training environment. Simulation is not permitted for this unit
Name of the organisation submitting the unit	Defence Awarding Organisation
Availability for use	Restricted