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

Contact Us:
Skill Council for Green Jobs,
CBIP Building, Malcha Marg, Chanakyapuri
New Delhi – 110021
Ph. 011- 41792866

E-mail:
info@sscgj.in

Introduction

Qualifications Pack - Solar PV Engineer

(Option: Solar water pumping system)

SECTOR: GREEN JOBS

SUB-SECTOR: RENEWABLE ENERGY

OCCUPATION: DESIGN, INSTALLATION AND COMMISSIONING

REFERENCE ID: SGJ/Q0112

ALIGNED TO: NCO-2015/ 7421.1403

Brief Job Description: A solar PV engineer specializes in the design, installation and commissioning of the solar PV power plant, its quality assurance and HSE issues. He/she also specializes in designing, installation and commissioning of solar water pumping systems.

Option

Solar water pumping system: *To cater to the emerging market for Solar Water Pumping Systems, this optional NOS will skill the learner to Design, Install and Commission these systems.*

Personal Attributes: This job requires the individual to oversee the complete installation, testing and commissioning of solar PV power plants and ensure no accidents occur at site, so diligence and hardworking are desired attributes for individuals performing this role. He must also demonstrate strong work ethics, an ability to communicate courteously with co-workers and sub-ordinates

Job Details

Qualifications Pack Code	**SGJ/ Q0112**		
Job Role	**Solar PV Engineer** [This job role is applicable in both national and international scenarios]		
Credits (NSQF)	TBD	**Version number**	**1.0**
Sector	**Green Jobs**	**Drafted on**	**01/09/2016**
Sub-sector	**Renewable Energy**	**Last reviewed on**	**14/06/2017**
Occupation	**Design, Installation and commissioning**	**Next review date**	**30/09/2019**
NSQC Clearance on	**03/08/2018**		

Job Role	**Solar PV Engineer**
Role Description	Solar PV Engineer is responsible for design, installation and commissioning of solar power plant at site including the QA and HSE issues. S/he is also responsible for design, installation and commissioning of solar pumping systems
NSQF level	5
Minimum Educational Qualifications **Maximum Educational Qualifications**	Diploma (Electrical/Electronics/ Civil/ Mechanical) or Pre-final engineering and technology candidate with 3 years of formal engineering education NA
Prerequisite License or Training	N/A
Minimum Job Entry Age	20 years
Experience	Diploma holder with 1 year of relevant experience
Applicable National Occupational Standards (NOS)	**Compulsory:** 1. SGJ/N0109: Prepare site feasibility study report 2. SGJ/N0146: Design of solar PV power plant 3. SGJ/N0132: Installation and commissioning of solar PV power plant 4. SGJ/N0133: Quality Assurance of solar PV power plant & components 5. SGJ/N0106: Maintain personal health & safety at project site 6. SGJ/N0120: Work effectively with others **Option:** Solar water pumping system: 7. SGJ/N0134: Design, Installation and Commissioning of Solar Water Pumping System
Performance Criteria	As described in the relevant OS units

Definitions

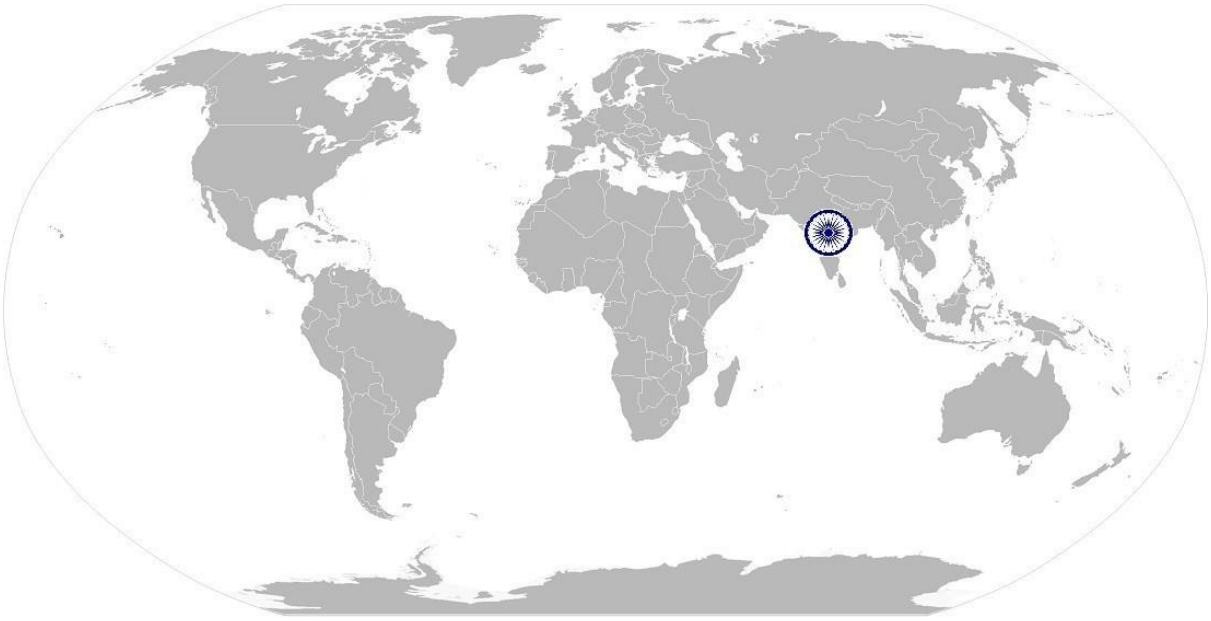
Keywords /Terms	Description
Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further 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.
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 (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OSs, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.
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 need 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	Core skills or generic skills are a group of skills that are the key to

Skills	learning and working in today's world. These skills are typically needed in any work environment in today's world. In the context of the OS, these include communication related skills that are applicable to most job roles.

Acronym

Keywords /Terms	Description
SCGJ	Skill Council for green jobs
NOS	National Occupational Standards
NSQF	National Skills Qualification Framework
NVEQF	National Vocational Educational Qualification Framework
NVQF	National Vocational Qualification Framework
OS	Occupational Standards
PC	Performance Criteria
QP	Qualification Pack
SSC	Sector Skills Council
DC	Direct Current
AC	Alternating Current
SCADA	Supervisory Control and Data Acquisition
PV	Photovoltaic
GHI	Operation and Maintenance
ERP	Enterprise Resource Planning
QA	Quality Assurance
HSE	Health, Safety and Environment
OHS	Occupational Health and Safety
CERC	Central Electricity Regulatory Commission
SERC	State Electricity Regulatory Commission
LT	Low tension
MMPT	Maximum Power Point Tracker

National Occupational Standard



Overview

This unit is about the key steps involved in preparing a site feasibility report for rooftop solar PV power plant along with the assessment of client's requirement

SGJ/N0109 **Prepare a site feasibility report**

National Occupational Standard

Unit Code	**SGJ/N0109**
Unit Title (Task)	**Prepare a site feasibility study report**
Description	This unit is about the key steps involved in developing a site feasibility report for rooftop solar PV system along with assessing client requirement
Scope	This unit/ task covers the following: • assess the rooftop condition • assess the client requirement • prepare site feasibility study report
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Assess the rooftop condition	To be competent, the user/ individual must be able to: PC1. identify optimum location of installations PC2. assess the site level pre-requisites for solar panel installation PC3. decide on the type of mounting to be constructed and place of mounting as per client requirement PC4. check for any shading obstacles PC5. prepare a site map of the location where installation has to be carried out
Assess the client requirement	To be competent, the user/ individual must be able to: PC6. assess the load to be run on solar PV power Plant and prepare a load profile PC7. estimate the capacity of solar PV power plant PC8. decide on battery backup as per grid availability, loads and client expectation
Prepare a site feasibility study report	To be competent, the user/ individual must be able to: PC9. assess or obtain the site specific major parameters of solar resource data like GHI, DNI, Temperature and Wind PC10. perform shading analysis PC11. estimate the energy generated from the rooftop solar PV power plant using solar design software like PV*SOL®, PVsyst, etc. PC12. identify the risks associated with the specific solar project PC13. prepare a site feasibility study report using specialized software like PV*SOL®, PVsyst, etc.
Knowledge and Understanding (K)	
A. Organizational Context	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. company's documentation policy KA5. company's installation policy KA6. company's customer support policy
B. Technical Knowledge	The individual on the job needs to know and understand: KB1. perform simple calculations to derive the power and energy received from solar radiation in a given area KB2. solar resource assessment including Direct normal irradiation, diffuse horizontal irradiation, global horizontal irradiation and albedo KB3. understand ground based measurement and satellite derived data KB4. determine the building orientation KB5. types of roofs and suggestive mounting structure for that specific roof KB6. basic concepts of Trigonometry and coordinate geometry

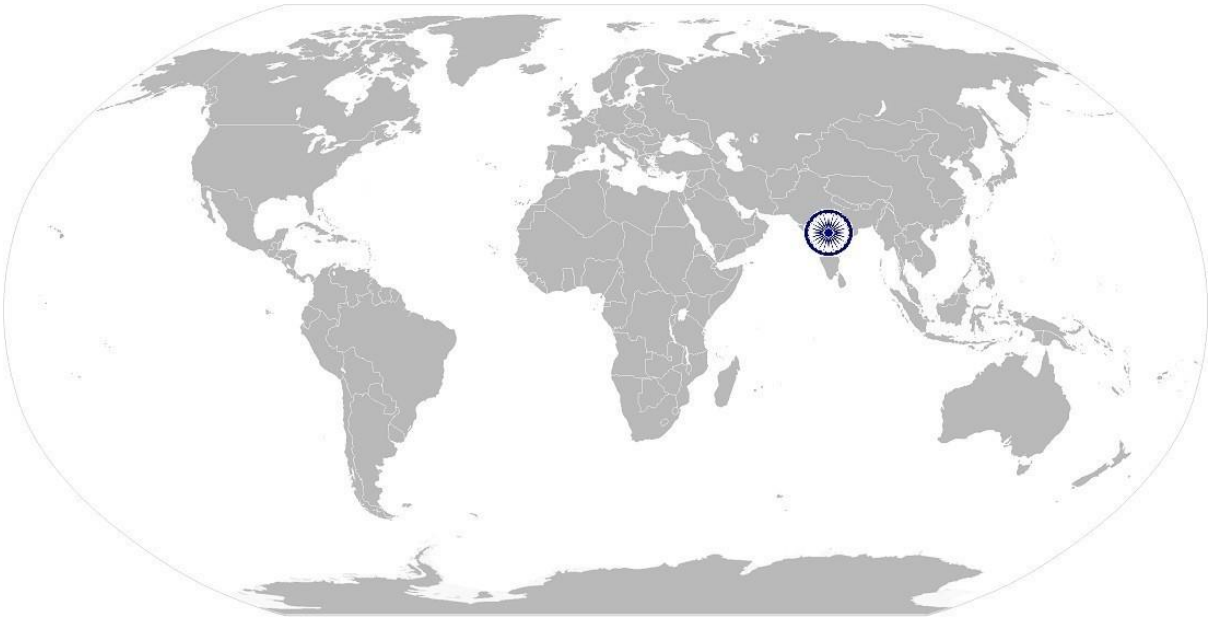
	KB7. effect on array output of current and voltage based on series / parallel connections of modules, tilt angle, orientation and shading KB8. determining whether any shading will occur and estimate its effect on the system using tools like Solar path finder and softwares like PV*SOL®, PVsyst, etc. KB9. determining the cabling route and estimate the length of cable required KB10. different types of tracking systems KB11. how to use a simulation software, such as PV*SOL®, PVsyst, etc., optimally KB12. risks associated with the solar project
Skills (S)	
A. Core Skills/ Generic Skills	**Reading and writing skills**
	The individual on the job needs to know and understand: SA1. how to read warnings, instructions and other text material on product labels, components etc.
	Oral Communication skills
	The individual on the job needs to know and understand how to: SA2. express statements for information clearly so that customer can hear and understand SA3. participate in and understand main points of simple discussions with customer SA4. respond properly to any query of the customer
B. Professional Skills	**Customer Centricity**
	The individual on the job needs to know and understand how to: SB1. follow code of conduct SB2. manage relationships with customers with intent on satisfying its requirements for service delivery
	Interpersonal skills
	The individual on the job needs to know and understand: SB3. how to interact with client to analyse client exact requirement SB4. how to interact with workers in order to coordinate work processes

NOS Version Control

NOS Code	SGJ/N0109		
Credits (NSQF)	TBD	Version number	1.0
Industry	Green jobs	Drafted on	15/04/2016
Industry Sub-sector	Renewable energy	Last reviewed on	14/06/2017
Occupation	Solar Site Survey	Next review date	01/05/2019

Back to Top

National Occupational Standard



Overview

This unit is about review of structural design, preparing the electrical design and energy generation report of solar PV power plant

SGJ/N0146 **Design of solar PV power plant**

National Occupational Standard

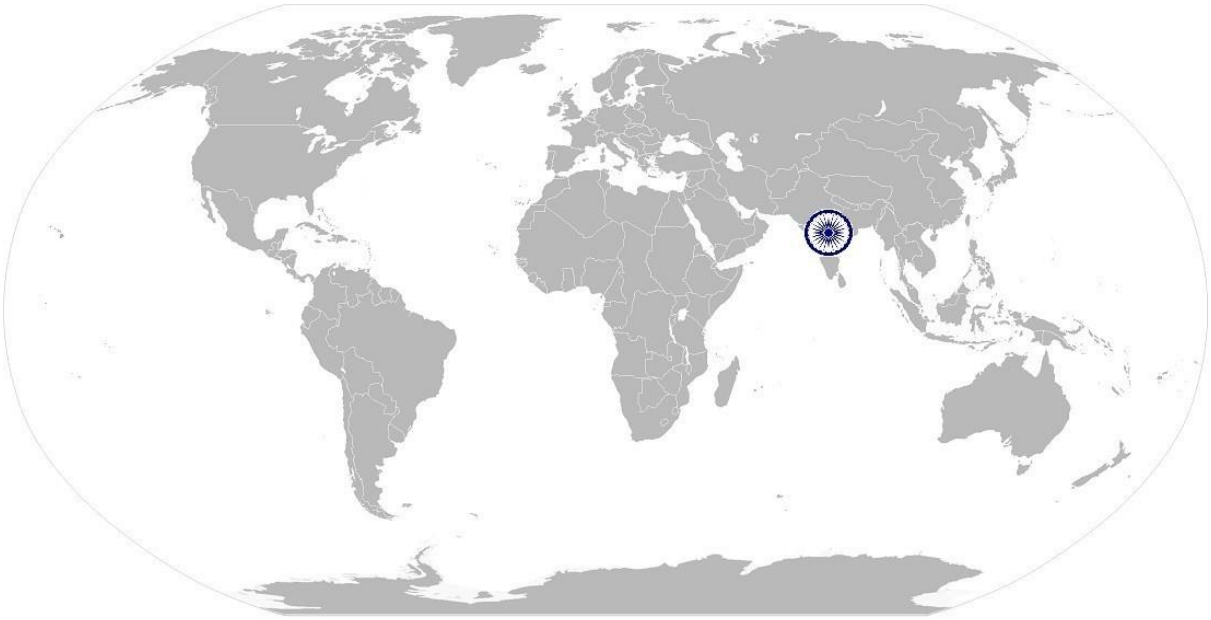
Unit Code	SGJ/ N0146
Unit Title (Task)	**Design of solar PV power plant**
Description	This unit is about reviewing of structural design, preparing the electrical design of solar PV power plant
Scope	This unit/task covers the following: • review of structural design of solar PV power plant • prepare the design and selection of solar modules • prepare the design and selection of inverters • prepare the design and selection of strings • prepare the design and selection of combiner boxes and switchgear • selection of batteries for rooftop off grid solar power plant
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Review of structural design of solar PV power plant	To be competent, the user/ individual must be able to: PC1. review and interpret of the mounting structure and foundation design drawings PC2. review the overall structural layout of the solar PV power plant
Prepare the design and selection of solar modules	To be competent, the user/ individual must be able to: PC3. select solar module technology and size, based on analysis of cost, power output, quality, climatic conditions of the site, global and diffused irradiance ratio at the site, etc. PC4. workout the total numbers of modules based on the total capacity of the plant and the capacity of selected modules PC5. prepare the earthing design of solar module arrays
Prepare the design and selection of inverters	To be competent, the user/ individual must be able to: PC6. select inverter, based on compatibility with module technology, compliance with grid code and other applicable regulations, reliability, system availability, serviceability, quality, cost, DC TO AC conversion efficiency PC7. in case of a roof top power plant, decide on specifications of the inverter to power the AC loads in the building PC8. decide on number of inverters to be used based on the capacity and specifications of the inverter selected PC9. finalize the inverter layout and inverter locations on the basis of total capacity PC10. prepare the earthing design of inverters
Prepare the design and selection of strings	To be competent, the user/ individual must be able to: PC11. workout number of modules in a string based on the input voltage and MPPT voltage range of the inverter PC12. workout number of strings connected to a combiner box based on minimum run of DC connecting cables to minimized DC losses PC13. finalize the inter row distance between the solar modules on the basis of minimum inter row shading, adequate space for cleaning and maintenance of solar modules and the tilted to south at an angle that optimizes the annual energy yield PC14. specify DC cabling material, size, type of PVC for cables connecting modules, junction boxes to the combiner boxes and combiner boxes to the inverter panels etc.

	PC15. prepare the specification of DC connectors (plugs and sockets) to be used
Prepare the design and selection of combiner boxes and switchgear	To be competent, the user/ individual must be able to: PC16. prepare the design specifications for junction boxes/combiner including IP number PC17. prepare the specifications for disconnects/switches PC18. workout number of combiner boxes connected to one panel of the inverter based on the input current rating of the inverter PC19. prepare islanding facility for grid connected power plant, in case of non-availability of grid PC20. protect incorrect polarity, over-voltage and overload for the DC cables
Selection of batteries for rooftop off grid solar power plant	To be competent, the user/ individual must be able to: PC21. decide the battery storage capacity (AH) based on the number of days autonomy required (KWH/WH) and the depth of discharge of the battery bank PC22. decide on the specifications for the charge controller/ inverter to control the overcharging/discharging of the batteries, prepare energy generation report using simulation software
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the organization and its processes)	The user/individual on the job needs to know and understand: KA1. government/corporate policies and guidelines on: workplace safety, identification and mitigation of safety hazards, work procedures and guidelines for working at height KA2. document information using appropriate corporate forms KA3. obtain authorization from specified field safety officer and supervisor KA4. legislative, organization, site requirements and procedures
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. efficiency, cost and typical specifications, functioning and operating principle of different types of solar PV plants, commercially available PV cells and modules, inverters, transformers, charge controllers, battery, mounting structures, cables, junction boxes and other components KB2. site survey reports , availability of shadow free space for installation of solar power plant KB3. the survey equipment and the methodology of survey KB4. electrical designs for the module/ inverters and balance of system KB5. solar irradiation including GHI, DHI and DNI KB6. mechanical and electrical features necessary for the long life of the PV Power Plant under a wide range of operating conditions KB7. solar PV power plant design software such as PVSYST and PV*SOL etc. KB8. energy simulation report and its parameters and effect on solar PV plants
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The user/ individual on the job needs to know and understand how to: SA1. prepare documentation as per relevant industry standards
	Reading Skills
	The user/individual on the job needs to know and understand: SA2. read vernacular/English language SA3. how to read and understand manuals, health and safety instructions, memos, other company documents

	SA4. how to read from different sources- books, screens in machines and signage SA5. the various colour codes, as per standard electrical, mechanical and civil nomenclature
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA6. express statements or information clearly so that others can hear and understand SA7. participate in and understand the main points of simple discussions SA8. respond appropriately to any queries SA9. communicate with peers, superiors and sub-ordinates
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. follow organization rule-based decision making process SB2. analyze critical points in day to day tasks and identify control measures to solve the issue SB3. handle issues in case the superior is not available with clear choice of procedures in familiar contexts (as per the authority matrix defined by the organisation)
	Plan and Organize
	The user/individual on the job needs to know and understand how to : SB4. plan and organize work to meet deadlines SB5. work constructively and collaboratively with others SB6. support the superiors in scheduling tasks
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB7. follow organisation code of conduct SB8. manage relationships with customers with intent on satisfying its requirements for service delivery
	Problem Solving
	The user/individual on the job needs to know and understand how to: SB9. recognize problems and provide solutions using a range of cognitive and practical skills SB10. approach relevant authority when required
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB11. apply knowledge of facts, principles and processes to select the right course of action to perform tasks
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB12. use reasoning skills to identify and resolve basic problems SB13. use intuition to detect any potential problems which could arise during operations SB14. use acquired knowledge of the process for identifying and handling issues

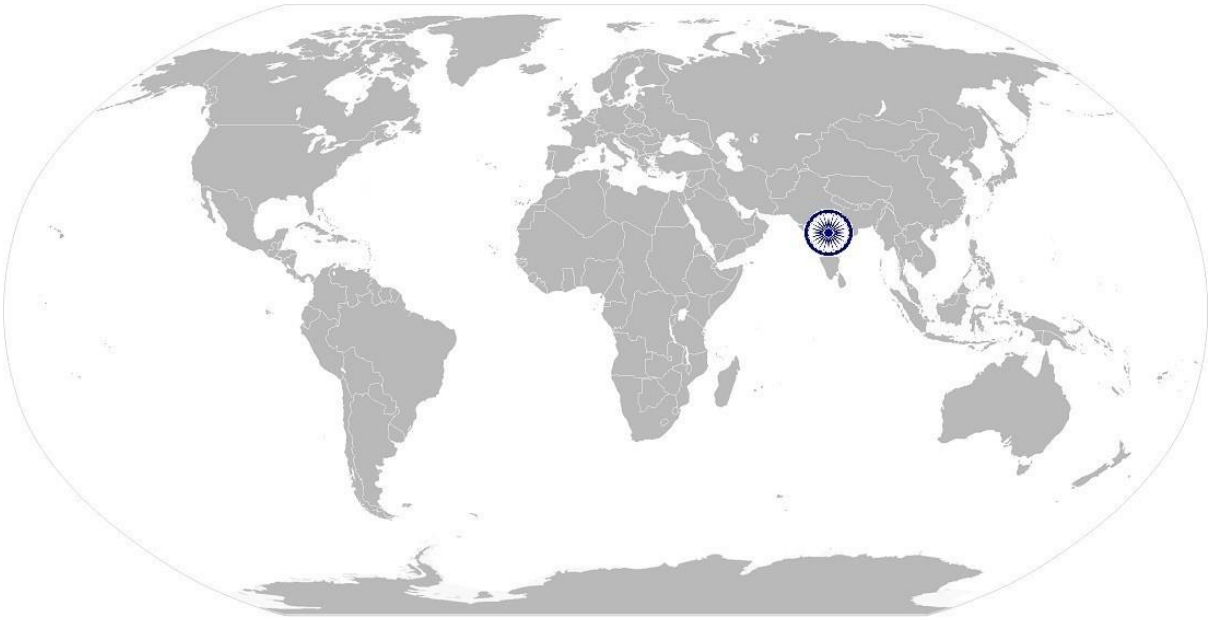
NOS Version Control

NOS Code	SGJ/ N0146		
Credits (NSQF)	TBD	Version number	1.0
Industry	Green Jobs	Drafted on	15/02/2017
Industry Sub-sector	Renewable Energy	Last reviewed on	14/06/2017
Occupation	Designer	Next review date	30/09/2019



Back to Top

National Occupational Standard



Overview

This unit is about installation and commissioning of solar PV power plant

SGJ/N0132 **Installation and Commissioning of solar PV power plant**

National Occupational Standard

Unit Code	SGJ/N0132
Unit Title (Task)	**Installation and commissioning of solar PV power plant**
Description	This unit is about installation and commissioning of solar PV power plant
Scope	This unit/task covers the following: • preparation before initiating construction at site • manage the installation schedule • test and commission the solar PV power plant
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Preparation before initiating construction at site	To be competent, the user/ individual must be able to: PC1. read and interpret the design and detailed drawings of the civil, mechanical and electrical works to be carried out at site PC2. ensure the marking of the complete layout of the plant as per design PC3. arrange for tools and consumable required for installation
Manage the installation schedule	To be competent, the user/ individual must be able to: PC4. follow the schedule for each of the civil and mechanical construction activity PC5. manage the schedule for installation of modules, inverters, transformers, power protection devices , lightning arresters ,earthing systems, etc. and ensure installation as per the design documents PC6. ensure the installation of cables between different components including modules, inverter and other components as per design documents PC7. check cables for continuity PC8. manage the installation of communication and storage system with SCADA facility/ any monitoring system PC9. ensure installation of battery banks if required PC10. prepare, review and report progress on daily basis to the site in-charge for further action
Test and commission the solar PV power plant	To be competent, the user/ individual must be able to: PC11. visually inspect the plant after installation PC12. get pre connection connectivity and conductivity test done PC13. verify system grounding and get the insulation resistance measured PC14. confirm that electrical protections, disconnection and other provisions are fulfilled as per design documents PC15. get the DC voltage and current test done for each of the module strings PC16. measure and record all relevant parameters of energy storage system if present PC17. ensure calibration of SCADA/any monitoring system PC18. prepare inspection report and forward to site-in charge for further PC19. on getting the clearance from electricity inspector, initiate startup procedures as per manufacturer's instructions PC20. monitor the energy readings and voltages at regular intervals on start up PC21. record and report any anomalous condition to the site in-charge for further action PC22. prepare as-built drawings and document design changes, if any

SGJ/N0132 **Installation and Commissioning of solar PV power plant**

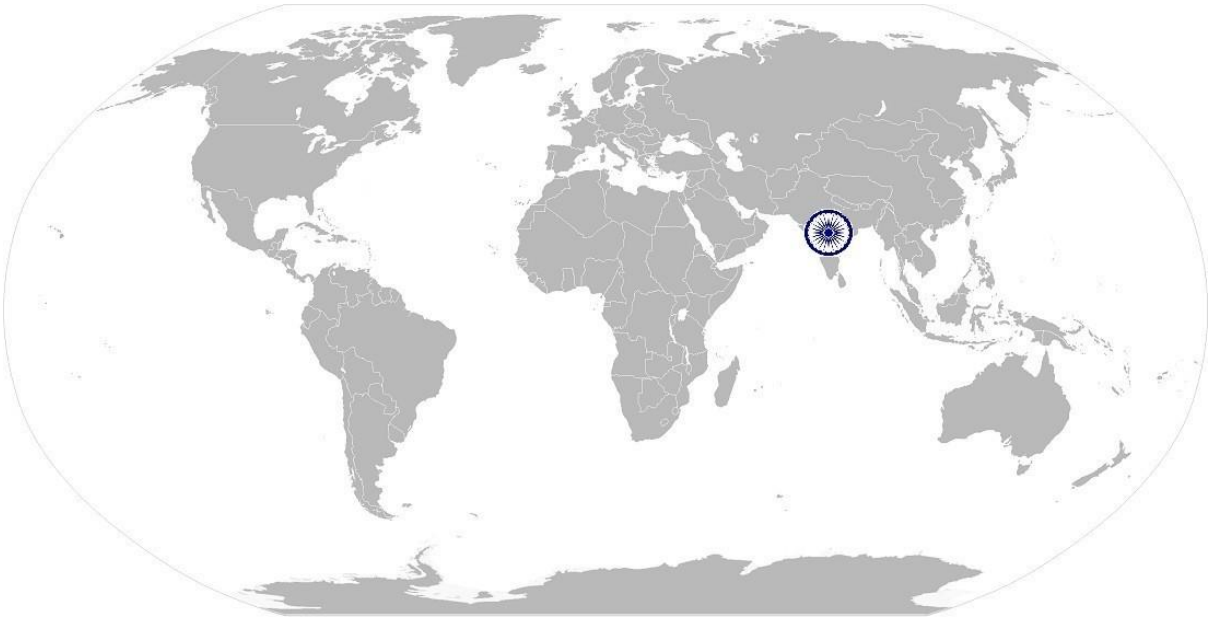
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the organization and its processes)	The user/individual on the job needs to know and understand: KA1. government/corporate policies and guidelines on: workplace safety, identification and mitigation of safety hazards, work procedures and guidelines for working at height KA2. document information using appropriate corporate forms KA3. obtain authorization from specified field safety officer and supervisor KA4. legislative, organization, site requirements and procedures
B. Technical Knowledge	The user/individual on the job needs to know and understand the following aspects: KB1. definition of the terms: energy and power, cell, module, string, array, mono-crystalline, poly-crystalline, amorphous silicon KB2. efficiency, cost and typical specifications, functioning and operating principle of different types of solar photovoltaic plants, commercially available PV modules, inverters, charge controllers, battery, mounting structures, cables, junction boxes and other components KB3. fundamentals of solar resource like GHI, DNI etc. and measurement of solar irradiance with a pyranometer KB4. effect on array output of current and voltage based on series / parallel connections of modules, tilt angle, orientation and shading KB5. simple calculations to derive the power and energy received from solar radiation in a given area KB6. mechanical and electrical features necessary for the long life of the PV power plant under a wide range of operating conditions KB7. site survey reports, availability of shadow free space for installation of solar power plant KB8. structural designs and foundation plans of rooftop and ground mount systems KB9. do's and don'ts of DC wiring and installation of other electrical equipment KB10. do's and don'ts of material handling and storage KB11. basic functioning and operation of different types of inverters and other electrical equipment KB12. connection of solar power plant to LT panel and switchover along with precautions KB13. testing and commissioning activities and their interpretation- continuity of wiring, earthing, polarity check, insulation, voltage drop KB14. measurement of losses in a PV systems at different points and interpretation of results KB15. typical faults, their causes and resolution for all system components KB16. grid codes and other regulatory provisions
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The user/ individual on the job needs to know and understand how to: SA1. prepare documentation as per relevant industry standards
	Reading Skills
	The user/individual on the job needs to know and understand how to: SA2. read vernacular/English language SA3. read and understand manuals, health and safety instructions, memos, other company documents SA4. read and interpret data from various sources

SGJ/N0132 **Installation and Commissioning of solar PV power plant**

	SA5. understand the various colour codes, as per standard electrical, mechanical and civil nomenclature
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA6. express statements or information clearly so that others can hear and understand SA7. participate in and understand the main points of simple discussions SA8. respond appropriately to any queries SA9. communicate with peers, superiors and sub-ordinates
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. follow organization rule-based decision making process SB2. take decision with systematic course of actions and/or response
	Plan and Organize
	The user/individual on the job needs to know and understand: SB3. plan and organize service work to meet deadlines SB4. organize raw materials and packaging materials required for site survey SB5. plan to utilize time and equipment's effectively SB6. work constructively and collaboratively with others
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB7. follow code of conduct SB8. manage relationships with customers with intent on satisfying its requirements for service delivery
	Problem Solving
	The user/individual on the job needs to know and understand how to: SB9. recognize problems and provide solutions using a range of cognitive and practical skills SB10. approach relevant authority when required
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB11. apply knowledge of facts, principles and processes to select the right course of action to perform tasks
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB12. use reasoning skills to identify and resolve basic problems SB13. use intuition to detect any potential problems which could arise during operations SB14. use acquired knowledge of the process for identifying and handling issues

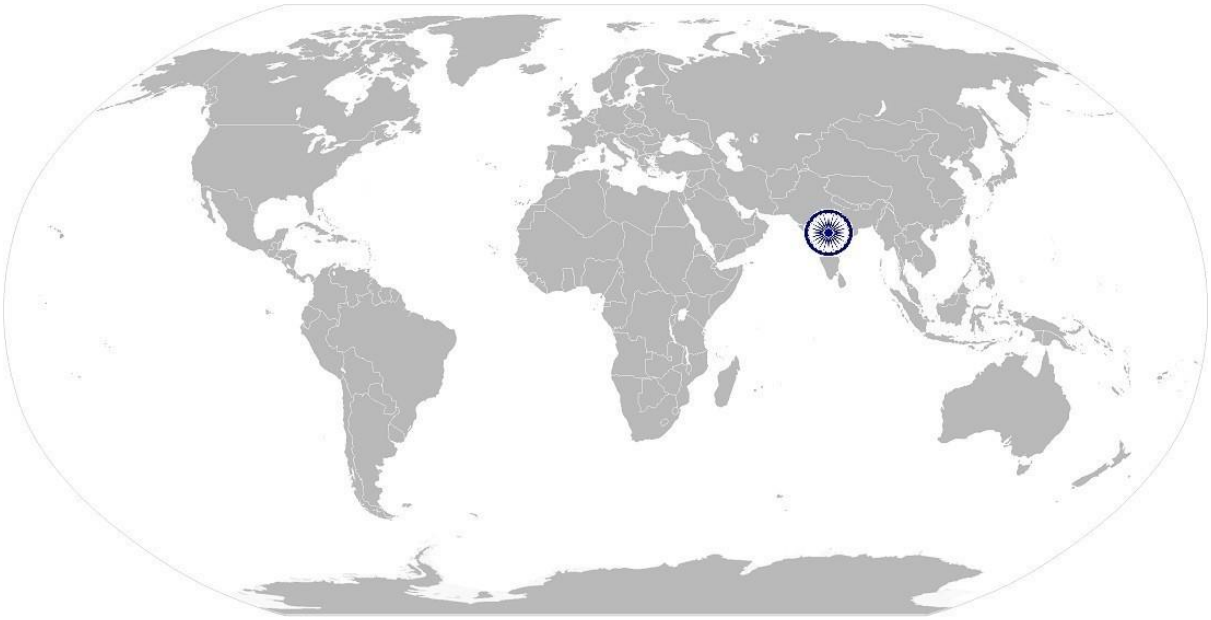
NOS Version Control

NOS Code	SGJ/N0132		
Credits (NSQF)	TBD	Version number	1.0
Industry	Green Jobs	Drafted on	01/09/2016
Industry Sub-sector	Renewable Energy	Last reviewed on	14/06/2017
Occupation	Installation and commissioning	Next review date	30/09/2019



Back to Top

National Occupational Standard



Overview

This unit is about quality assurance of solar PV power plant and its components

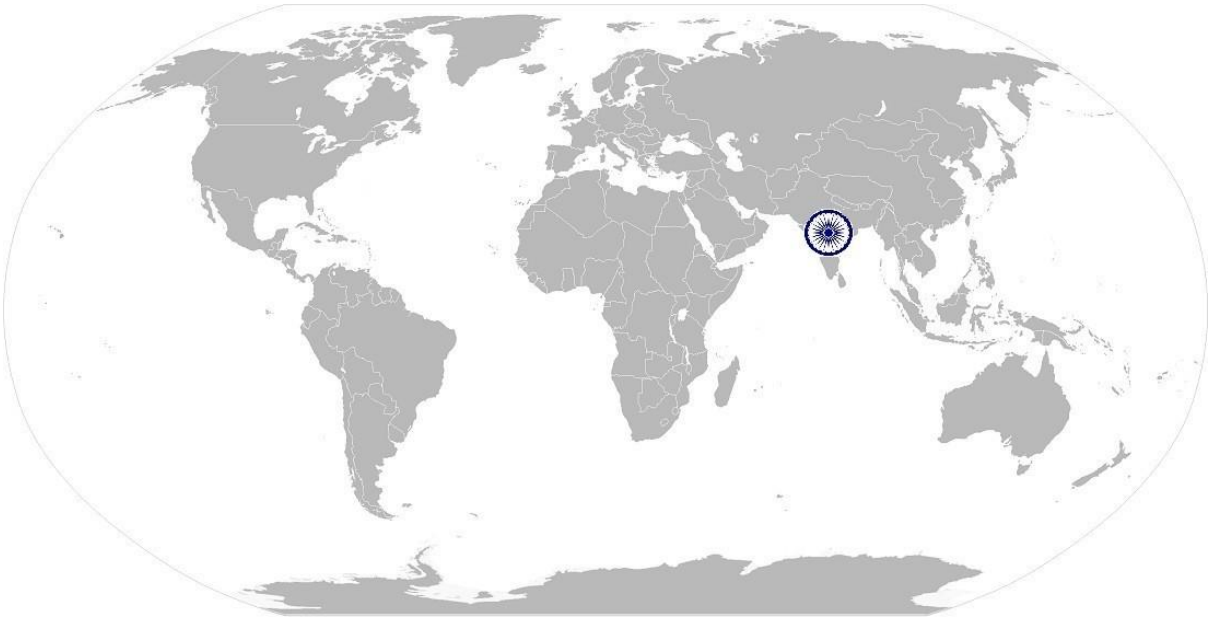
SGJ/N0133 **Quality Assurance of solar PV power plant and its components**

Unit Code	**SGJ/ N0133**
Unit Title (Task)	**Quality assurance of solar PV power plant**
Description	This unit is about quality assurance of solar PV power plant and its components
Scope	This unit/task covers the following: • before receiving material at site • on receipt of material at site • during installation • after installation • preparing handing over documents
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Before receiving material at site	To be competent, the user/ individual must be able to: PC1. check modules earmarked for power plant using a random selection as per relevant IS/IEC standards PC2. visit manufacturing facility of inverter supplier and witness testing of a few inverters PC3. collect documentation related to each and every equipment and submit to site in-charge
On receipt of material at site	To be competent, the user/ individual must be able to: PC4. ensure proper delivery/off-load of solar equipment PC5. check all the material and equipment received at site for any physical damage PC6. ensure specifications of the equipment and components match with what has been ordered PC7. ensure all warrantees by manufacturers are properly signed and are in order
During installation	To be competent, the user/ individual must be able to: PC8. inspect the foundations of structures PC9. inspect and verify cable routes and specifications as per design documents PC10. inspect module installation PC11. inspect the cable terminations and ensure tightness PC12. inspect the installation of inverters, protection devices and systems
After installation	To be competent, the user/ individual must be able to: PC13. carry out visual inspection of the plant to find out defects and deficiencies PC14. measure and record the circuit voltage and short circuit current of all the module strings and compare that with design values PC15. carry out thermography of doubtful strings and modules to know the defects PC16. carry out performance ratio test by continuous operation of the plant as per the industry norms and compare with designed values
Preparing handing over documents	To be competent ,the user/individual on the job must be able to: PC17. collect and compile conformity, warranty documentation, performance guarantees, calibration certificates and any other relevant documentation and handover to site in-charge, certificates
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the organization and	The user/individual on the job needs to know and understand: KA1. government/corporate policies and guidelines on: workplace safety, identification and mitigation of safety hazards, work procedures and guidelines for working at height

its processes)	KA2. document information using appropriate corporate forms KA3. obtain authorization from specified field safety officer and supervisor KA4. legislative, organization, site requirements and procedures
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. relevant IEC/IS standards and MNRE guidelines KB2. all test and inspection documentation of various components KB3. testing and commissioning activities and their interpretation- continuity of wiring, earthing, polarity check, insulation, voltage drop KB4. measurement of losses in a PV systems at different interconnections and interpretation of the results KB5. typical faults, their causes and resolution for all system components KB6. IV curve and performance ratio tests
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The user/ individual on the job needs to know and understand how to: SA1. prepare documentation as per relevant industry standards
	Reading Skills
	The user/individual on the job needs to know and understand how to: SA2. read vernacular/English language SA3. read and understand manuals, health and safety instructions, memos, other company documents SA4. ability to read from different sources- books, screens in machines and signage SA5. understand the various colour codes, as per standard electrical, mechanical and civil nomenclature
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA6. express statements or information clearly so that others can hear and understand SA7. participate in and understand the main points of simple discussions SA8. respond appropriately to any queries SA9. communicate with peers, superiors and sub-ordinates
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. follow organization rule-based decision making process SB2. take decision with systematic course of actions and/or response
	Plan and Organize
	The user/individual on the job needs to know and understand: SB3. plan and organize service work to meet deadlines SB4. organize raw materials and packaging materials required for site survey SB5. plan to utilize time and equipment's effectively SB6. work constructively and collaboratively with others
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB7. follow code of conduct SB8. manage relationships with customers with intent on satisfying its requirements for service delivery

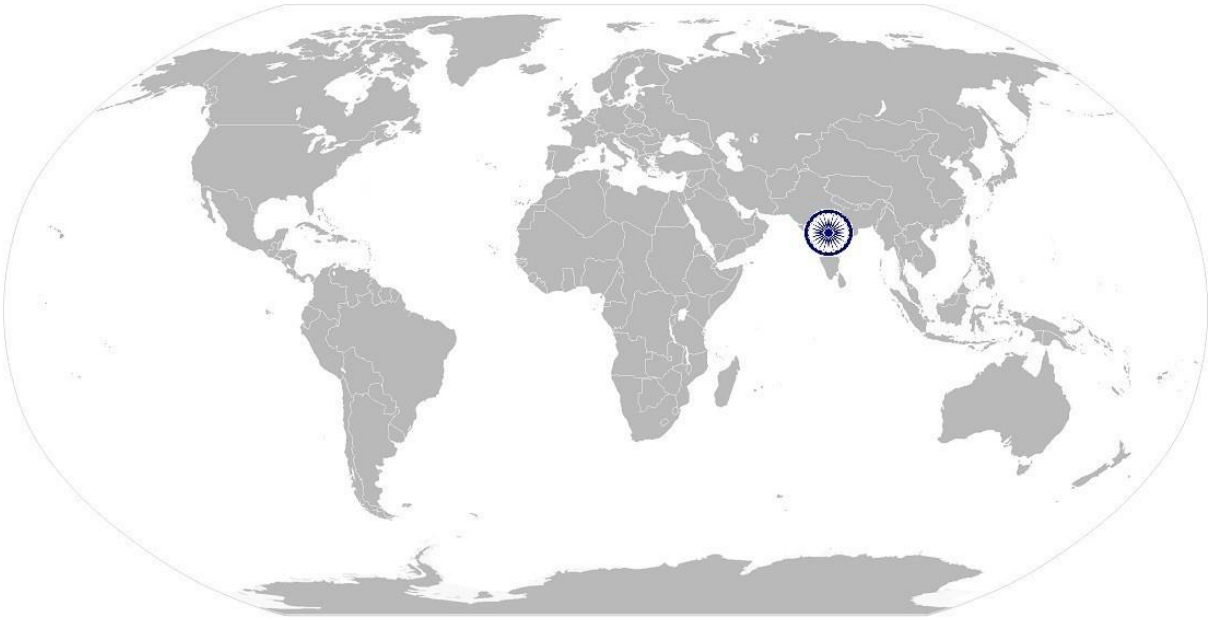
SGJ/N0133 **Quality Assurance of solar PV power plant and its components**

	Problem Solving
	The user/individual on the job needs to know and understand how to: SB9. recognize problems and provide solutions using a range of cognitive and practical skills SB10. approach relevant authority when required
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB11. apply knowledge of facts, principles and processes to select the right course of action to perform tasks
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB12. use reasoning skills to identify and resolve basic problems SB13. use intuition to detect any potential problems which could arise during operations SB14. use acquired knowledge of the process for identifying and handling issues



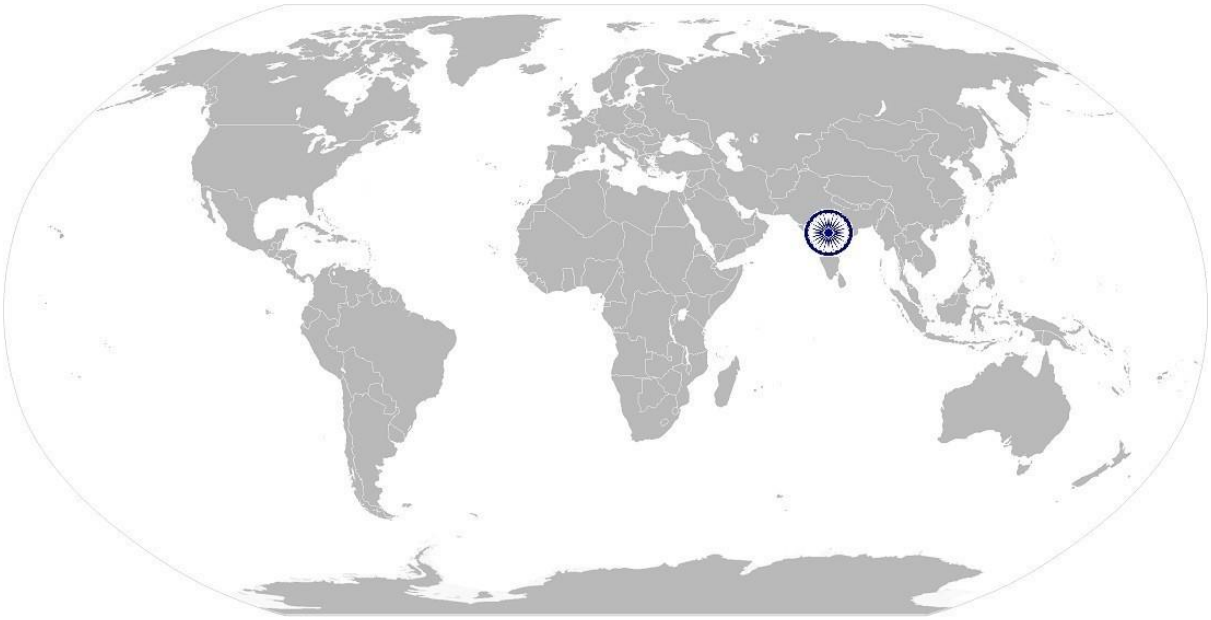
NOS Version Control

NOS Code	SGJ/ N0133		
Credits (NSQF)	TBD	Version number	1.0
Industry	Green Jobs	Drafted on	01/09/2016
Industry Sub-sector	Renewable Energy	Last reviewed on	14/06/2017
Occupation	Quality Assurance	Next review date	30/09/2019



Back to Top

National Occupational Standard



Overview

This unit is about maintaining health & safety at project site

SGJ/N0106 **Maintain Personal Health & Safety at project site**

National Occupational Standard

Unit Code	SGJ/N0106
Unit Title (Task)	**Maintain personal health & safety at project site**
Description	This unit is about maintaining health & safety at project site
Scope	This unit/task covers the following: • establish and follow safe work procedure • use and maintain personal protective equipment • identify and mitigate safety hazards • demonstrate safe and proper use of required tools and equipment • identify work safety procedures and instructions for working at height
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Establish and Follow safe work procedure	To be competent, the user/individual on the job must be able to: PC1. identify corporate policies required for workplace safety PC2. identify requirements for safe work area and create a safe work environment PC3. identify contact person when workplace safety policies are violated PC4. provide information about incident/violation PC5. identify the location of first aid materials and administer first aid
Use and maintain personal protective equipment	To be competent, the user/individual on the job must be able to: PC6. identify the personal protection equipment required for specific locations on-site PC7. identify expiry dates and wear & tear issues of specified equipment PC8. demonstrate safe and accepted practices for personal protection
Identify and mitigate safety hazards	To be competent, the user/individual on the job must be able to: PC9. identify environmental hazards associated with the project site PC10. identify electrical hazards PC11. identify personal safety hazards or work site hazards and mitigate hazards
Demonstrate safe and proper use of required tools and equipment	To be competent, the user/individual on the job must be able to: PC12. select tools, equipment and testing devices needed to carry out the work PC13. demonstrate safe and proper use of required tools and equipment
Identify work safety procedures and instructions for working at height	To be competent, the user/individual on the job must be able to: PC14. check access from ground to work area to ensure it is safe and in accordance with requirements PC15. re-assess risk control measures, as required, in accordance with changed work practices and/or site conditions and undertake alterations PC16. inspect/install fall protection and perimeter protection equipment ensuring adequacy for work and conformance to regulatory requirements PC17. identify approved methods of moving tools and equipment to work area and minimize potential hazards associated with tools at heights PC18. select and install appropriate signs and barricades PC19. place tools and materials to eliminate or minimize the risk of items being knocked down PC20. dismantle plant safely in accordance with sequence and remove from worksite to clear work area

SGJ/N0106 **Maintain Personal Health & Safety at project site**

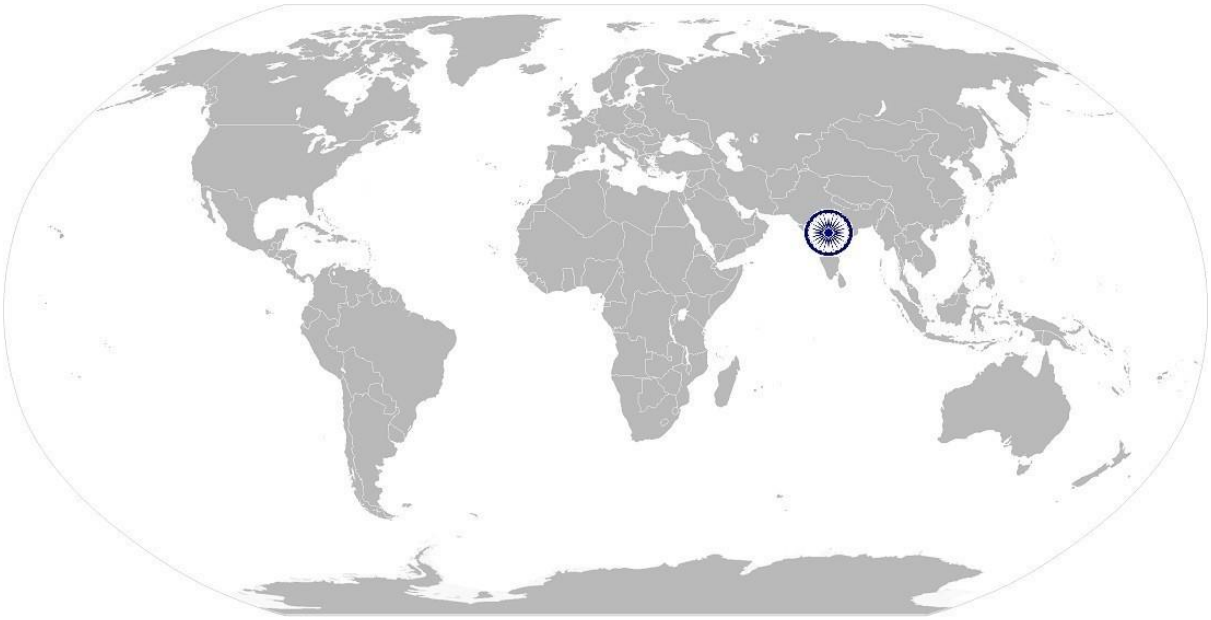
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the organization and its processes)	The user/individual on the job needs to know and understand: KA1. company's installation policy KA2. company's customer support policy KA3. company's documentation policy KA4. document information using appropriate corporate forms KA5. obtain authorization from specified field safety officer and supervisor KA6. company's reporting structure & organization culture KA7. company's different department and concerned authority
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. relevant personal protective equipment's required for installation KB2. relevant standards and regulations for installation of solar photovoltaic power plant in India KB3. occupational health and safety (OHS) standards for installation of solar photovoltaic power plant KB4. risk identification and mitigation procedure for safe installation of solar photovoltaic power plant KB5. knowhow of tools & tackles required to carry out the work
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The user/ individual on the job needs to know and understand how to: SA1. fill up documentation applicable to one's role
	Reading Skills
	The user/individual on the job needs to know and understand how to: SA2. read vernacular/English language SA3. read and understand manuals, health and safety instructions, memos, other company documents SA4. ability to read from different sources- books, screens in machines and signage SA5. understand the various colour codes, as per standard electrical, mechanical and civil nomenclature
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA6. express statements or information clearly so that others can hear and understand SA7. participate in and understand the main points of simple discussions SA8. respond appropriately to any queries SA9. communicate with peers, sub-ordinates and superiors
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. follow organization rule-based decision making process SB2. take decision with systematic course of actions and/or response
	Plan and Organize
	The user/individual on the job needs to know and understand: SB3. plan and organize service work to meet deadlines SB4. organize raw materials and packaging materials required for site survey SB5. plan to utilize time and equipment's effectively SB6. work constructively and collaboratively with others

SGJ/N0106 **Maintain Personal Health & Safety at project site**

	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB7. follow code of conduct SB8. manage relationships with customers with intent on satisfying its requirements for service delivery
	Problem Solving
	The user/individual on the job needs to know and understand how to: SB9. think through the problem, evaluate the possible solution(s) and suggest an optimum /best possible solution(s) SB10. choose best methods to complete assigned tasks SB11. approach relevant authority when required
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB12. apply domain knowledge, observations and data to select course of action to perform tasks related to solar photovoltaic systems
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB13. critically evaluate information obtained from customers, supervisor and co-workers to perform day to day activities SB14. ask questions for better understanding

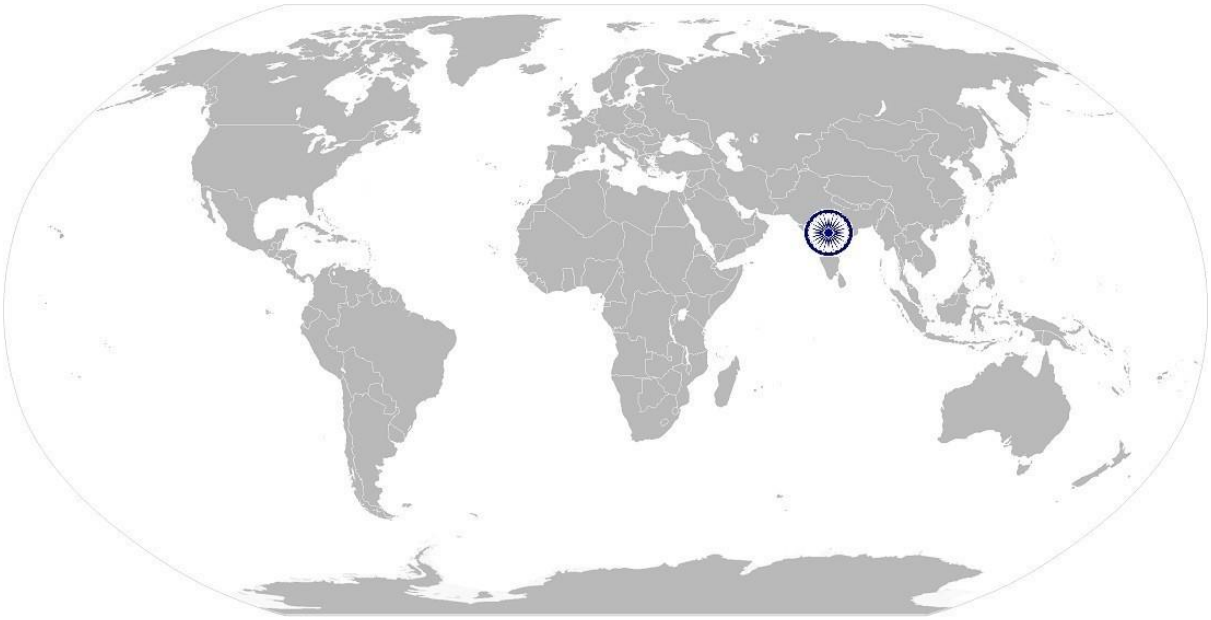
NOS Version Control

NOS Code	SGJ/N0106		
Credits (NSQF)	TBD	Version number	1.0
Industry	Green Jobs	Drafted on	26/06/2015
Industry Sub-sector	Solar Photovoltaic	Last reviewed on	21/10/2015
Occupation	Health & Safety	Next review date	01/10/2018



Back to Top

National Occupational Standard



Overview

This unit covers basic practices that improves the effectiveness of working with others in an organizational set-up

SGJ/N0120 **Work effectively with others**

National Occupational Standard

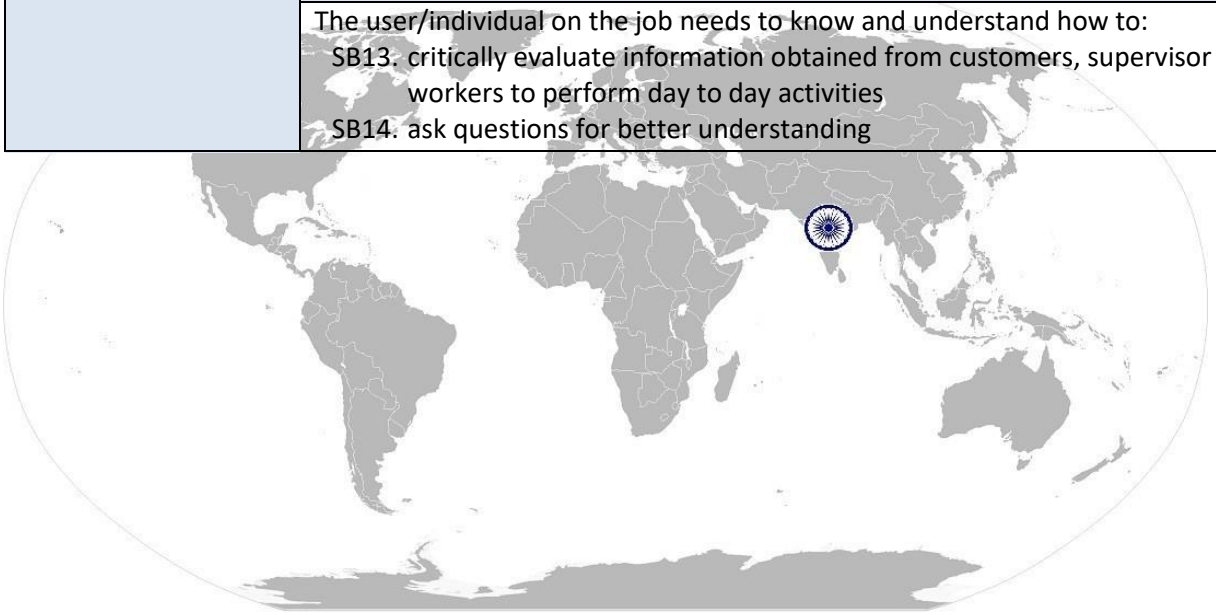
Unit Code	SGJ/ N0120
Unit Title (Task)	**Work effectively with others**
Description	This unit covers basic etiquette and competencies that a candidate is required to possess and demonstrate in their behavior and interactions with others at the workplace
Scope	This unit/task covers the following: • working with others
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Working with others	The user/individual on the job should be able to: PC1. accurately pass on information to the authorized persons who require it and within agreed timescale and confirm its receipt PC2. assist others in performing tasks in a positive manner where required and possible PC3. consult and assist others to maximize effectiveness and efficiency in carrying out tasks PC4. display appropriate communication etiquette while working PC5. display active listening skills while interacting with others at work PC6. demonstrate responsible and disciplined behaviors at the project site PC7. escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict PC8. identify the need for common grounds with clients, team members, etc. and negotiate in an effective manner to achieve the same PC9. consider and respect the opinions, creativity, values, beliefs and perspectives of others PC10. ensure collaboration and group participation to achieve common goals PC11. promote a friendly, co-operative environment that is conducive to employee's sense of belonging PC12. facilitate an understanding and appreciation of the differences among team members
Knowledge and Understanding (K)	
A. Organizational context (Knowledge of the company / organization and its processes)	The user/individual on the job needs to know and understand: KA1. legislation, standards, policies, and procedures followed in the organization relevant to own employment and performance conditions KA2. reporting structure, inter-dependent functions, lines and procedures in the work area KA3. relevant people and their responsibilities within the work area KA4. escalation matrix and procedures for reporting work and employment related issues
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. various categories of people that one is required to communicate and co-ordinate with in the organization KB2. importance of effective communication in the workplace KB3. importance of teamwork in organizational and individual success KB4. various components of effective communication KB5. key elements of active listening

SGJ/N0120 **Work effectively with others**

	KB6. value and importance of active listening and assertive communication KB7. barriers to effective communication KB8. importance of tone and pitch in effective communication KB9. importance of avoiding casual expletives and unpleasant terms while communicating professional circles KB10. how poor communication practices can disturb people, environment and cause problems for the employee, the employer and the customer KB11. key elements and importance of non-verbal communication KB12. importance of ethics for professional success KB13. importance of discipline for professional success KB14. what constitutes disciplined behavior for a working professional KB15. common reasons for interpersonal conflict KB16. importance of developing effective working relationships for professional success KB17. expressing and addressing grievances appropriately and effectively KB18. importance and ways of managing interpersonal conflict effectively KB19. importance of teamwork and collaboration
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The user/ individual on the job needs to know and understand how to: SA1. note the information communicated SA2. record the readings of various parameters in the prescribed format SA3. note down observations related to the activity SA4. write information documents to internal departments/ internal teams
	Reading Skills
	The user/individual on the job needs to know and understand how to: SA5. read vernacular/English language SA6. read and understand equipment manuals, health and safety instructions, memos, other company documents SA7. read from different sources- books, screens in machines and signage SA8. read internal information documents sent by internal teams
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA9. express statements or information clearly so that others can hear and understand SA10. participate in and understand the main points of simple discussions SA11. respond appropriately to any queries SA12. communicate effectively with supervisor, peers and subordinates
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. follow organization rule-based decision making process SB2. analyze critical points in day to day tasks and identify control measures to solve the issue SB3. handle issues in case the superior is not available (as per the authority matrix defined by the organisation)
	Plan and Organize
	The user/individual on the job needs to know and understand how to : SB4. planning and organization of work to meet deadlines SB5. work constructively and collaboratively with others

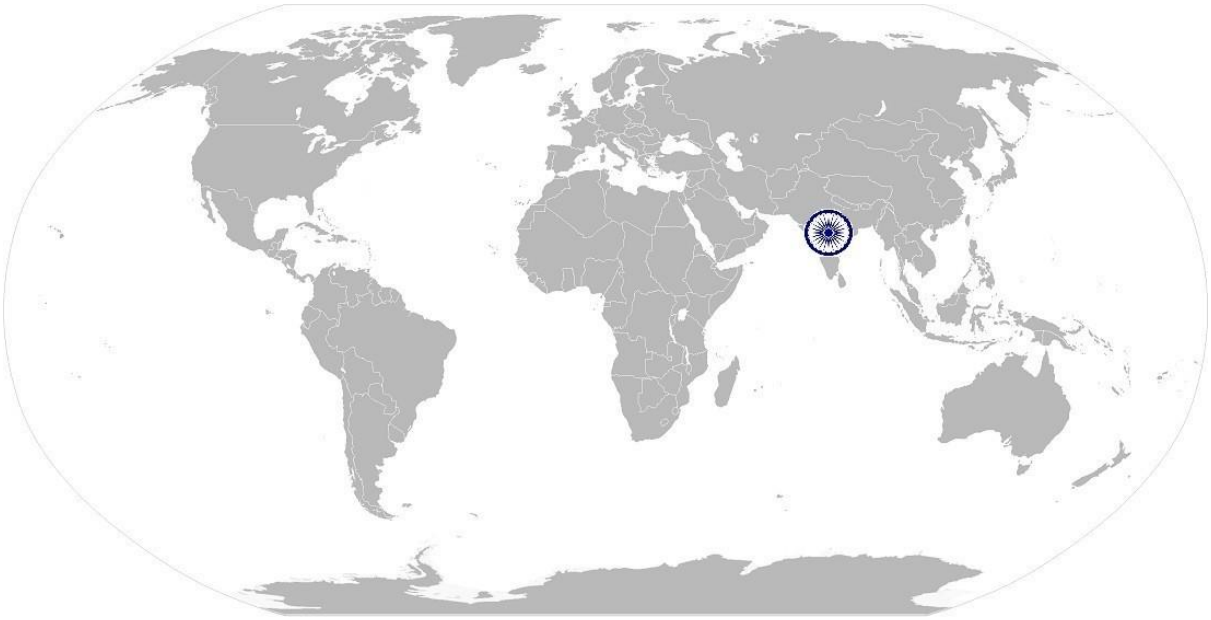
SGJ/N0120 **Work effectively with others**

	SB6. support the superiors in scheduling tasks
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB7. follow organisation code of conduct SB8. manage relationships with customers with intent on satisfying its requirements for service delivery
	Problem Solving
	The user/individual on the job needs to know and understand how to: SB9. recognize problems and search for solutions SB10. choose best methods to complete assigned tasks SB11. approach relevant authority when required
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB12. apply domain knowledge, observations and data to select course of action to perform tasks
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB13. critically evaluate information obtained from customers, supervisor and co-workers to perform day to day activities SB14. ask questions for better understanding



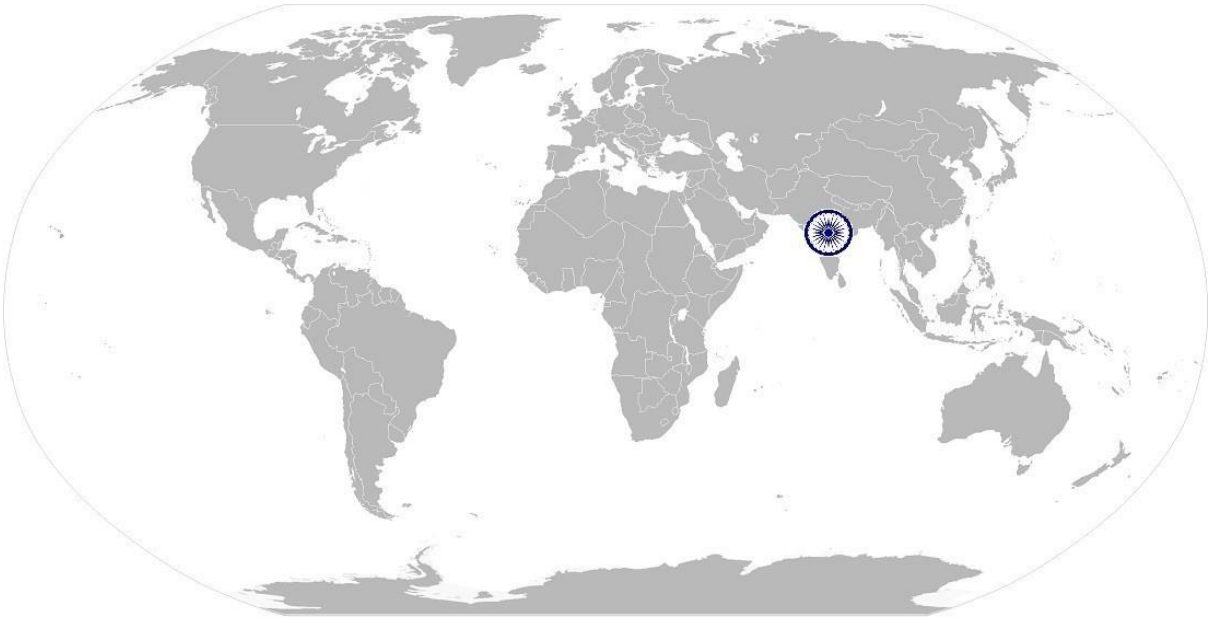
NOS Version Control

NOS Code	SGJ/ N0120		
Credits (NSQF)	TBD	Version number	1.0
Industry	Green Jobs	Drafted on	01/09/2016
Industry Sub-sector	Renewable Energy	Last reviewed on	15/02/2019
Occupation	Team management	Next review date	30/09/2019



Back to Top

National Occupational Standard



Overview

This unit is about Design, Installation and Commissioning of Solar Water Pumping System

SGJ/N0134 Design, Installation and Commissioning of Solar Water Pumping System

National Occupational Standard

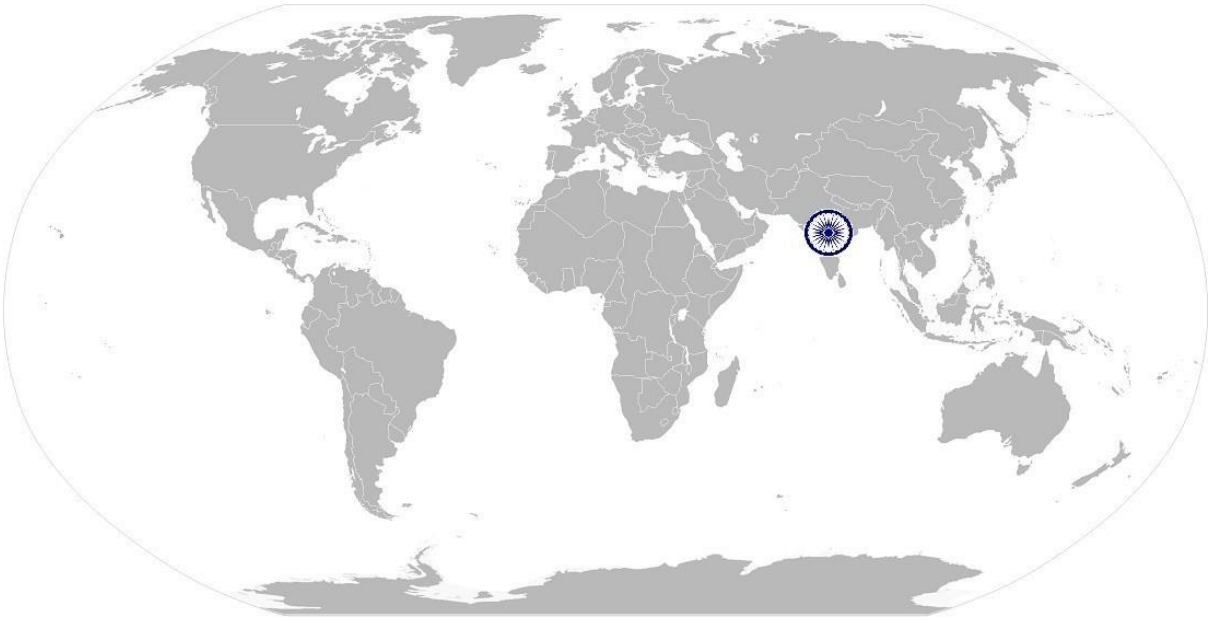
Unit Code	SGJ/N0134
Unit Title (Task)	**Design, installation and commissioning of solar pumping system**
Description	This unit is about Design, Installation and Commissioning of Solar Pumping System
Scope	This unit/task covers the following: • design of solar pumping system • installation, test and commissioning of solar pumping system • operation and maintenance of solar pumping system
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Design of solar pumping system	To be competent, the user/individual on the job must be able to: PC1. analyze the water usage and level of water table at site PC2. decide on the specifications of the pumping set and motor PC3. decide on the capacity of PV modules PC4. design the plan of mounting structures and foundation
Installation, testing and commissioning of solar pumping system	To be competent, the user/individual on the job must be able to: PC5. oversee the preparation of the foundation for solar module mounting structure and motor pump set PC6. ensure structure is fixed on the foundations PC7. oversee the mounting of solar modules PC8. oversee the connection of solar module array to pump set in case of DC pumps PC9. oversee the installation of inverter in case of AC pumps PC10. ensure protection system are in place PC11. perform inspection and testing of equipment PC12. perform start-up procedures and measure output PC13. compare the output with design output and take corrective actions, if required PC14. ensure connection of the solar module array to motor pump set through a Maximum Power Point Tracker (MPPT) to get maximum power from the array PC15. install an inverter after MPPT to convert DC power to AC power in case an AC submersible motor pump set is used
Operation and maintenance of solar pumping system	To be competent, the user/individual on the job must be able to: PC16. ensure periodical cleaning of solar module array PC17. periodically ensure tightness of cable connections PC18. ensure periodic maintenance of motor pump set
Knowledge and Understanding (K)	
A. Organizational Context (Knowledge of the organization and its processes)	The user/individual on the job needs to know and understand: KA1. company's installation policy KA2. company's customer support policy KA3. company's documentation policy KA4. document information using appropriate corporate forms KA5. obtain authorization from specified field safety officer and supervisor KA6. company's reporting structure & organization culture KA7. company's different department and concerned authority

SGJ/N0134 Design, Installation and Commissioning of Solar Water Pumping System

B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. solar resource assessment including Direct normal irradiation, diffuse horizontal irradiation, global horizontal irradiation and albedo KB2. knowledge of Excel and Solar simulation software like PV*SOL®, PVsyst, etc. KB3. various type of tracking system like maximum PowerPoint Tracker (MPPT) system and their usage KB4. type of DC/AC pumping systems usage and their operating characteristics KB5. underground water levels, availability of water and recharging frequency of water KB6. efficiency, cost and typical specifications, functioning and operating principle of different types of solar photovoltaic plants, commercially available PV modules, inverters, charge controllers, battery, mounting structures, cables, junction boxes and other components
Skills (S)	
A. Core Skills/ Generic Skills	**Writing Skills**
	The user/ individual on the job needs to know and understand how to: SA1. fill up documentation applicable to one's role
	Reading Skills
	The user/individual on the job needs to know and understand how to: SA2. read vernacular/English language SA3. read and understand manuals, health and safety instructions, memos, other company documents SA4. ability to read from different sources- books, screens in machines and signage SA5. understand the various colour codes, as per standard electrical, mechanical and civil nomenclature
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA6. express statements or information clearly so that others can hear and understand SA7. participate in and understand the main points of simple discussions SA8. respond appropriately to any queries SA9. communicate with peers, superiors and sub-ordinates
B. Professional Skills	**Decision Making**
	The user/individual on the job needs to know and understand how to: SB1. follow organization rule-based decision making process SB2. take decision with systematic course of actions and/or response
	Plan and Organize
	The user/individual on the job needs to know and understand: SB3. plan and organize service work to meet deadlines SB4. organize raw materials and packaging materials required for site survey SB5. plan to utilize time and equipment's effectively SB6. work constructively and collaboratively with others
	Customer Centricity
	The user/individual on the job needs to know and understand how to: SB7. follow code of conduct SB8. manage relationships with customers with intent on satisfying its requirements for service delivery

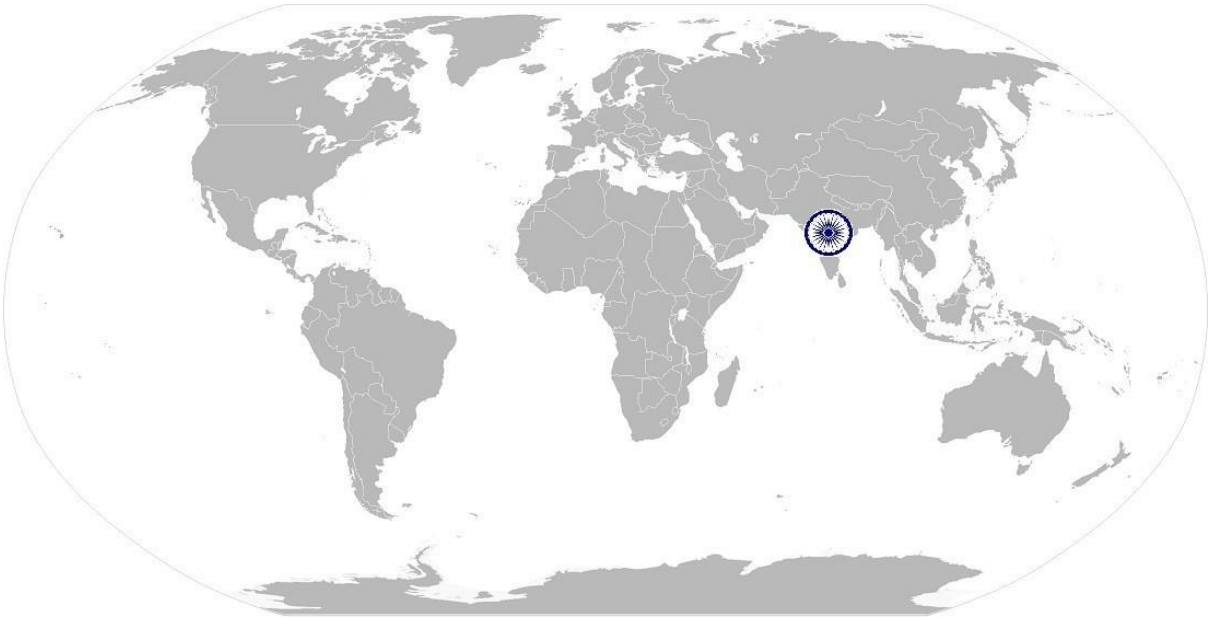
SGJ/N0134 Design, Installation and Commissioning of Solar Water Pumping System

	Problem Solving
	The user/individual on the job needs to know and understand how to: SB9. recognize problems and provide solutions using a range of cognitive and practical skills SB10. approach relevant authority when required
	Analytical Thinking
	The user/individual on the job needs to know and understand how to: SB11. apply knowledge of facts, principles and processes to select the right course of action to perform tasks
	Critical Thinking
	The user/individual on the job needs to know and understand how to: SB12. use reasoning skills to identify and resolve basic problems SB13. use intuition to detect any potential problems which could arise during operations SB14. use acquired knowledge of the process for identifying and handling issues



NOS Version Control

NOS Code	SGJ/N0134		
Credits (NSQF)	TBD	Version number	1.0
Industry	Green Jobs	Drafted on	01/09/2016
Industry Sub-sector	Renewable Energy	Last reviewed on	14/06/2019
Occupation	Design, Installation and Commissioning	Next review date	30/09/2019

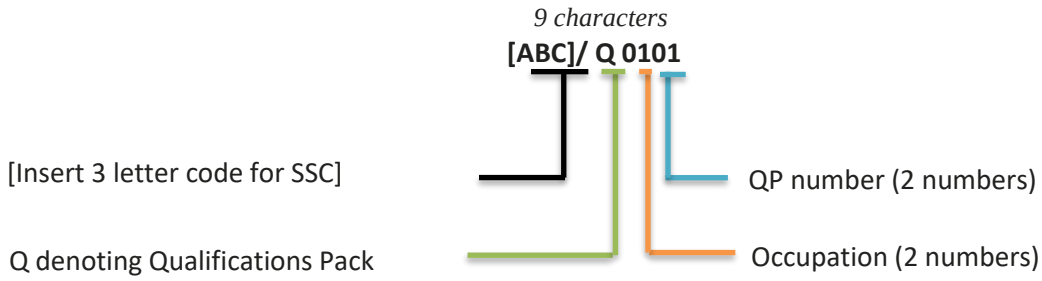


Back to Top

Annexure

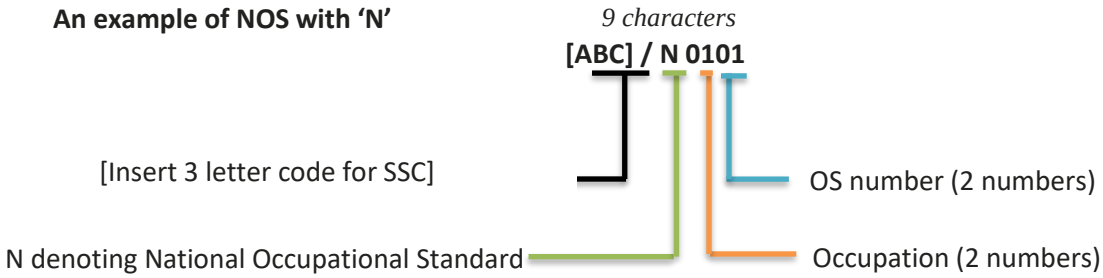
Nomenclature for QP and NOS

Qualifications Pack



Occupational Standard

An example of NOS with 'N'



Back to top…

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

Sub-sector		Range of Occupation numbers
Renewable Energy (01-35)	**Solar Photovoltaic**	01-05
	Solar Thermal	06-10
	Wind	11-15
	Hydro	16-20
	Biomass	21-25
	Geothermal	26-30
	All Renewables (Cross-cutting/ Enabling Activities)	31-35
Green Transportation (36 - 40)	**Alternative Fuel Transportation**	36-40
	Bio-fuels and Farming	40-45
	Other Green Transportation	46-50
Green Construction (51- 60)	**Green Buildings**	51-55
	Energy Efficiency	56-60
Waste Management (61- 65)	**Waste Management**	61-65
Water Management (66-70)	**Water and Wastewater Management**	66-70
Co-Generation (71 - 75)	**Co-generation**	71-75
Other Green Jobs (76- 99)	**Carbon Sinks**	76-80
	Environmental Compliance and Sustainability Planning	81-85
	Other Green Jobs	85-99

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

Back to top…

Qualifications Pack for "Solar PV Engineer"

CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role Solar PV Engineer

Qualification Pack **SGJ**/Q0112

Sector Skill Council Green Jobs

Guidelines for Assessment

1. Criteria for assessment for each Qualification Pack will be created by the Sector Skill Council. Each Performance Criteria (PC) will be assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.
2. The assessment for the theory part will be based on knowledge bank of questions created by the SSC.
3. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.
4. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below).
5. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criterion.
6. To pass the Qualification Pack , every trainee should score a minimum of 70% of aggregate marks to successfully clear the assessment.
7. In case of *unsuccessful completion*, the trainee may seek reassessment on the Qualification Pack.

Compulsory NOS **Total Marks: 465**				**Marks allocation**	
Assessment Outcomes	**Assessment Criteria for outcomes**	**Total Marks**	**Out of**	**Theory**	**Skills Practical**
SGJ/N0109 Prepare a site feasibility study report	PC1. identify optimum location of Installations	**65**	3	1	2
	PC2. assess the site level pre-requisites for solar panel installation		10	4	6
	PC3. decide on the type of mounting to be constructed and place of mounting as per client requirement		4	2	2
	PC4. check for any shading obstacles		3	1	2
	PC5. prepare a site map of the location where installation has to be carried out		3	1	2
	PC6. assess the load to be run on Solar PV power plant and prepare a load profile		3	1	2
	PC7. estimate the capacity of Solar PV power plant		5	2	3
	PC8. decide on battery backup as per grid availability, loads and client expectation		5	2	3
	PC9. assess or obtain the site specific major parameters of solar resource data like GHI, DNI, Temperature and Wind		3	1	2
	PC10. perform shading analysis		5	2	3
	PC11. estimate the energy generated from the rooftop solar PV power plant using software like PV*SOL®, PVSYST, etc.		10	3	7
	PC12. identify the risks associated with the specific solar project		5	2	3

Qualifications Pack for "Solar PV Engineer"

	PC13. prepare a site feasibility study report		6	3	3
		TOTAL	**65**	**25**	**40**
SGJ/N0146 Design of solar PV power plant	PC1. review and interpret of the mounting structure and foundation design drawings	**100**	4	1	3
	PC2. review the overall structural layout of the solar PV power plant		6	2	4
	PC3. select solar module technology and size, based on analysis of cost, power output, quality, climatic conditions of the site, global and diffused irradiance ratio at the site, etc.		6	2	4
	PC4. workout the total numbers of modules based on the total capacity of the plant and the capacity of selected modules		6	2	4
	PC5. prepare the earthing design of solar module arrays		4	2	2
	PC6. select inverter, based on compatibility with module technology, compliance with grid code and other applicable regulations, reliability, system availability, serviceability, quality, cost, DC TO AC conversion efficiency		6	2	4
	PC7. in case of a roof top power plant, decide on specifications of the inverter to power the AC loads in the building		4	2	2
	PC8. decide on number of inverters to be used based on the capacity and specifications of the inverter selected		6	2	4
	PC9. finalize the inverter layout and inverter locations on the basis of total capacity		4	2	2
	PC10. prepare the earthing design of inverters		2	1	1
	PC11. workout number of modules in a string based on the input voltage and MPPT voltage range of the inverter		2	1	1
	PC12. workout number of strings connected to a combiner box based on minimum run of DC connecting cables to minimized DC losses		4	2	2
	PC13. finalize the inter space between the solar modules on the basis of minimum inter row shading, adequate space for cleaning and maintenance of solar modules and the tilted to south at an angle that optimizes the annual energy yield		4	2	2
	PC14. specify DC cabling material, size, type of PVC for cables connecting modules, junction boxes to the combiner boxes and combiner boxes to the inverter panels etc.		6	2	4
	PC15. prepare the specification of DC connectors (plugs and sockets) to be used		4	2	2
	PC16. prepare the design specifications for junction boxes/combiner including IP number		4	2	2
	PC17. prepare the specifications for disconnects/switches		4	2	2
	PC18. workout number of combiner boxes connected to one panel of the inverter based		4	2	2

Qualifications Pack for "Solar PV Engineer"

	on the input current rating of the inverter				
	PC19. prepare islanding facility for grid connected power plant, in case of non- availability of grid		4	2	2
	PC20. protect incorrect polarity, over-voltage and overload for the DC cables		4	1	3
	PC21. decide on specification of charge controller/ inverter to the control the overcharging/ discharging of batteries		4	2	2
	PC22. decide the storage battery capacity (AH) based on the number of days autonomy required (KWH/WH) and the depth of discharge of the battery bank		4	1	3
	PC23. decide on the specifications for the charge controller/ inverter to control the overcharging/discharging of the batteries, prepare energy generation report using simulation software		4	1	3
		TOTAL	**100**	**40**	**60**
SGJ/N0132 Installation and commissioning of solar PV power plant	PC1. read and interpret the design and detailed drawings of the civil, mechanical and electrical works to be carried out at site	**100**	4	2	2
	PC2. ensure the marking of the complete layout of the plant as per design		2	1	1
	PC3. arrange for tools and consumable required for installation		2	1	1
	PC4. follow the schedule for each of the civil and mechanical construction activity		8	2	6
	PC5. manage the schedule for installation of modules, inverters, transformers, power protection devices , lightning arresters ,earthing systems, etc. and ensure installation as per the design documents		8	2	6
	PC6. ensure the installation of cables between different components including modules, inverter and other components as per design documents		6	2	4
	PC7. check cables for continuity		4	1	3
	PC8. manage the installation of communication and storage system with SCADA facility/ any monitoring system		8	2	6
	PC9. ensure installation of battery banks if required		4	2	2
	PC10. prepare, review and report progress on daily basis to the site in-charge for further action		**4**	**2**	**2**
	PC11. visually inspect the plant after installation		4	2	2
	PC12. get pre connection connectivity and conductivity test done		4	2	2
	PC13. verify system grounding and get the insulation resistance measured		4	2	2
	PC14. confirm that electrical protections, disconnection and other provisions are fulfilled as per design documents		4	2	2

Qualifications Pack for "Solar PV Engineer"

	PC15. get the DC voltage and current test done for each of the module strings		4	2	2
	PC16. measure and record all relevant parameters of energy storage system if present		4	2	2
	PC17. ensure calibration of SCADA/any monitoring system		4	2	2
	PC18. prepare inspection report and forward to site in-charge for further		8	2	6
	PC19. on getting the clearance from electricity inspector, initiate start up procedures as per manufacturer's instructions		4	2	2
	PC20. monitor the energy readings and voltages at regular intervals on start up		6	3	3
	PC21. record and report any anomalous condition to the site in-charge for further action		2	1	1
	PC22. Prepare as-built drawings and document design changes, if any		2	1	1
		TOTAL	**100**	**40**	**60**
SGJ/N0133 Quality Assurance of solar PV power plant and its components	PC1. visit the module manufacturing facility of the supplier	**100**	2	1	1
	PC2. check modules earmarked for power plant using a random selection as per relevant IS/IEC standards		6	3	3
	PC3. visit manufacturing facility of Inverter supplier and witness testing of a few inverters		4	1	3
	PC4. collect documentation related to each and every equipment and submit to site in-charge		4	2	2
	PC5. ensure proper delivery/off-load of solar equipment		6	2	4
	PC6. check all the material and equipment received at site for any physical damage		6	2	4
	PC7. ensure specifications of the equipment and components match with what has been ordered		6	3	3
	PC8. ensure all warrantees by manufacturers are properly signed and are in order		6	3	3
	PC9. inspect the foundations of structures		4	1	3
	PC10. inspect and verify cable routes and specifications as per design documents		6	2	4
	PC11. inspect module installation		4	1	3
	PC12. inspect the cable terminations and ensure tightness		4	1	3
	PC13. inspect the installation of inverters, protection devices and systems		4	1	3
	PC14. carry out visual inspection of the plant to find out defects and deficiencies		6	4	2
	PC15. measure and record the circuit voltage and short circuit current of all the module strings and compare that with design values		8	3	5
	PC16. carry out thermography of doubtful strings and modules to know the defects		8	4	4

Qualifications Pack for "Solar PV Engineer"

	PC17. carry out performance ratio test by continuous operation of the plant as per the industry norms and compare with designed values		8	4	4
	PC18. collect and compile conformity, warranty documentation, performance guarantees, calibration certificates and any other relevant documentation and handover to site in-charge, certificates		8	2	6
		TOTAL	**100**	**40**	**60**
SGJ/N0106 Maintain personal health & safety at project site	PC1. identify corporate policies required for workplace safety	**50**	2	1	1
	PC2. identify requirements for safe work area and create a safe work environment		3	2	1
	PC3. identify contact person when workplace safety policies are violated		1	1	0
	PC4. provide information about incident/violation		1	1	0
	PC5. identify the location of first aid materials and administer first aid		2	1	1
	PC6. identify the personal protection equipment required for specific locations on-site		3	2	1
	PC7. identify expiry dates and wear & tear issues of specified equipment		2	1	1
	PC8. demonstrate safe and accepted practices for personal protection		3	2	1
	PC9. identify environmental hazards associated with the project site		2	1	1
	PC10. identify electrical hazards		4	2	2
	PC11. identify personal safety hazards or work site hazards and mitigate hazards		4	2	2
	PC12. select tools, equipment and testing devices needed to carry out the work		4	2	2
	PC13. demonstrate safe and proper use of required tools and equipment		4	2	2
	PC14. check access from ground to work area to ensure it is safe and in accordance with requirements		2	1	1
	PC15. reassess risk control measures, as required, in accordance with changed work practices and/or site conditions and undertake alterations		2	2	0
	PC16. inspect/install fall protection and perimeter protection equipment ensuring adequacy for work and conformance to regulatory requirements		4	2	2
	PC17. identify approved methods of moving tools and equipment to work area and minimize potential hazards associated with tools at heights		2	1	1
	PC18. select and install appropriate signs and barricades		2	1	1

	PC19. place tools and materials to eliminate or minimize the risk of items being knocked down		1	1	0
	PC20. dismantle plant safely in accordance with sequence and remove from worksite to clear work area		2	1	1
		TOTAL	**50**	**29**	**21**
SGJ/N0120 Work effectively with others	PC1. accurately pass on information to the authorized persons who require it and within agreed timescale and confirm its receipt	**50**	4	2	2
	PC2. assist others in performing tasks in a positive manner where required and possible		4	2	2
	PC3. consult and assist others to maximize effectiveness and efficiency in carrying out tasks		4	2	2
	PC4. display appropriate communication etiquette while working		6	3	3
	PC5. display active listening skills while interacting with others at work		4	2	2
	PC6. demonstrate responsible and disciplined behaviours at the project site		4	2	2
	PC7. escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict		3	1	2
	PC8. identify the need for common grounds with clients, team members, etc. and negotiate in an effective manner to achieve the same		3	1	2
	PC9. consider and respect the opinions, creativity, values, beliefs and perspectives of others		4	2	2
	PC10. ensure collaboration and group participation to achieve common goals		6	3	3
	PC11. promote a friendly, co-operative environment that is conducive to employee's sense of belonging		4	2	2
	PC12. facilitate an understanding and appreciation of the differences among team members		4	2	2
		TOTAL	**50**	**24**	**26**

Qualifications Pack for "Solar PV Engineer"

OPTION **Option:** Solar water pumping system					
Total Marks: 100				**Marks Allocation**	
Assessment outcomes	**Assessment Criteria for outcomes**	**Total Mark**	**Out Of**	**Theory**	**Skills Practical**
SGJ/N0134 Design, installation and commissioning of solar water pumping system	PC1. analyze the water usage and level of water table at site	**100**	6	3	3
	PC2. decide on the specifications of the pumping set and motor		6	3	3
	PC3. decide on the capacity of PV modules		6	3	3
	PC4. design the plan of mounting structures and foundation		4	2	2
	PC5. oversee the preparation of the foundation for solar module mounting structure and motor pump set		4	2	2
	PC6. ensure structure is fixed on the foundations		4	2	2
	PC7. oversee the mounting of solar modules		4	2	2
	PC8. oversee the connection of solar module array to pump set in case of DC pumps		6	3	3
	PC9. oversee the installation of inverter in case of AC pumps		4	2	2
	PC10. ensure protection system are in place		8	4	4
	PC11. perform inspection and testing of equipment		8	2	6
	PC12. perform start-up procedures and measure output		8	3	5
	PC13. compare the output with design output and take corrective actions, if required		8	4	4
	PC14. ensure connection of the solar module array to motor pump set through a Maximum Power Point Tracker (MPPT) to get maximum power from the array		3	1	2
	PC15. install an inverter after MPPT to convert DC power to AC power in case an AC submersible motor pump set is used		3	1	2
	PC16. ensure periodical cleaning of solar module array		6	3	3
	PC17. periodically ensure tightness of cable connections		6	2	4
	PC18. ensure periodic maintenance of motor pump set		6	2	4
		TOTAL	**100**	**44**	**56**

Back to top…