Contents

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- Solar Panel Installation Technician

SECTOR: ELECTRONICS

SUB-SECTOR: Solar Electronics

OCCUPATION: Installation

REFERENCE ID: ELE/Q5901

ALIGNED TO: NCO-2004/ NIL

Solar Panel Installation Technician: Also known as 'Panel Installer', the Solar Panel Installation Technician is responsible for installing solar panels at the customers' premises.

Brief Job Description: The individual at work checks the installation site, understands the layout requirement as per design, assesses precautionary measures to be taken, installs the solar panel as per customer's requirement and ensures effective functioning of the system post installation.

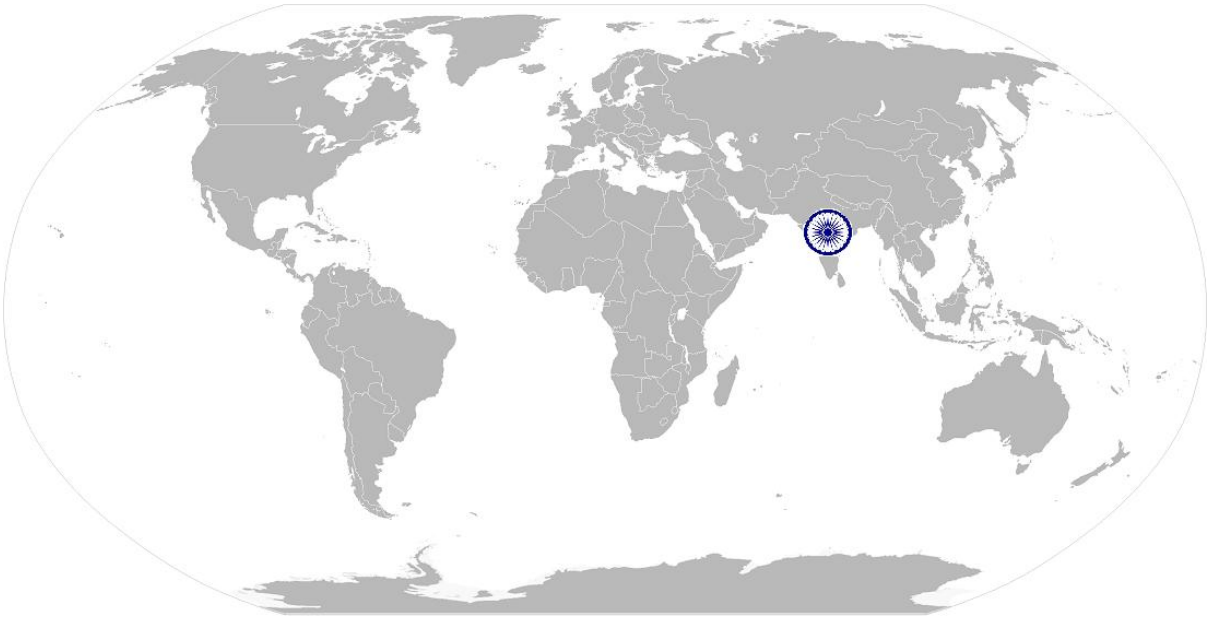
Personal Attributes: The individual must have: ability to work in standing position for long hours, good physical strength to handle solar panels and willingness to work in outdoor settings at varied locations such as roof tops, fields, urban or rural.

Job Details

Qualifications Pack Code	**ELE/Q5901**		
Job Role	**Solar Panel Installation Technician**		
Credits(NVEQF/NVQF/NSQF) [*OPTIONAL*]	**TBD**	**Version number**	**1.0**
Sector	**Electronics**	**Drafted on**	**24/02/14**
Sub-sector	**Solar Electronics**	**Last reviewed on**	**24/03/14**
Occupation	**Installation**	**Next review date**	**24/03/15**

Job Role	**Solar Panel Installation Technician** Also known as 'Solar Panel Installer'
Role Description	Assessing the installation site, understanding the installation pre-requisites, arranging for installation materials, mounting and installing the panels at customer's premises; and ensuring effective functioning of solar energy system after installation
NVEQF/NVQF level	4
Minimum Educational Qualifications	10th Standard passed
Maximum Educational Qualifications	ITI/Diploma (electrical, mechanical)
Training	Not Applicable
Experience	Minimum 6 months preferred but not mandatory in equipment installation
Applicable National Occupational Standards (NOS)	**Compulsory:** 1. ELE/N5901 Check site conditions, collect tools and raw materials 2. ELE/N5902 Install the solar panel 3. ELE/N9952 Coordinate colleagues at work 4. ELE/N9953 Ensure safety at workplace **Optional:** Not applicable
Performance Criteria	As described in the relevant OS units

National Occupational Standard



Overview

This OS unit is about assessing the site conditions where the solar panels would be installed, understanding the customer's requirement and arranging for tools are materials required for solar installation.

National Occupational Standard

ELE/N5901 Check site conditions, collect tools and raw materials

Unit Code	ELE/N5901
Unit Title (Task)	**Check Site conditions and collect tools and raw materials for solar panel installation**
Description	This OS unit is about assessing conditions at site where the solar panels would be installed, understanding the customer requirement in installation and arranging for tools and raw materials required for solar panel installation
Scope	This unit/ task covers the following: • Understand the work requirement • Check out and assess the site condition • Understand the installation requirement • Collect materials required for installation • Ensure quality material usage and appropriate handling mechanism

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Understanding the work requirement	To be competent, the user/ individual must be able to: PC1. understand the individual work requirement and areas of operation PC2. interact with the supervisor in order to understand the installation targets for the day and/or week PC3. understand the location of installations and optimise the route plan PC4. plan the day's activities and the complete work plan for each installation PC5. coordinate with the various departments and persons involved in installation operation such as design, logistics, material handling and stores PC6. minimise absenteeism and report to work on time
Assessing site conditions	To be competent, the user/ individual must be able to: PC7. assess the site level pre-requisites for solar panel installation PC8. decide on the type of mounting to be made such as roof top, open fields, small spaces PC9. ensure that land is levelled for flat surface mounting PC10. decide the type of mounting accessories required for installation as per the site condition PC11. decide the place of installation and ensure maximum period of sunlight is captured in the area PC12. ensure that construction is strong to hold solar panel for 20-25 years, especially, on roof top PC13. inform the customer for any civil construction to be undertaken for installing the panels
Understanding the installation requirement	To be competent, the user/ individual must be able to: PC14. understand the location and mounting preference of customers PC15. interact with customers and understand the purpose of installation and suggest alternatives PC16. match the voltage and power output of the type of installation designed and losses with customer's requirement

ELE/N5901 Check site conditions, collect tools and raw materials

	PC17. inform customers about the approximate time required for installation and any requirements during installation PC18. get concurrence from the customer on the package of materials to be procured for installation based on agreed design
Collecting material for installation	To be competent, the user/ individual must be able to: PC19. arrange for and collect the solar panels as per customer's requirement PC20. ensure that the quantity of modules / panels match the voltage requirement of the system PC21. arrange for mounting stands as per design PC22. arrange for tools and consumables required for mounting the solar panels PC23. decide on the workforce required and arrange for team PC24. ensure that only company recommended quality materials are used unless specified by customer
Ensuring quality of material and handling	To be competent, the user/ individual must be able to: PC25. ensure all the materials procured are QC passed PC26. ensure that module is not damaged and the outer glass is not broken PC27. understand the material handling requirement and follow the standard operating procedure while moving them PC28. cover the glass module with an opaque material to ensure that there is no electricity generation before installation PC29. ensure standard module handling procedure such as two people should lift a module, module should not be carried on head, etc. PC30. ensure that modules are stored in a way that it is not damaged by falling or by any external disturbance
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the company / organization and its processes)	The individual on the job needs to understand: KA1. company's policies on: incentives, personnel management KA2. company's code of conduct KA3. importance of individual's role in the work flow KA4. organisation culture KA5. company's reporting structure KA6. company's documentation policy KA7. company's different department and concerned authority KA8. company's installation policy KA9. company's customer support policy
B. Technical Knowledge	The individual on the job needs to know and understand: KB1. basics on solar energy and power generation systems KB2. use and handling procedure of solar panels KB3. energy storage, control and conversion KB4. basic electrical system and functioning KB5. mechanical equipments and its functioning KB6. maintenance procedure of equipments KB7. site survey, design and evaluation of various parameters KB8. tools involved in installation of system KB9. quality and process standards KB10. occupational health and safety standards

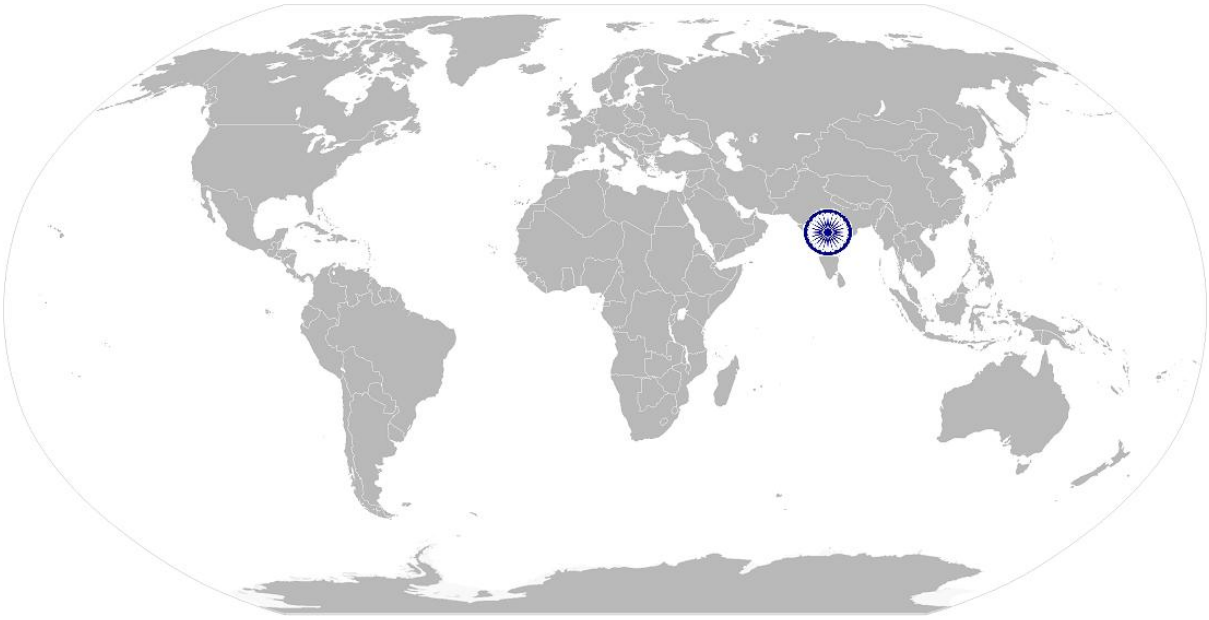
ELE/N5901 Check site conditions, collect tools and raw materials

	KB11. waste management and disposal procedures and standards KB12. importance of wearing protective clothing and other safety gear while carrying out installation KB13. precautions to be taken while handling different electrical and mechanical products
Skills (S)	
A. Core Skills/ Generic Skills	**Reading and writing skills**
	The individual on the job needs to know and understand how to: SA1. read product and equipment manuals, installation manuals, etc. SA2. read warnings, instructions and other text material on product labels, components, etc. SA3. fill in job completion form after installation activities have been completed
B. Professional Skills	**Using tools and machines**
	The individual on the job needs to know and understand: SB1. purpose and specification of tools used in maintenance activity SB2. how to operate/use different tools such as screw driver, inspection fixtures, wire cutter, pliers, tester, spanner, etc. SB3. how to handle tools and equipments and maintain them in a good condition
	Interpersonal skills
	The individual on the job needs to know and understand: SB4. how to interact with supervisor to understand the daily production target SB5. how to interact with co workers in order to co ordinate work processes

NOS Version Control

NOS Code	ELE/N5901		
Credits(NVEQF/NVQF/NSQF) [*OPTIONAL*]	TBD	Version number	1.0
Industry	Electronics	Drafted on	24/02/14
Industry Sub-sector	Solar Electronics	Last reviewed on	24/03/14
		Next review date	24/03/15

National Occupational Standard



Overview

This OS unit is about mounting and installing the solar panel at the customer premises. It also includes connecting the solar panels with the inverters and ensuring the functioning of solar power system.

ELE/N5902 **Install the solar panel**

National Occupational Standard

Unit Code	ELE/N5902
Unit Title (Task)	Install the solar panel
Description	This OS unit is about mounting and installing the solar panel in the customer premises. It also includes connecting the solar panels with the inverters and ensuring the functioning of solar power system.
Scope	This unit/ task covers the following: • Understand the installation and material usage procedure • Assess mounting requirements • Install the solar panel • Connect the system and check for functioning • Report and document completion of work • Follow quality and safety procedures

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Understanding installation and material usage procedure	To be competent, the user/ individual must be able to: PC1. understand the customer requirement on installation PC2. ensure that all appropriate materials are available during installation time PC3. ensure that the installation meets the local building rules and regulations PC4. ensure to disconnect PV module from any electric sources such as batteries, inverters, etc., before working on the module PC5. check that the module is defect free before installing PC6. ensure to take specified measures such as fire resistance, corrosion resistance for the module during installation
Assessing mounting	To be competent, the user/ individual must be able to: PC7. understand the type of mounting and other accessories required PC8. assess the degree of inclination and angle of tilt of PV module for the specific area, locality or region to enable the system absorb maximum annual sunlight PC9. ensure that sunlight falls perpendicular to the PV module to absorb maximum energy PC10. ensure that panels are mounted in a place where there is no shade at any time of the year PC11. ensure that mounting is strong to withstand wind, rain, etc. PC12. ensure that any special construction requirement for mounting is done by following acceptable quality standards, especially, in rooftop installations PC13. use approved tools for mounting PC14. set the mounting fixture firmly at the desired location
Installing the panel	To be competent, the user/ individual must be able to: PC15. remove packaging of the solar panel carefully PC16. handle the panels carefully without damaging the material PC17. take safety measures and wear protection gear such as gloves to avoid shock / injuries while handling modules

	PC18. cover the module with opaque material while installing to avoid any current generation PC19. ensure that junction box in covered PC20. do not disturb or disassemble any part of the module part during installation PC21. take necessary precautions for fire resistance of modules PC22. use recommended material of solar cable and plugs for electrical connection PC23. Install spare fuse to avoid any short circuits as per company policy PC24. mount the module on the fixture with the mounting rails using bolts and nuts PC25. ensure that the panels are mounted firmly
Connecting the system and check for functioning	To be competent, the user/ individual must be able to: PC26. use the cables to connect multiple PV modules in combination to generate the desired voltage and current PC27. choose type of connection, i.e., series or parallel, as per design PC28. use recommended cable to generate maximum voltage PC29. Check the maximum system voltage as per the installation and follow adjustment measures accordingly to match output requirement PC30. ensure that the modules are grounded as specified PC31. connect the system and check for functioning PC32. escalate for any issues faced during the functioning of the system
Completing the work	To be competent, the user/ individual must be able to: PC33. clean the work area after completing the installation activity PC34. remove all the tools, consumables used from the installation area PC35. fill in the job completion form and get the signature of the customer PC36. inform customers about maintenance of solar panels and procedure for cleaning of solar panels PC37. follow company standards in documentation of installation activities performed
Following quality and safety procedures	To be competent, the user/ individual must be able to: PC38. remove any metals or jewellery to avoid possibility of current shock during installation activity PC39. wear all safety gears such as work shoes, cotton gloves, goggles while carrying out installation activities PC40. take specified precautionary measures while handling electrical system PC41. keep work area clean and organised PC42. adhere to relevant health and safety standards PC43. dispose off any waste materials in accordance with safe working practices and procedures
Knowledge and Understanding (K)	
B. Organizational Context (Knowledge of the company / organization and	The individual on the job needs to understand: KA1. company's policies on: incentives, personnel management KA2. company's code of conduct KA3. importance of individual's role in the work flow KA4. organisation culture KA5. company's reporting structure KA6. company's documentation policy

its processes)	KA7. company's different department and concerned authority KA8. company's installation policy KA9. company's customer support policy
B. Technical Knowledge	The individual on the job needs to know and understand: KB1. basics on solar energy system and power generation KB2. solar energy system components such as panels, batteries, charge controllers, inverters KB3. significance of volts, amps and watts: series and parallel connection KB4. handling procedure for solar panels KB5. energy storage, control and conversion KB6. basic electrical system and functioning KB7. mechanical equipment and their functioning KB8. maintenance procedure of equipment KB9. voltage requirement of various equipment KB10. panel mounting and inclination and angle of tilt KB11. placement of solar panel mounting KB12. sunlight and direction assessment KB13. site surveying methods and evaluation parameters KB14. tools involved in installation of system KB15. basic electrical engineering and circuitry KB16. quality and process standards KB17. occupational health and safety standards and waste management procedures KB18. importance of wearing protective clothing and other safety gear while carrying out installation activities KB19. precautions to be taken while handling different electrical and mechanical products
Skills (S)	
C. Core Skills/ Generic Skills	**Reading and writing skills** The individual on the job needs to know and understand how to: SA1. read product and equipment manuals, installation manual, maintenance reports etc. SA2. read warnings, instructions and other text material on product labels, components etc. SA3. fill in job completion form after installation activity is completed
D. Professional Skills	**Using tools and machines** The individual on the job needs to know and understand: SB1. how to operate/use screw driver, inspection fixtures, wire cutter, pliers, tester, spanner, etc. SB2. how to use tools for panel mounting **Interpersonal skills** The individual on the job needs to know and understand: SB3. how to interact with co workers in order to co ordinate work processes SB4. how to interact with supervisor to understand the daily target

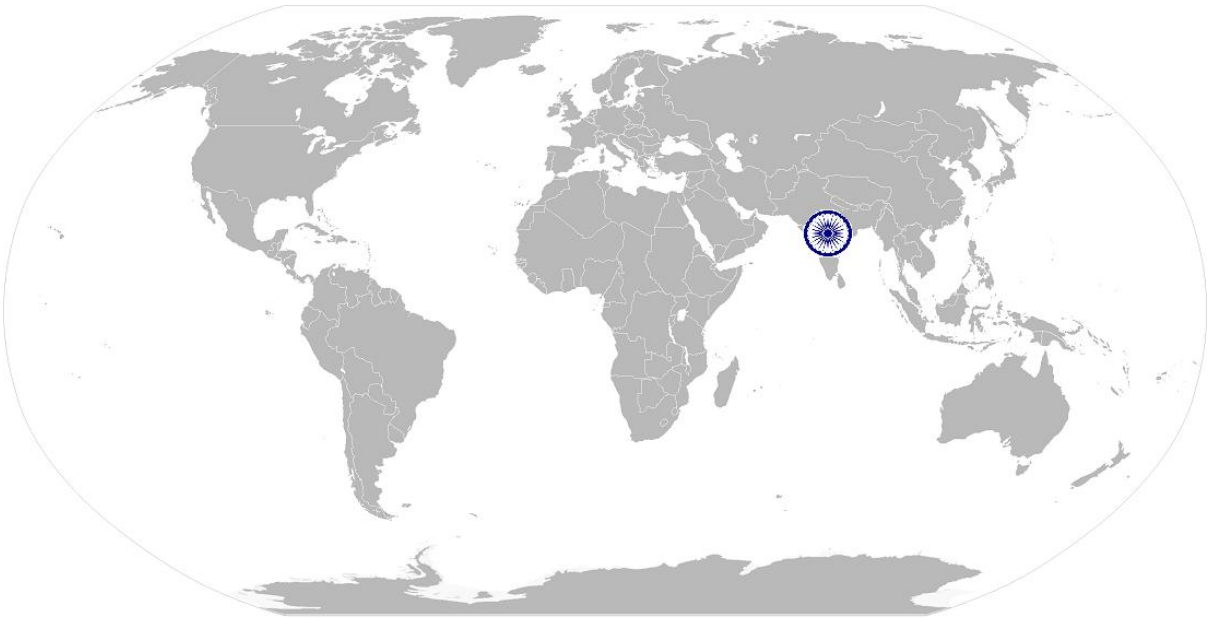
ELE/N5902 **Install the solar panel**

	Reflective thinking
	The user/individual on the job needs to know and understand how: SB5. to improve work processes SB6. to reduce repetition of errors
	Decision making
	The individual on the job needs to know and understand: SB7. how to report potential areas of disruptions to work process SB8. when to report to supervisor and when to deal with a colleague depending on the type of concern

NOS Version Control

NOS Code	ELE/N5902		
Credits(NVEQF/NVQF/NSQF) [*OPTIONAL*]	TBD	Version number	1.0
Industry	Electronics	Drafted on	24/02/14
Industry Sub-sector	Solar Electronics	Last reviewed on	24/03/14
		Next review date	24/03/15

National Occupational Standard



Overview

This unit is about the individual's level of communication and coordination with colleagues and other departments within the organisation. It also describes about how an individual interact with the team to achieve desired workflow.

National Occupational Standard

Unit Code	ELE/N9952
Unit Title (Task)	Coordinate with members at work
Description	This OS unit is about communicating with the co workers during work to achieve the desired output in the workflow.
Scope	This unit/ task covers the following: • Interact with supervisor or superior • Coordinate with colleagues

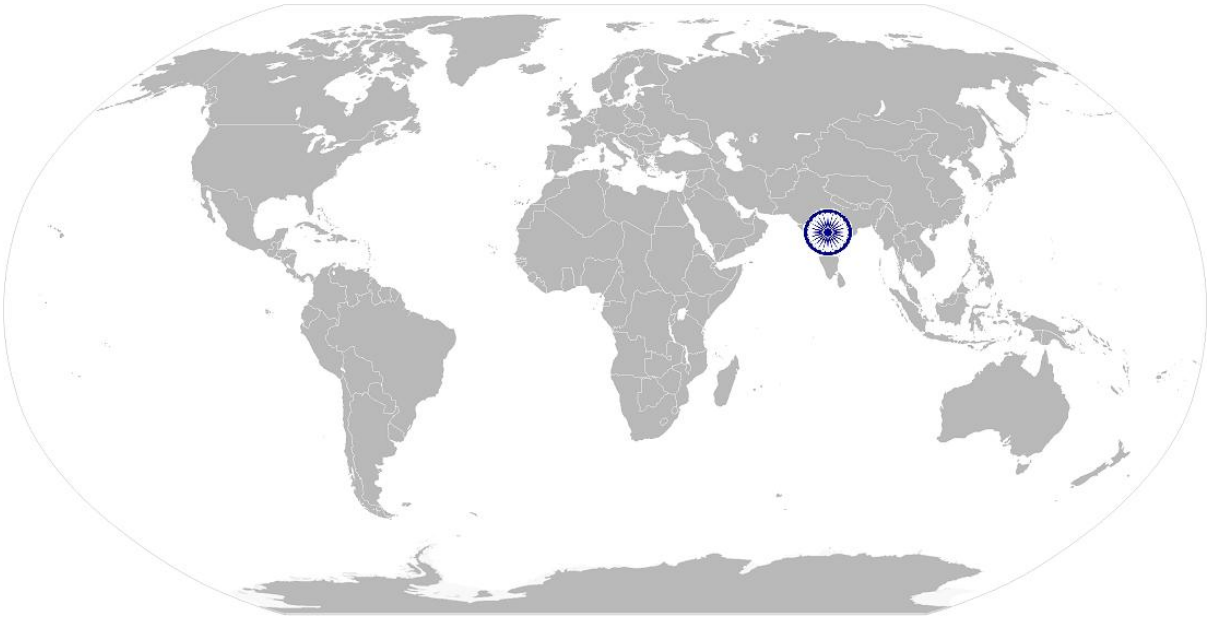
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Interacting with supervisor	To be competent, the user/ individual must be able to: PC1. understand and assess work requirements PC2. understand the targets and incentives PC3. understand new operating procedures and constraints PC4. report problems in the field PC5. resolve personnel issues PC6. receive feedback on work standards and customer satisfaction PC7. communicate any potential hazards at a particular location PC8. meet given targets PC9. deliver work of expected quality despite constraints PC10. get trained on latest technologies and updates PC11. receive positive feedback on behaviour and attitude shown during interaction
Coordinating with colleagues	To be competent, the user/ individual must be able to: PC12. interact with colleagues from different functions and understand the nature of their work PC13. receive materials from tool room or stores; deposit faulty modules and tools to stores PC14. pass on work allocation to colleagues in a respective geographical area PC15. share work according to competency and capability PC16. assist colleagues with resolving field problems resolve conflicts and achieve smooth workflow PC17. follow the company policy during cross functional interaction

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: incentives, delivery standards, and personnel management KA2. importance of the individual's role in the workflow KA3. reporting structure

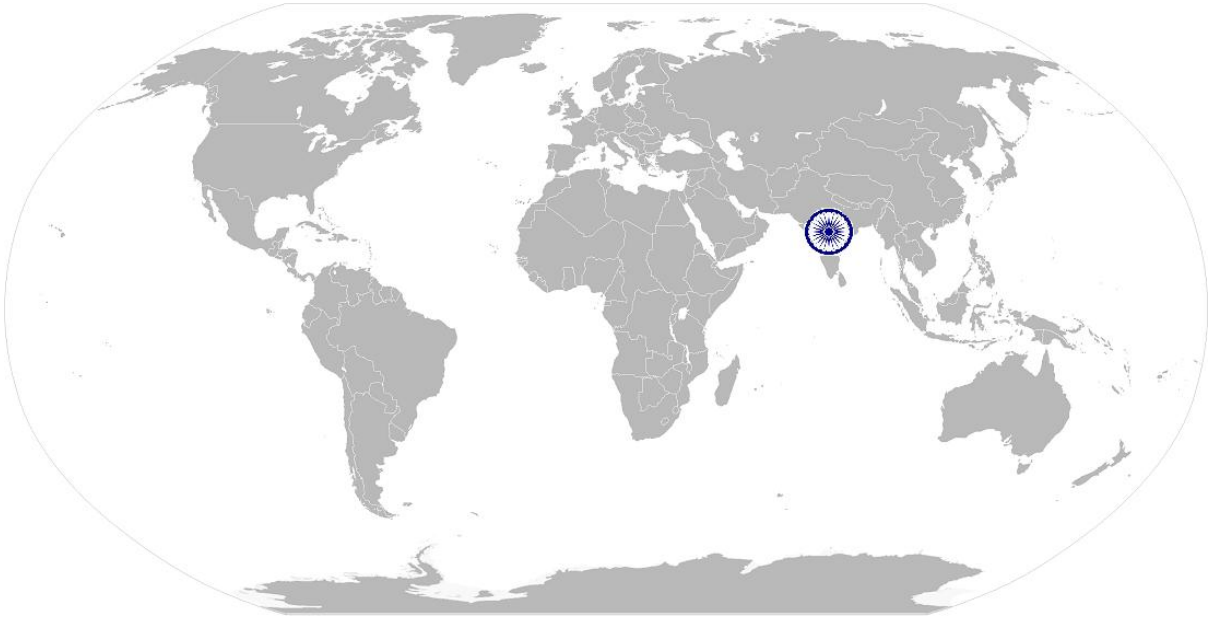
B. Technical Knowledge	The individual on the job needs to know and understand: KB1. how to communicate effectively KB2. how to build team coordination
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Teamwork and multitasking**
	The individual on the job needs to know and understand how: SA1. to complete installation on time and as per quality standards specified SA2. to work as a team member for achieving smooth workflow and a satisfied customer
	Communication skills
	The individual on the job needs to know and understand how: SA3. to clearly communicate installation and design instructions to team SA4. to clearly communicate customer's requirements SA5. to communicate the constraints and quality requirements to team
B. Professional Skills	**Decision making**
	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
	Reflective thinking
	The individual on the job needs to know and understand: SB3. how to improve work process
	Critical thinking
	The individual on the job needs to know and understand: SB4. how to spot process disruptions and delays

NOS Version Control

NOS Code	ELE/N9952		
Credits(NVEQF/NVQF/NSQF) [*OPTIONAL*]	TBD	Version number	1.0
Industry	Electronics	Drafted on	24/02/14
Industry Sub-sector	Solar Electronics	Last reviewed on	24/03/14
		Next review date	24/03/15



National Occupational Standard



Overview

This unit is about the individual's effort to maintain safety in the workplace and avoid any hazards during the work.

National Occupational Standard

Unit Code	ELE/N9953
Unit Title (Task)	**Ensure safety at workplace**
Description	This OS unit is about maintaining safety in the workplace and avoid any work related hazards.
Scope	This unit/ task covers the following: • Follow standard safety procedures while handling an equipment • Participate in company's safety drills and workshops
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Following safety measures	To be competent, the user/ individual must be able to: PC1. comply with safety procedures followed in the company PC2. take adequate safety measures while handling hazardous materials or tools PC3. take necessary measures while handling electrical equipment PC4. escalate matters about hazardous materials or things found in the premises PC5. follow appropriate material handling procedures to avoid any damages and injuries PC6. use safety materials such as gloves, goggles, masks, helmets, etc. PC7. undertake adequate safety measures while on work to prevent accidents PC8. ensure zero accidents in work PC9. avoid damage of components due to negligence in ESD procedures PC10. ensure no loss for company due to safety negligence
Participating in drills and workshops	To be competent, the user/ individual must be able to: PC11. participate in regular safety drills for being prepared in the event of a fire or natural calamity PC12. help others during the drill or calamity PC13. administer basic first aid PC14. participate in company organised games and fitness sessions such as yoga, etc. PC15. develop good posture for working so that long term health problems do not arise
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: incentives, delivery standards, and personnel management 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 operate hazardous tools and equipment KB4. emergency procedures to be followed such as fire accidents, etc.
Skills (S) [Optional]	
A. Professional Skills	**Handling safety equipments**
	The individual on the job needs to know and understand: SB1. the purpose of using safety materials such as gloves, etc. SB2. how to use safety equipments such as fire extinguisher during fire accidents

NOS Version Control

NOS Code	ELE/N9953		
Credits(NVEQF/NVQF/NSQF) [*OPTIONAL*]	TBD	Version number	1.0
Industry	Electronics	Drafted on	24/02/14
Industry Sub-sector	Solar Electronics	Last reviewed on	24/03/14
		Next review date	24/03/15

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.
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.

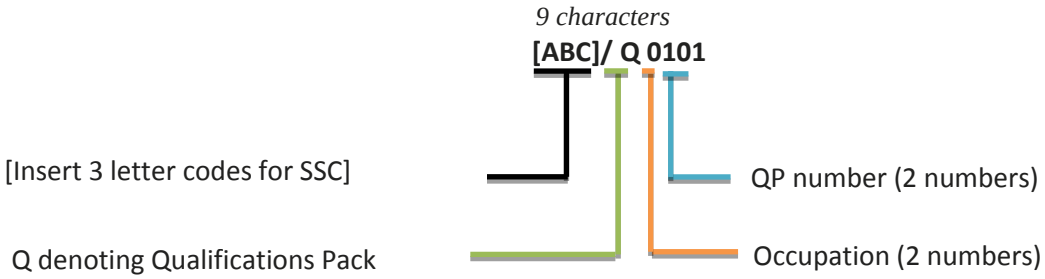
Acronyms

Keywords /Terms	Description
NOS	National Occupational Standard(s)
NVQF	National Vocational Qualifications Framework
NSQF	National Qualifications Framework
NVEQF	National Vocational Education Qualifications Framework
QP	Qualifications Pack

Annexure

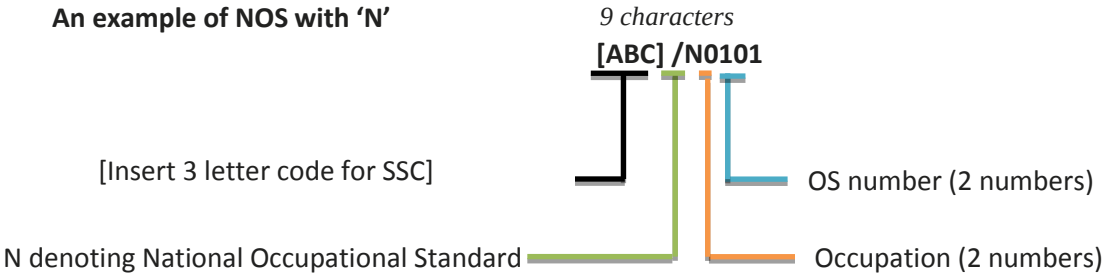
Nomenclature for QP and NOS

Qualifications Pack



Occupational Standard

An example of NOS with 'N'



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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 **Q**P or **N**OS	Q
Next two numbers	Occupation code	01
Next two numbers	OS number	01