

QUALIFICATIONS PACK - OCCUPATIONAL STANDARDS FOR ELECTRONICS INDUSTRY

What are Occupational Standards(OS)?

- OS describe what individuals need to do, know and understand in order to carry out a particular job role or function
- OS are performance standards that individuals must achieve when carrying out functions in the workplace, together with specifications of the underpinning knowledge and understanding

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Introduction

Qualifications Pack- Design Engineer

SECTOR: ELECTRONICS

SUB-SECTOR: PCB Assembly

OCCUPATION: Design

REFERENCE ID: ELE/Q8703

ALIGNED TO: NCO-2004/ NIL

Design Engineer: The Design Engineer assists on research and development of new products and systems and creates the initial drawings.

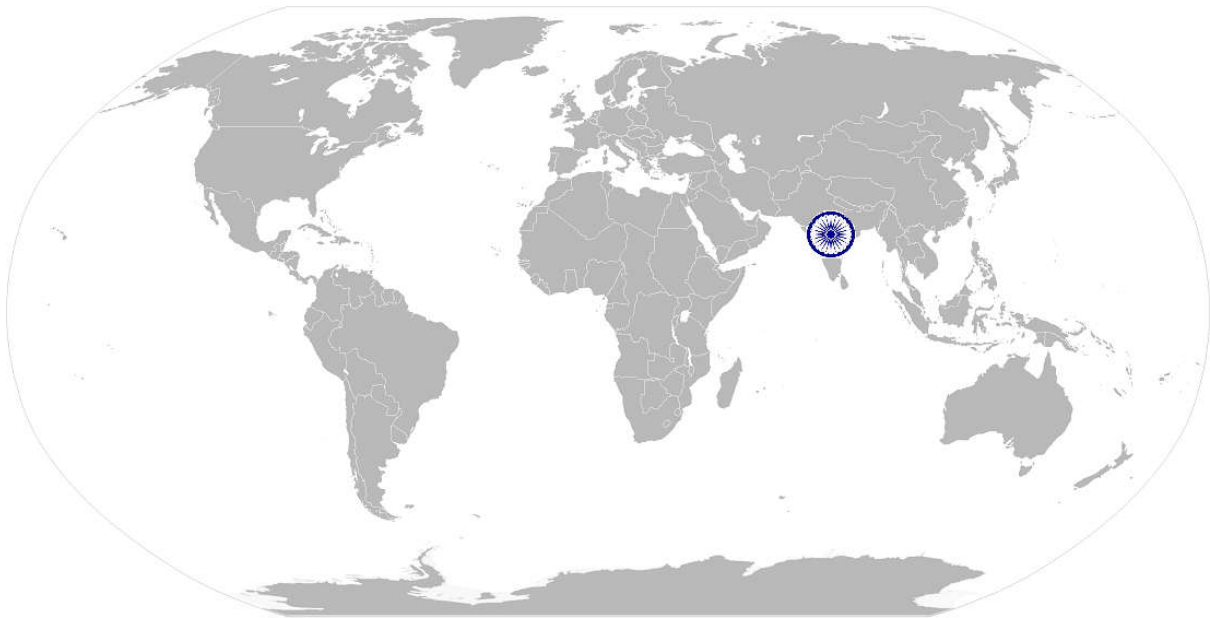
Brief Job Description: The individual at work is responsible for assisting R&D engineers in undertaking research on new products, and working with systems designer to create initial drawings.

Personal Attributes: The job requires the individual to have: attention to details, analytical thinking, and ability to work for long hours on computer.

Job Details	Qualifications Pack Code	ELE/Q8703		
	Job Role	Design Engineer		
	Credits(NVEQF/NVQF/NSQF) [OPTIONAL]	TBD	Version number	1.0
	Sector	Electronics	Drafted on	19/02/14
	Sub-sector	PCB Assembly	Last reviewed on	24/03/14
	Occupation	Design	Next review date	24/03/15

Job Role	Design Engineer
Role Description	Assisting R&D to research on new products, working with systems designer to create initial designs, library management for component building, testing and finalizing design.
NVEQF/NVQF level	4
Minimum Educational Qualifications	Diploma
Maximum Educational Qualifications	BE
Training	Not Applicable
Experience	Not Applicable
Applicable National Occupational Standards (NOS)	<p>Compulsory:</p> <ol style="list-style-type: none"> ELE/N8703 Design the layout ELE/N9919 Work with superiors and colleagues ELE/N9920 Follow safety procedures <p>Optional: Not applicable</p>
Performance Criteria	As described in the relevant OS units

National Occupational Standard



Overview

This unit is about researching on new ideas to designing the product layout and assisting the designer to create initial drawings.

ELE/N8703

Design and finalise the layout

National Occupational Standard

Unit Code	ELE/N5401
Unit Title (Task)	Design and finalise the layout
Description	This OS unit is about assisting R&D to research on new products and innovations and working with designer to create the initial drawings for the design layout.
Scope	<p>This unit/task covers the following:</p> <ul style="list-style-type: none"> • Research new products and innovations • Design and create layout • Test and modify designs • Achieve productivity and quality standards
Performance Criteria(PC) w.r.t. the Scope	
Element	Performance Criteria
Researching new products	<p>To be competent, the user/individual on the job must be able to:</p> <p>PC1. work with R&D to research for competitive technologies</p> <p>PC2. develop new product and designs</p> <p>PC3. upgrade the existing products and designs as per market requirement</p> <p>PC4. work closely with R&D to integrate new improvements into designs</p> <p>PC5. initiate, guide and coordinate the overall design and development of new ideas and products</p> <p>PC6. keep up to date with developments in technologies and regulations</p>
Designing and creating layout	<p>To be competent, the user/individual on the job must be able to:</p> <p>PC7. understand layout requirements and develop procedures and analysis</p> <p>PC8. assist designer with initial drawings to develop schematics</p> <p>PC9. construct circuits according to engineering principles, technical manuals using knowledge of electronic systems and components</p> <p>PC10. work with the designer to create design and blueprints with assistance of computer software</p> <p>PC11. support the designer to provide a detailed layout of complex PCB designs</p> <p>PC12. generate, maintain and manage parts library</p> <p>PC13. respond to customer/client requests and queries as they occur, after discussion with systems analyst</p>
Testing and modifying designs	<p>To be competent, the user/individual on the job must be able to:</p> <p>PC14. verify design through hand assembly, as instructed by systems analyst</p> <p>PC15. help test, debug and validate hardware designs</p> <p>PC16. analyze and interpret test data as part of the design verification and validation process</p> <p>PC17. support debugging, trouble shooting, and correction of defects</p> <p>PC18. recommend changes in specifications to simplify assembly and maintenance</p> <p>PC19. edit, develop and implement solutions accordingly as per customer requirements, on approval from systems analyst and the designer</p> <p>PC20. assist the designer for building the instructions file given along with the design</p>
Achieving productivity and	<p>To be competent, the user/ individual must be able to:</p> <p>PC21. ensure product safety approvals are met</p>

ELE/N8703

Design and finalise the layout

quality standards	<p>PC22. meet deadlines, schedule and commitments for assigned projects</p> <p>PC23. work with quality assurance team to ensure quality standards</p>
Knowledge and Understanding (K)	
<p>A. Organizational Context (Knowledge of the company / organization and its processes)</p>	<p>The individual on the job needs to know and understand:</p> <p>KA1. company's policies on: incentives, delivery standards and personnel management and IPR</p> <p>KA2. work flow involved in assembly process of the company</p> <p>KA3. importance of the individual's role in the workflow</p> <p>KA4. reporting structure</p> <p>KA5. organizational capabilities with respect to input materials/processes</p> <p>KA6. safety and quality standards followed in the organization</p>
<p>B. Technical Knowledge</p>	<p>The user/individual on the job needs to know and understand:</p> <p>KB1. basic electronics and components values and polarities</p> <p>KB2. CADSTAR, Cadence Or CAD & Allegro, AutoCAD LT, eagle, protel, altium, AutoCAD, Hyper lynx and layout techniques for good signal integrity, mentor graphics, Valor NPI, DXDesigner and PADs with DXDatabook, CAD packages, CAM350 and other softwares for schematic capture, PCB design and layout tools</p> <p>KB3. PCB layout design placement, routing, Gerber verification, Build library parts (footprints, schematic symbols), ERP systems, BOM structures, design for test (DFT) and design for manufacturability (DFM), foot-printing, Net listing, constraint setup</p> <p>KB4. PCB manufacturing process, fabrication drawings and assembly process</p> <p>KB5. modular design techniques, designing for double side and multilayer, design constraints and complete design cycle from understanding customer requirements to release to production</p> <p>KB6. quality standards associated with PCB design</p> <p>KB7. installing and configuring Operating Systems (Linux, Windows), Storage subsystems</p> <p>KB8. servers, Storage Hardware, RAID technology, hardware design, testing, verification and validation</p> <p>KB9. debugging, schematics, PCB design, assembly process, wire diagram and interpretation of technical drawings</p> <p>KB10. IPC standards for printed circuit board</p>
Skills (S) [Optional]	
<p>A. Core Skills/ Generic Skills</p>	<p>Reading and writing skills</p>
	<p>The user/individual on the job needs to know and understand how:</p> <p>SA1. to read schematics, customer blueprints, product and customer specifications</p> <p>SA2. to document designs for PCB requirements</p> <p>SA3. to read job sheet, process, production schedules, machine operation manuals</p> <p>SA4. to use computer work with designing software.</p>
	<p>Communication Skills</p>
<p>The user/individual on the job needs to know and understand how:</p> <p>SA5. to effectively communicate with external PCB manufacturers and in house</p>	

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Design and finalise the layout

	<p>assembly team to deliver high quality boards and manufacturability in a timely manner</p> <p>SA6. to coordinate with various departments such as marketing, sales, production, research and development</p>
	<p>Team work and Multitasking</p>
	<p>The user/individual on the job needs to know and understand how:</p> <p>SA7. to work in teams to devise creative solutions</p> <p>SA8. to plan and organize own tasks</p> <p>SA9. to multi-task, handle additional responsibility, and adapt quickly to changing priorities</p>
B. Professional Skills	<p>Reflective thinking</p>
	<p>The user/individual on the job needs to know and understand how:</p> <p>SB1. to suggest on corrective actions to reduce repetitive errors</p> <p>SB2. to improve work process with less rework within PCB layout function</p>
	<p>Leadership skills</p>
	<p>The user/individual on the job needs to know and understand how:</p> <p>SB3. to demonstrated leadership in CAD system, library management and design release process for high-volume product manufacturing</p>
	<p>Analytical thinking</p>
	<p>The user/individual on the job needs to know and understand how:</p> <p>SB4. to be prompt to resolve problems effectively</p>
	<p>Using tools and machines</p>
	<p>The user/individual on the job needs to know and understand how:</p> <p>SB5. to use test and measurement equipment like Oscilloscopes, PCIe/SAS protocol analyzers etc</p> <p>SB6. to use various design tools, equipment, and computer applications and softwares</p>
	<p>Technical skills</p>
	<p>The user/individual on the job needs to know and understand how:</p> <p>SB7. to ensure designs are feasible with knowledge on physics, engineering and mathematics</p>
	<p>Creative thinking</p>
	<p>The user/individual on the job needs to know and understand how:</p> <p>SB8. To have a creative and innovative approach for generating new ideas</p>
	<p>Critical thinking</p>
	<p>The user/individual on the job needs to know and understand how:</p> <p>SB9. to spot process disruptions and delays</p>
<p>Problem solving</p>	
<p>The user/individual on the job needs to know and understand how:</p> <p>SB10. to troubleshoot and identify problems</p> <p>SB11. to propose possible solutions</p>	

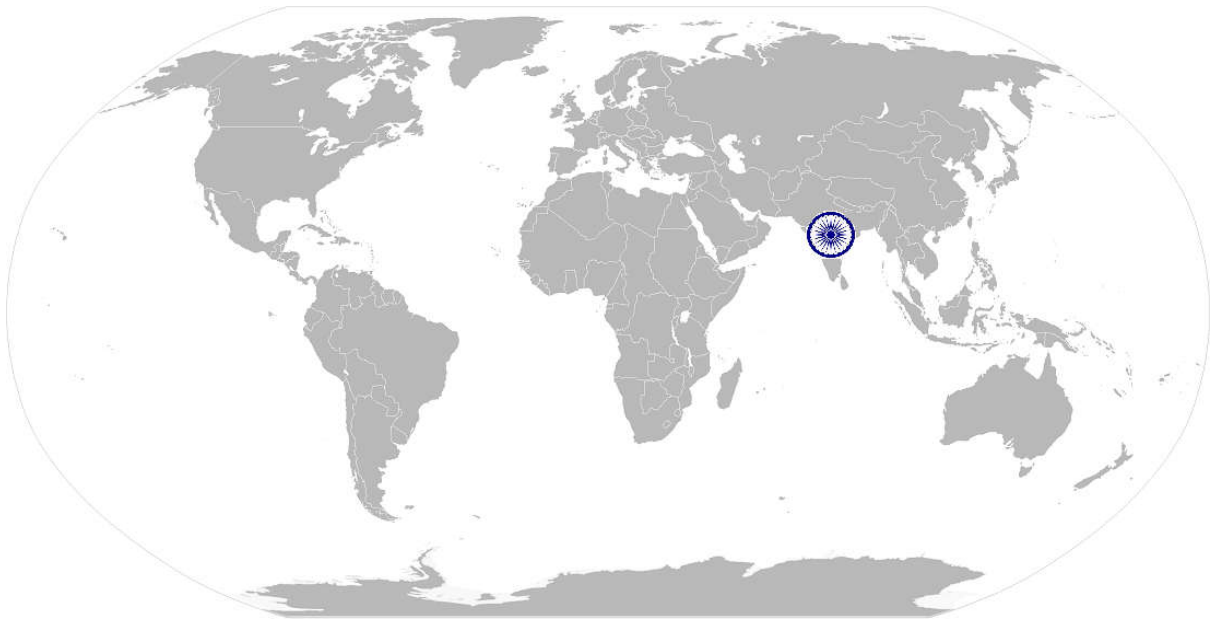
ELE/N8703

Design and finalise the layout

NOS Version Control

NOS Code	ELE/N8703		
Credits(NVEQF/NVQF/NSQF) [OPTIONAL]	TBD	Version number	1.0
Industry	Electronics	Drafted on	19/02/14
Industry Sub-sector	PCB Assembly	Last reviewed on	24/03/14
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Overview

This unit is about the individual's level of communication with colleagues and other departments within the organisation. It determines the ability to work as a team member to achieve the required deliverables on schedule.

ELE/N9919

Work with superiors and colleagues

Unit Code	ELE/N9919
Unit Title (Task)	Work with superiors and colleagues
Description	This OS unit is about communicating, coordinating and maintaining proper relationship with colleagues and seniors in order to achieve smooth work flow
Scope	<p>This unit/ task covers the following:</p> <ul style="list-style-type: none"> • Interact with supervisor or superior • Coordinate with colleagues
Performance Criteria(PC) w.r.t. the Scope	
Element	Performance Criteria
Interacting with supervisor	<p>To be competent, the user/ individual must be able to:</p> <p>PC1. understand work requirements by receiving instructions from reporting supervisor</p> <p>PC2. understand standard operating procedure of the company</p> <p>PC3. escalate problems that cannot be handled including repetitive PCB defects, machine failures, potential hazards, process disruptions, repairs and maintenance of machine</p> <p>PC4. report work completed and receive feedback on work done</p> <p>PC5. resolve personnel issues</p> <p>PC6. rectify errors as per feedback and minimize mistakes to zero in future</p> <p>PC7. communicate about process flow improvements, quality of output, product defects received from previous process, repairs and maintenance of tools and machinery as required and find technical solutions on specific issues</p> <p>PC8. handover completed work and deliver the work of expected quality despite constraints</p>
Interacting with colleagues	<p>To be competent, the user/ individual must be able to:</p> <p>PC9. collect required spares and raw materials from tool room or stores</p> <p>PC10. deposit unused or faulty materials, parts and tools to stores</p> <p>PC11. assist colleagues where necessary and as per capability</p> <p>PC12. resolve conflicts with colleagues at work to achieve smooth workflow</p> <p>PC13. complete rework in time based on feedback from quality or process departments</p> <p>PC14. put team over individual goals</p>
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	<p>The individual on the job needs to know and understand:</p> <p>KA1. company's policies on: incentives, delivery standards, and personnel management</p> <p>KA2. work flow involved in company's process</p> <p>KA3. importance of the individual's role in the workflow</p> <p>KA4. reporting structure</p>

ELE/N9919

Work with superiors and colleagues

B. Technical Knowledge	The individual on the job needs to know and understand: KB1. how to communicate effectively KB2. how to build team coordination
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	<p>Teamwork and Multitasking</p> <p>The individual on the job needs to know and understand how: SA1. to deliver product to next work process on time SA2. to share work load as required</p>
B. Professional Skills	<p>Decision Making</p> <p>The individual on the job needs to know and understand: SB1. how to report potential areas of disruptions to work process SB2. when to report to supervisor and when to deal with a colleague depending on the type of concern</p> <p>Reflective Thinking</p> <p>The individual on the job needs to know and understand: SB3. To reduce repetitive errors and improve work process</p> <p>Critical Thinking</p> <p>The individual on the job needs to know and understand: SB4. how to spot process disruptions and delays</p>

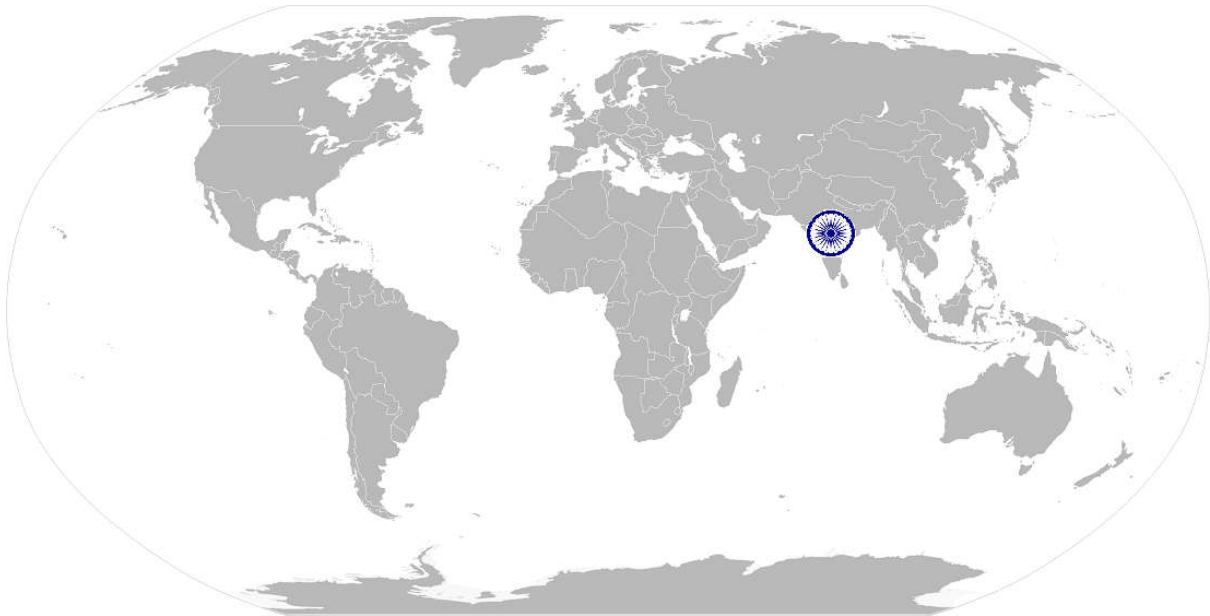
ELE/N9919

Work with superiors and colleagues

NOS Version Control

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Credits(NVEQF/NVQF/NSQF) [OPTIONAL]	TBD	Version number	1.0
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Industry Sub-sector	PCB Assembly	Last reviewed on	24/03/14
		Next review date	24/03/15

National Occupational Standard



Overview

This unit is about the worker's commitment towards reporting potential hazards and containing accidents in order to make the work environment safe, healthy and secure, for self and colleagues

ELE/N9920

Follow safety procedures

National Occupational Standard

Unit Code	ELE/N9920
Unit Title (Task)	Follow safety procedures
Description	This OS unit is about following safety procedures, communicating potential hazards and dangers of accidents on the job
Scope	<p>This unit/ task covers the following:</p> <ul style="list-style-type: none"> • Understand potential sources of accidents • Use safety gear to avoid accidents • Understand the safety procedures followed by the company
Performance Criteria(PC) w.r.t. the Scope	
Element	Performance Criteria
Understanding potential sources of accidents	<p>To be competent, the user/individual on the job must be able to:</p> <p>PC1. spot and report potential hazards on time</p> <p>PC2. follow company policy and rules regarding hazardous materials</p> <p>PC3. avoid accidents related to use of potentially dangerous chemicals, gases, sharp tools and hazards from machines which involves exposure to possible injuries such as cuts, bites, stings, minor burns, etc.</p> <p>PC4. handle with care when using an electrical drill and sharp cutting objects</p>
Using safety gear	<p>To be competent, the user/individual on the job must be able to:</p> <p>PC5. understand which safety gear must be used for a particular task</p> <p>PC6. eye, respiratory and hearing protection as per company policy</p> <p>PC7. use safety gear such as respirator, mask, skull caps, gloves, goggles, jacket , etc., as prescribed for the job</p>
Understanding of safety procedures	<p>To be competent, the user/individual on the job must be able to:</p> <p>PC8. comply with standard health and safety procedure followed in the company while handling an equipment and hazardous materials and tools or situations</p> <p>PC9. understand and follow the evacuation procedure properly such as fire drills, emergency evacuation procedures, first aid to self and others, etc., which help in case of an emergency</p>
Following daily safety measure	<p>To be competent, the user/ individual must be able to:</p> <p>PC10. take adequate safety measures while on work to prevent accidents</p> <p>PC11. ensure zero accidents in work</p> <p>PC12. avoid damage of components due to negligence in ESD procedures</p> <p>PC13. ensure no loss for company due to safety negligence</p> <p>PC14. ensure proper machine maintenance, work process achieving quality outputs as per the company standard</p>
Communicating to supervisor	<p>To be competent, the user/ individual must be able to:</p> <p>PC15. improve process flow to reduce anticipated or repetitive hazards</p> <p>PC16. report on mishandling of tools, machines or hazardous materials and on electrical problems that could result in accident</p> <p>PC17. escalate about any hazardous materials or things found in the premises</p> <p>PC18. report about any breach of safety procedure in the company</p> <p>PC19. follow electrostatic discharge (ESD) measures for electronic component safety</p>

ELE/N9920

Follow safety procedures

Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The individual on the job needs to know and understand: KA1. company's policies on handling: harmful chemicals and sharp tools, safety and hazards of machines, fire safety/drill, first aid and, disposal of harmful chemicals and materials, quality standards KA2. company occupational safety and health policy followed KA3. company emergency evacuation procedure KA4. company's medical policy
B. Technical Knowledge	The individual on the job needs to know and understand: KB1. how to maintain the work area safe and secure KB2. how to handle hazardous material KB3. how to follow safety procedures while operating hazardous tools and equipment KB4. emergency procedures to be followed such as fire accidents and fire safety education KB5. how to use machines and tools without causing bodily harm KB6. first aid execution KB7. disposal of hazardous chemicals, tools and materials by following prescribed environmental norms or as per company policy
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	Communication Skills
	The individual on the job needs to know and understand how: SA1. to effectively communicate the danger SA2. to understand the quality standard of the company
B. Professional Skills	Reflective Thinking
	The individual on the job needs to know and understand how: SA3. to learn from past mistakes regarding use of hazardous machines, tools or chemicals
	Critical Thinking
	The individual on the job needs to know and understand: SA4. how to spot danger SA5. procedure to follow in the event of a fire or other hazard
	Handling Safety Equipment
	The individual on the job needs to know and understand: SA6. how to use safety materials such as gloves, etc. SA7. how to use safety equipments such as fire extinguisher during fire accidents
	Decision Making
	The individual on the job needs to know and understand: SA8. importance of reporting potential sources of danger SA9. appropriate actions to be taken in the event of an accident SA10. procedure for disposing of hazardous materials, safely and following environmental guidelines

ELE/N9920

Follow safety procedures

NOS Version Control

NOS Code	ELE/N9920		
Credits(NVEQF/NVQF/NSQF) [OPTIONAL]	TBD	Version number	1.0
Industry	Electronics	Drafted on	19/02/14
Industry Sub-sector	PCB Assembly	Last reviewed on	24/03/14
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Qualifications Pack For Design Engineer

Definitions

Keywords /Terms	Description
Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Function	Function is an activity necessary for achieving the key purpose of the sector, occupation, or an area of work, which can be carried out by a person or a group of persons. Functions are identified through functional analysis and form the basis of OS.
Sub-function	Sub-functions are sub-activities essential to fulfil the achieving the objectives of the function.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the knowledge and understanding they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria	Performance criteria are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (OS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.
Knowledge and Understanding	Knowledge and understanding are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.
Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.

Qualifications Pack For Design Engineer

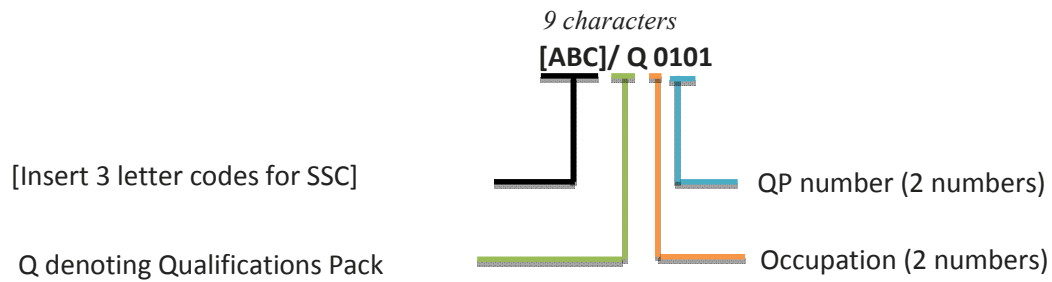
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills	Core skills or generic skills are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
Keywords /Terms	Description
IPR	Intellectual Property Rights
NOS	National Occupational Standard(s)
NVQF	National Vocational Qualifications Framework
NSQF	National Qualifications Framework
NVEQF	National Vocational Education Qualifications Framework
PCB	Printed Circuit Board
QP	Qualifications Pack

Acronyms

Annexure

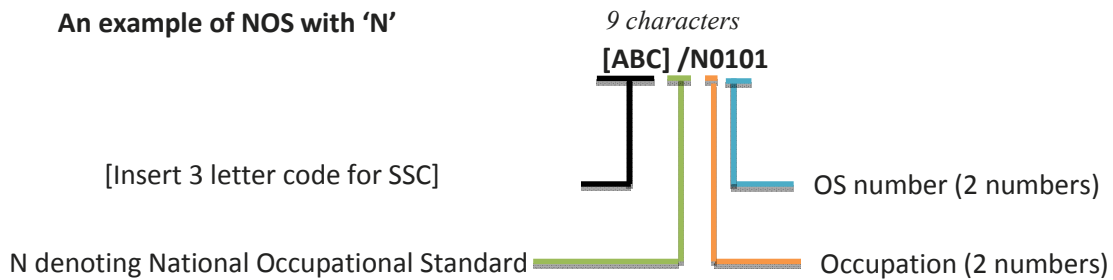
Nomenclature for QP and NOS

Qualifications Pack



Occupational Standard

An example of NOS with 'N'



Qualifications Pack For Design Engineer

The following acronyms/codes have been used in the nomenclature above:

Sub-sector	Range of Occupation numbers
Passive Components	01 - 10
Semiconductors	11 - 20
PCB Manufacturing	21 - 30
Consumer Electronics	31 - 40
IT Hardware	41 - 50
PCB Assembly	51 - 55
Solar Electronics	56 - 60
Strategic Electronics	61 - 65
Automotive Electronics	66 - 70
Industrial Electronics	71 - 75
Medical Electronics	76 - 80
Communication Electronics	81 - 85
PCB Design	86 - 90
LED	91 - 95

Sequence	Description	Example
Three letters	Industry name	ELE
Slash	/	/
Next letter	Whether QP or NOS	Q
Next two numbers	Occupation code	01
Next two numbers	OS number	01