QUALIFICATIONS PACK - OCCUPATIONAL STANDARDS FOR POWER

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- Power Plant High Pressure Welder

SECTOR: POWER

SUB-SECTOR: Generation

OCCUPATION: Welding and Cutting

REFERENCE ID: PSS / Q 0401

ALIGNED TO: NCO-2004/NIL

Power Plant High Pressure Welders are responsible for welding of ferrous and non-ferrous pressure products such as structures, frames, plate and sheet assemblies, pipe-work and vessels used for producing pressure vessels, boilers and high pressure pipework, as per given specifications. The welding will comply with very high quality standards.

Brief Job Description: The welder will use different welding methods like Tungsten Inert gas welding, Manual metal arc welding, submerged arc welding, stud welding as well as Oxy-fuel gas cutting in all positions; apply welding principles to plan the weld; mark out the material; prepare and perform the weld that can clear various tests such as visual examination, tension tests, guided-bend tests, notch-toughness tests, stud-weld tests, micro tests radiographic or ultrasonic examination, liquid penetrant.

Personal Attributes: Physically and mentally able to safely perform essential functions of the job. The candidate should be able to climb ladders, scaffolds, poles and towers of various heights. Also able to crawl and work in confined spaces such as attics, manholes and crawlspaces.The candidate should be able to read and understand instructions and warnings.

Job Details

Qualifications Pack Code	**PSS / Q 0401**		
Job Role	**Power Plant High Pressure Welder**		
Credits (NSQF)	**TBD**	**Version number**	**1.0**
Sector	**Power**	**Drafted on**	**26/03/15**
Sub-sector	**Generation**	**Last reviewed on**	**26/03/15**
Occupation	**Welding and Cutting**	**Next review date**	**26/03/17**

Job Role	**Power Plant High Pressure Welder**
Role Description	**Power Plant High Pressure Welders** are responsible for welding of ferrous and non-ferrous pressure products such as structures, frames, plate and sheet assemblies, pipe-work and vessels used for producing pressure vessels, boilers and high pressure pipework, as per given specifications.
NSQF level	4
Minimum Educational Qualifications	12th
Maximum Educational Qualifications	NA
Training (Suggested but not mandatory)	ITI or Certificate in Basic MMAW, Gas cutting, Plasma arc cutting
Experience	1 year as MMAW, TIG or MIG welder
Applicable National Occupational Standards (NOS)	**Compulsory:** 1. PSS/ N 0401 (Perform welding on pressure vessels, boilers and high pressure equipment in a power plant) 2. CSC/ N 0208 (Manually weld carbon steel/ low alloy steel and austenitic stainless steel using Metal Arc Welding / Shielded Metal Arc Welding) 3. CSC/ N 0212 (Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding) 4. CSC/ N 0210 (Weld stud joints using stud welding equipment/machines) 5. PSS/ N 2001 (Use basic health and safety practices for power related work) 6. CSC/ N 1336 (Work effectively with others) **Optional:** N.A.
Performance Criteria	As described in the relevant OS units

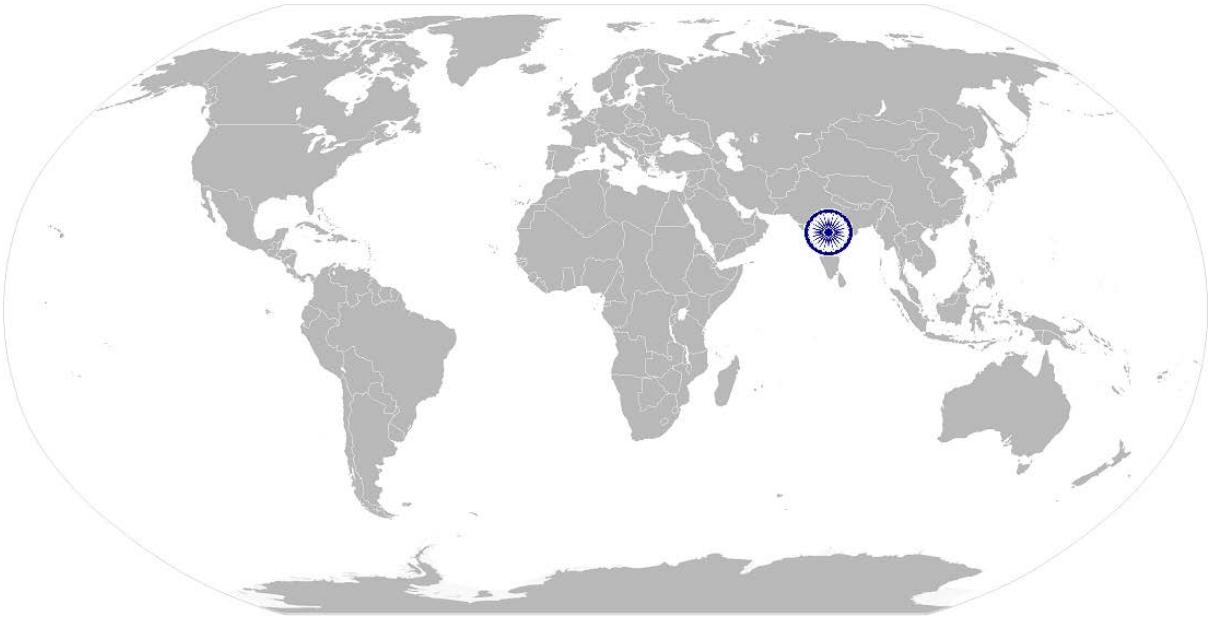
Definitions

Keywords /Terms	Description
Core Skills/Generic Skills	Core Skills or Generic Skills are a group of skills that are key to learning and working in today's world. These skills are typically needed in any work environment. In the context of the NOS, these include communication related skills that are applicable to most job roles.
Function	Function is an activity necessary for achieving the key purpose of the sector, occupation, or 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 NOS.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organization.
Knowledge and Understanding	Knowledge and Understanding are statements which together specify the technical, generic, professional and organizational specific knowledge that an individual needs in order to perform to the required standard.
National Occupational Standards (NOS)	NOS are Occupational Standards which apply uniquely in the Indian context
Occupation	Occupation is a set of job roles, which perform similar/related set of functions in an industry.
Organisational Context	Organisational Context includes the way the organization is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Performance Criteria	Performance Criteria are statements that together specify the standard of performance required when carrying out a task.
Qualifications Pack(QP)	Qualifications Pack comprises the set of NOS, together with the educational, training and other criteria required to perform a job role. A Qualifications Pack is assigned a unique qualification pack code.
Qualifications Pack Code	Qualifications Pack Code is a unique reference code that identifies a qualifications pack.
Scope	Scope is the 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 the quality of performance required.
Sector	Sector is a conglomeration of different business operations having similar businesses 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.
Sub-functions	Sub-functions are sub-activities essential to fulfil the achieving the objectives of the function.
Technical Knowledge	Technical Knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Unit Code	Unit Code is a unique identifier for a NOS unit, which can be denoted with an 'N'
Unit Title	Unit Title gives a clear overall statement about what the incumbent should be able to do
Vertical	Vertical may exist within a sub-sector representing different domain areas or the client industries served by the industry.

Acronyms

Keywords /Terms	Description
MIG	Metal Inert Gas Welding
GMAW	Gas Metal Arc Welding
WPS	Welding Procedure Speciation
NDT	Non-Destructive Testing
DT	Destructive Testing
RT	Radiographic Testing
UT	Ultrasonic Testing
DPT	Dye Penetrant Testing
MPT	Magnetic Particle Testing
FPT	Fluorescent Penetrant Testing
IS	Indian Standards
EN	European Standards
ASME	American Society of Mechanical Engineers
ISO	International Organization for Standardization
MIG	Metal Inert Gas Welding
D.C.	Direct Current
STT	Surface Tension Transfer
PQR	Process Qualification Record
CO2	Carbon dioxide
CPR	Cardiac Pulmonary Resuscitation
PPE	Personal Protective Equipment

National Occupational Standard



Overview

This unit covers welding of ferrous and non-ferrous pressure products such as structures, frames, plate and sheet assemblies, pipe-work and vessels used for producing pressure vessels, boilers and high pressure pipework, as per given specifications.

PSS/ N 0401: Perform welding for pressure vessels, boilers and high pressure pipes in power plants

National Occupational Standard

Unit Code	**PSS/ N 0401**
Unit Title (Task)	**Perform welding for pressure vessels, boilers and high pressure pipes in power plants**
Description	This unit covers welding of ferrous and non-ferrous pressure products such as structures, frames, plate and sheet assemblies, pipe-work and vessels used for producing pressure vessels, boilers and high pressure pipework, as per given specifications. The candidate will be expected to use different welding methods like Tungsten Inert gas welding, Manual metal arc welding, submerged arc welding, stud welding as well as Oxy-fuel gas cutting in the following positions and comply with very high quality standards. • Groove Welds (Plate positions: 1G,2G,3G,4G; Pipe Positions : 1G,2G,3G,4G,5G,6G) • Fillet Welds(Plate position:1F,2F,3F,4F; Pipe Positions: 1F,2F,2FR,4F,5F) The candidate will apply welding principles to plan the weld, use appropriate tools and equipment to mark out the material for the features to be produced, prepare and perform the weld that can clear various tests such as visual examination, tension tests, guided-bend tests, notch-toughness tests, stud-weld tests, micro tests radiographic or ultrasonic examination, liquid penetrant, while coordinating with the fitters and other team members adhering to applicable regulations and safety standards. The candidate will work independently, whilst taking responsibility for their own actions as well as for the team outcomes in terms of productivity, quality and accuracy of the work being carried out.
Scope	This unit/task covers the following: • Work safely • Plan and prepare for the welding operations • Mark out the components • Perform welding operations

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Work safely	The user/individual on the job should be able to: PC1. comply with health and safety, environmental and other relevant regulations and guidelines at work PC2. adhere to procedures and guidelines for personal protective equipment (PPE) and other relevant safety regulations while performing broaching operations PC3. ensure work area is clean and safe from hazards **Hazards:** use of power tools, trailing leads or hoses, damaged or badly maintained tools and equipment; using files with damaged or poor fitting handles; handling of chemicals like fluxes, oil, grease; misuses of tools; not following laid-down procedures, handling long pipe lengths, using damaged or badly maintained tools and equipment, working at heights, working in windy and moist environments, etc. PC4. ensure that all tools, equipment, power sources, power tool cables, extension leads are in a safe and usable condition PC5. ensure that all machines and machine tools are secured at all times
Plan and Prepare for welding	The user/individual on the job should be able to: PC6. determine job requirement from job specification documents or WPS obtained from

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operations	valid sources **Job requirements**: raw materials or components required (type, quality, quantity); dimensions; limits and tolerances; surface texture requirements; operations required (list, sequence and procedures where applicable); shape or profiles to be fabricated; cutting, bending and rolling allowances for fabricated forms; instruments and tools to be used; interdependencies; timelines **Job specification documents**: detailed component drawings; approved sketches/illustrations; national, international and organisational standards; reference tables and charts; fabrication/casting drawings **Valid source**: job instruction sheet/job card; work drawings and instructions; planning documentation; quality control documents; operation sheets; process specifications; instructions from supervisor PC7. recognize physically , the different equipment installed within the plant premises and identify function of the individual equipment PC8. interpret weld procedure data sheets specifications **Interpreting the WPS:** welding process (ISO Codes); parent metal; consumables; pre welding joint preparation (cleaning, edge preparation, assembly, pre-heat); welding parameters; welding positions; number and arrangement of runs to fully fill/weld joints; electrode (W); filler wire; electrical conditions required (type of current, alternating [A.C.] direct [D.C.], electrode polarity (negative), welding current ranges; methods of arc ignition (scratch, high frequency, lift start); shielding gas (type, flow rate, pre-weld gas flow, post-weld gas flow); techniques (including autogenous); control of heat input; interpass/run cleaning/back gouging methods; root pass with back purging of gases on the root side of the welding; post welding activities (wiring brushing, removal of excess weld metal where required); post-weld heat treatment (normalising, stress relief) PC9. select welding machines e.g. transformer, inverters (AC/DC), rectifiers and generators, according to the materials and task PC10. identify and evaluate properties and limitations of various thermal welding and mechanical jointing systems for the job PC11. establish the type of welding to be done and procedures to complete the pipe fitting or assembling operations PC12. perform trail weld and confirm that specifications are achieved by selected welding procedure PC13. plan the sequence of activities and resources required PC14. identify and obtain materials or components to be welded and the applicable parent metal group in accordance with applicable data PC15. identify and obtain welding equipment as per the weld type established PC16. inspect the equipment for serviceability and correctly set up in accordance with standard operating procedures PC17. prepare the material for welding **Preparation of materials:** e.g. preheating; setting up of jigs, fixtures, clamps, etc.; joint preparation such as beveling, hard facing, etc.
Mark out the components	The user/individual on the job should be able to: PC18. prepare/determine suitable datums from which to mark out (e.g. choosing a machine face or filing a flat face as a datum) PC19. apply a marking medium to enhance clarity of the marking out

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	PC20. use an appropriate method of marking out **Marking out methods**: e.g. direct marking using tapes and markers, set-outs of pipework using templates, producing set wires, set-outs of pipework onto floor PC21. use a range of marking out equipment (e.g. rules, squares, scribers, vernier instruments) **Marking tools**: rules/tapes, dividers/trammels, scribers, punches, scribing blocks, squares, protractor, permanent markers PC22. mark out a range of features required to perform the welding **Features**: datum lines; welding or cutting guidelines
Perform welding operations	The user/individual on the job should be able to: PC23. perform various types of welding of cutting as per requirements **Types of Welding:** TIG welding, MMAW welding, stud welding, oxy-fuel gas cutting, plasma arc cutting(manual) PC24. produce joints from various materials in different forms **Materials:** carbon steel, low alloy steel, high alloy steel, stainless steel and aluminium **Forms:** structures, frames, plates and sheet assemblies, pipe-work and vessels PC25. perform groove and fillet weld in various positions **Groove Welds:** Plate positions (1G,2G,3G,4G); Pipe Positions (1G,2G,3G,4G,5G,6G) **Fillet Welds:** Plate position (1F,2F,3F,4F); Pipe Positions (1F,2F,2FR,4F,5F) PC26. ensure welds are deposited correctly as per specifications. PC27. select and apply appropriate distortion prevention measures for the weld type and material to ensure that distortions are rectified as required **Distortion prevention measures**: e.g. preheating, setting up of jigs, fixtures, clamps, etc. PC28. achieve joint quality, tolerances and acceptance levels that clears the following tests as laid out in ASME Pressure Vessel Code Sections I – XI, BS EN ISO5817 **Tests:** Visual examination, Tension Tests, Guided-Bend Tests, Notch-Toughness Tests, Stud-Weld Tests, Radiographic or ultrasonic examination, Liquid Penetrant PC29. co-ordinate with the fitter while performing the weld PC30. prepare the welded assembly and welded surface for quality tests to be conducted PC31. shut down and make safe the welding equipment on completion of the welding activities PC32. make sure that the work area is maintained and left in a safe and tidy condition
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 company relevant to own employment and performance conditions KA2. relevant health and safety requirements applicable in the work place KA3. Layout of a power plant and the various functions KA4. importance of working in clean and safe environment KA5. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities KA6. reporting structure, inter-dependent functions, lines and procedures in the work area KA7. relevant people and their responsibilities within the work area KA8. escalation matrix and procedures for reporting work and employment related issues

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	KA9. documentation and related procedures applicable in the context of employment and work KA10. importance and purpose of documentation in context of employment and work KA11. service request procedures, tools, and techniques KA12. company policy on repair/replacement of components during the maintenance process KA13. organizational procedure(s) to be adopted for the safe disposal of waste of all types of materials
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. the hazards associated with the pressure products welding activities and precautions that can be taken to minimize the risk **Safety precautions**: protection from live and other electrical components, including insulation, proper earthing, etc.; proper handling and placement of hot metal(adequate ventilation, fume extraction, away from naked flames, avoiding skin contact); taking account of spatter and related safe distance; adequate lighting; appropriate personal protective equipment- suitable aprons, welding gloves, respirators, safety boots, correctly fitting overalls, suitable eye shields/goggles, hard hat/helmet; protection of self and others from the effects of the welding arc; fume extraction/control measures; safety measures for elevated and windy areas (eg. harness, etc.) KB2. effects of exposure to the electric arc KB3. types of fire extinguishers and their suitable uses KB4. effects of exposure to welding fume KB5. methods of managing welding fume hazards KB6. personal protective equipment (PPE) and clothing to be worn during welding KB7. **Personal protective equipment (PPE)**: suitable aprons, welding gloves, respirators, safety boots, correctly fitting overalls, suitable eye shields/goggles, hard hat/helmet KB8. precautions to be taken when using gas torches to form the joint, and the effect of overheating the joint KB9. Relevant information about the power plant **Information:** different flow cycles/ systems, e.g. Water Flow (ACW, CCW, DM water) System, Fuel Flow (Coal/Gas/Fuel Oil) System, Steam and Condensate Flow System, Air & Flue Gas Flow and Ash Handling System etc.; function of above flow cycles/systems, involved in power generation; raw materials/ resources used (including Hazardous materials) in above flow cycles/systems and waste/byproducts generated (including Hazardous waste) during electric power generation; basic function , construction and capacity of major equipment of power plant KB10. various possible work environments for a pressure product welder **Possible work environments:** e.g. at heights, in confined spaces, engineering construction sites, inside a plant, fabrication workshops, nuclear sites, onshore and offshore installations, potential explosive atmospheres, shafts, tunnels, on access structures (scaffold), etc. KB11. some high pressure equipment and their applications **Some high pressure equipment: e.g.** boilers, pressure vessels, compressors, engines, heat exchangers, HVAC systems, pumps, protection devices, rotating equipment and tools, turbines, etc. KB12. range of pipe fittings that can be used, and how to identify them KB13. methods used to prepare pipe ends and fittings for welding, and why it is necessary

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	to ensure that these preparations are carried out KB14. various types of pipe connectors and joints used in pressure products KB15. the importance of quality welding for high pressure products KB16. welding symbols used and their correct interpretation KB17. power plant terminology KB18. various types of welding or thermal cutting used in pressure products, their respective equipment and uses **Types of Welding:** TIG welding, MIG/MAG welding, MMAW welding, flux cored welding, submerged arc welding, stud welding, oxy-fuel gas cutting, plasma arc cutting(manual and machine) KB19. various materials that need to be welded for pressure products and the relevant characteristics and identification **Materials:** carbon steel, low alloy steel, high alloy steel, stainless steel and aluminium KB20. type and thickness of base metals to be welded KB21. common use of carbon steel, stainless steel, mild steel, copper, bronze and aluminum in power plant KB22. ways in which a metal can fail KB23. how to conduct a spark test KB24. density, speed & velocity, acceleration, torque, flow and their relevance to welding and welding principles KB25. types of joint configurations **Joints:** fillet and groove (lap joints, tee fillet joints, corner joints, butt joints- square, single vee, double vee) KB26. various positions such as flat, horizontal, vertical and overhead **Groove Welds:** Plate positions (1G,2G,3G,4G); Pipe Positions (1G,2G,3G,4G,5G,6G) **Fillet Welds:** Plate position (1F,2F,3F,4F); Pipe Positions (1F,2F,2FR,4F,5F) KB27. main components and controls of welding equipment KB28. how to connect electrical components correctly KB29. type of current used and implication KB30. preparation of materials in readiness for the marking out activities, in order to enhance clarity, accuracy and safety KB31. how to prepare the pressure components and pipes in readiness for the marking out activities **Preparation:** e.g. visually checking for defects, cleaning the materials, removing burrs and sharp edges, pre-heating, hard facing, etc. KB32. selection and establishment of a suitable datum KB33. importance of ensuring that marking out is undertaken from the selected datum KB34. possible effects of working from an incorrect datum KB35. mark-out conventions when marking out the workpiece KB36. uses of various methods of deposition of welds and their relevant characteristics KB37. need for distortion prevention measures and their applicability as per weld type and material **Distortion prevention measures**: e.g. preheating, setting up of jigs, fixtures, clamps, etc. KB38. various defects associated with high pressure welding process **Weld defects**: lack of continuity of the weld; uneven and irregular ripple formation; excessive spatter; incorrect weld size or profile; burn through; undercutting; overlap;

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	inclusions; distortion; porosity; internal cracks; surface cracks; lack of fusion or incomplete fusion; lack of penetration; excessive penetration; gouges; stray arc strikes; sharp edges; excessive convexity KB39. importance of maintaining welding standards specified for the job KB40. impact of a welding job done right, acceptable or non-acceptable KB41. how to determine the overall length of the pipework required, taking into account allowances for pipe fittings and (where appropriate) screwed connections KB42. achieve joint quality, tolerances and acceptance levels that clears the following tests as laid out in ASME Pressure Vessel Code Sections I – XI, BS EN 287 ISO5817 **Tests:** visual examination, tension tests, guided-bend tests, notch-toughness tests, stud-weld tests, radiographic or ultrasonic examination, liquid penetrant, micro testing KB43. various codes applicable to welding of pressure products - ISO ASME EN & BS KB44. how to prepare the welded assembly and welded surface for quality tests to be conducted KB45. how to check the workpiece and the measuring equipment that is used **Measuring equipment**: external micrometers, vernier/digital/dial caliper, surface finish equipment (e.g. comparison plates, machines), rules, squares, protractors, depth micrometers, depth verniers, feeler gauges, bore/hole gauges, slip gauges, radius/profile gauges, thread gauges, height gauge, hardness tester, dial test indicators (DTI), surface roughness tester, coordinate measuring machine (CMM), profile projectors, form testers KB46. need to check that the measuring equipment is within current calibration dates, and that the instruments are correctly zeroed KB47. measuring internal and external dimensions KB48. measuring geometric features KB49. types of visual inspection indicators and methods **Visual inspections:** e.g. use of visual techniques, distance from workpiece, angle of observation, adequate lighting, low powered magnification, fillet weld gauges, etc. KB50. types of NDT and DT inspection methods KB51. procedure to conduct DP testing KB52. importance of shutting down and making safe the welding equipment on completion of the welding activities KB53. importance of keeping the work area in a safe and tidy condition
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Communication** The user/ individual on the job needs to know and understand how to: SA1. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language SA2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language SA3. convey and share technical information clearly using appropriate language SA4. check and clarify task-related information SA5. liaise with appropriate authorities using correct protocol SA6. communicate with people in respectful form and manner in line with organizational protocol

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	Numerical and computational skills
	The user/individual on the job needs to know and understand how to: SA7. undertake numerical operations, and calculations/ formulae **Numerical computations**: addition(with decimal digits and with carrying), subtraction(with decimal digits and with borrowing), multiplication(with decimal digits), division(with decimal digit), fractions and decimals, percentages and proportions, simple ratios and averages SA8. identify and draw various basic, compound and solid shapes as per dimensions given **Basic shapes**: square, rectangle, triangle, circle **Compound shapes**: involving squares, rectangles, triangles, circles, semi-circles, quadrants of a circle **Solid shapes**: cube, rectangular prism, cylinder SA9. demonstrate measurement and calculation of Angle, Perimeter, Area of a common geometrical shape and can co-relate with job area requirements SA10. use appropriate measuring techniques and units of measurement SA11. use British and metric system of measurement and make conversions between them SA12. describe the difference between Celsius & Fahrenheit Scale and relationship between them SA13. use appropriate units and number systems to express degree of accuracy **Units and number systems representing degree of accuracy**: decimals places, significant figures, fractions as a decimal quantity SA14. interpret and express tolerance in terms of limits on dimensions SA15. calculation of the value of angles in a triangle using trigonometry **Angles in a triangle**: right-angled, isosceles, equilateral
	Learning
	The user/individual on the job needs to know and understand how to: SA16. participate in on-the-job and other learning, training and development interventions and assessments SA17. clarify task related information with appropriate personnel or technical adviser SA18. seek to improve and modify own work practices SA19. maintain current knowledge of application standards, legislation, codes of practice and product/process developments
B. Professional Skills	**Problem Solving**
	The user/individual on the job needs to know and understand how to: SB1. identify problems with work planning, procedures, output and behavior and their implications SB2. prioritize and plan for problem solving SB3. communicate problems appropriately to others SB4. identify sources of information and support for problem solving SB5. seek assistance and support from other sources to solve problems SB6. identify effective resolution techniques SB7. select and apply resolution techniques SB8. seek evidence for problem resolution
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB9. plan, prioritize and sequence work operations as per job requirements

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	SB10. organize and analyze information relevant to work SB11. basic concepts of shop-floor work productivity including waste reduction, efficient material usage and optimization of time
	Initiative and Enterprise
	The user/individual on the job needs to know and understand how to: SB12. undertake and express new ideas and initiatives to others SB13. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses SB14. participate in improvement procedures including process, quality and internal/external customer/supplier relationships SB15. one's competencies in new and different situations and contexts to achieve more
	Self-Management
	The user/individual on the job needs to know and understand how to: SB16. exercise restraint while expressing dissent and during conflict situations SB17. avoid and manage distractions to be disciplined at work SB18. manage own time for achieving better results
	Teamwork
	The user/individual on the job needs to know and understand how to: SB19. work in a team in order to achieve better results SB20. identify and clarify work roles within a team SB21. communicate and cooperate with others in the team for better results SB22. seek assistance from fellow team members

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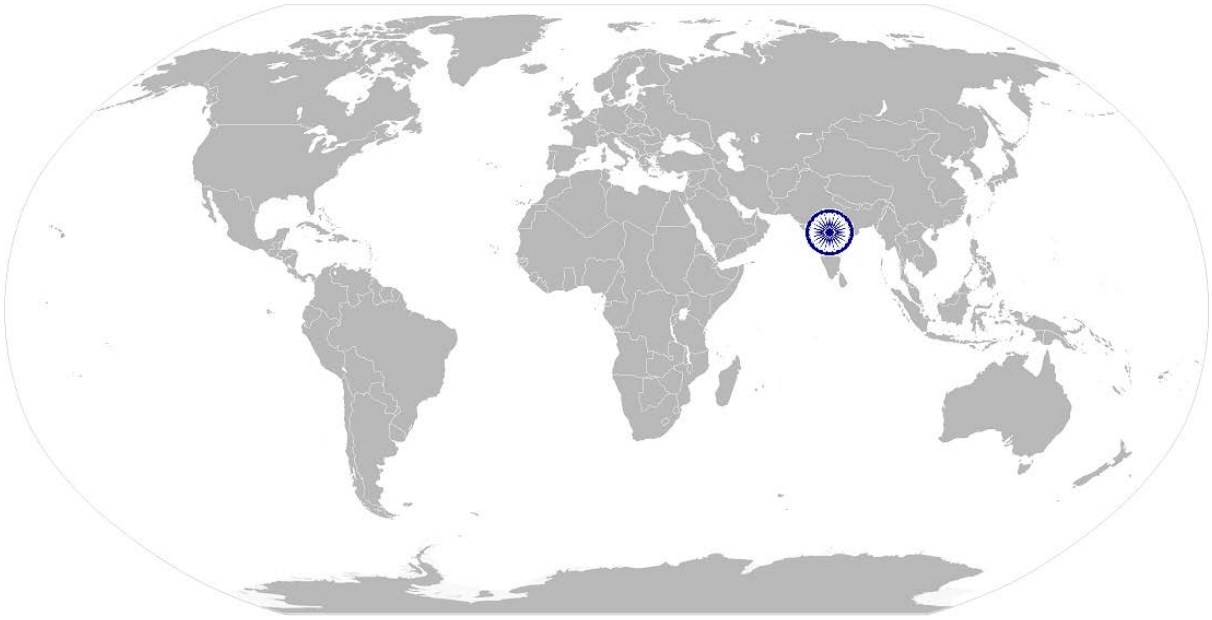
NOS Version Control

NOS Code	CSC/ N 0401		
Credits (NSQF)	TBD	Version number	1.0
Industry	Power Sector	Drafted on	26/03/15
Industry Sub-sector	Power Generation	Last reviewed on	26/03/15
		Next review date	26/03/17



CSC/ N 0208: Manually weld carbon steel/ low alloy steel and austenitic stainless steel using Metal Arc Welding / Shielded Metal Arc Welding

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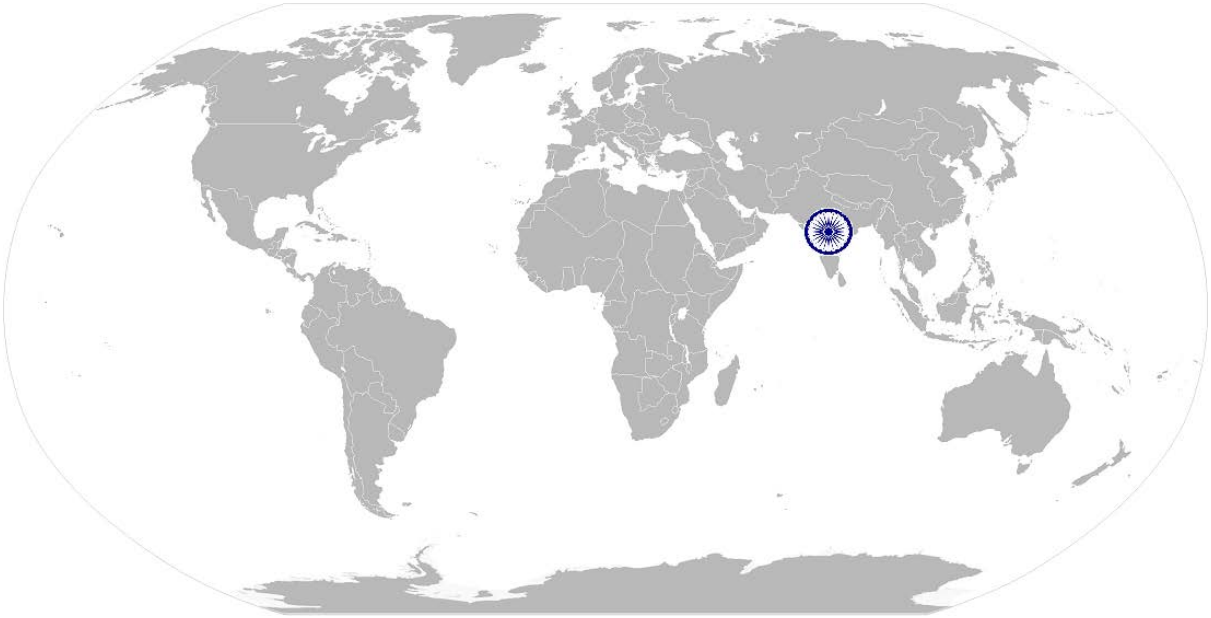
National Occupational Standard



Overview

This unit covers the performing of manual metal arc welding (MMAW) also known as shielded metal arc welding (SMAW) for producing a range of joints on various forms of metal and metal alloys including mild or low carbon steels and austenitic stainless steel as per welding specification procedures (WPS).

CSC/ N 0208: Manually weld carbon steel/ low alloy steel and austenitic stainless steel using Metal Arc Welding / Shielded Metal Arc Welding

National Occupational Standard

Unit Code	CSC/ N 0208
Unit Title (Task)	Manually weld carbon steel/ low alloy steel and austenitic stainless steel using Metal Arc Welding / Shielded Metal Arc Welding
Description	This OS unit is about performing manual metal arc welding (MMAW) welding also known as Shielded Metal Arc Welding (SMAW) for a range of standard welding job requirements. This is for a skilled welder who can weld different materials (mild or low carbon steel and austenitic stainless steel) in 1G/1F, 2G/2F, 3G/3F, 4G/4F, 5G/5F and 6G positions. The welder can prepare various joints including various groove and fillet welds. The welder carries out these operations in a safe manner following practices that ensure safety for self, others and the work environment.
Scope	This unit/task covers the following: • Working safely • Preparing for welding operations • Carrying out welding operations • Testing for quality • Post-welding activities • Dealing with contingencies

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Working Safely	The user/individual on the job should be able to: PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines PC2. adhere to procedures or systems in place for health and safety, personal protective equipment (PPE) and other relevant safety regulations **Safety precautions (general):** general workshop safety; fire prevention; general hazards; manual lifting; overhead lifting; shopfloor housekeeping including surface conditions; waste disposal; stability of surrounding structures, furniture etc. PC3. check the condition of, and correctly connect, welding leads, earthing arrangements and electrode holder PC4. deal with any faults or differential as per laid procedures PC5. follow fume extraction safety procedures
Preparing for welding operations	The user/individual on the job should be able to: PC6. read and interpret routine information on written job instructions, welding procedure specifications (WPS) and standard operating procedures **WPS**: e.g. welding process (ISO codes); parent metal; consumables; pre welding joint preparation (edge preparation, assembly, pre-heat); welding parameters; welding positions (ISO 6947 – PA, PB, PC, PD, PE, PF, PG; ASME IX – I-6 G/1-6 F); number and arrangement of runs to fully fill/weld joints; electrode sizes for joint thicknesses; electrode and covering; electrical

CSC/ N 0208: Manually weld carbon steel/ low alloy steel and austenitic stainless steel using Metal Arc Welding / Shielded Metal Arc Welding

	conditions required (type of current, alternating [A.C.] direct [D.C.], electrode polarity (positive or negative), welding current ranges); welding techniques; sequence of welding; control of heat input; interpass/run cleaning/back gouging methods; post welding activities (wire brushing and grinding, removal of excess weld metal where required); post-weld heat treatment (normalising, stress relief), etc. PC7. select welding machines (e.g. transformers, rectifiers, inverters and generators, etc.) according to the task PC8. select type and size of electrodes according to classification and specifications PC9. re-dry electrodes as per electrode classification requirement PC10. prepare the work area for the welding activities PC11. perform measurements for joint preparation and routine MMAW PC12. prepare the materials and joint in readiness for welding **Material and joint preparation:** made rust free; cleaned – free from scaling, paint, oil/grease; made dry and free from moisture; edges to be welded prepared as per job requirement - such as flat, square or bevelled; use various machines and techniques for the above (e.g. chamfering machine, grinding and stripping, gas or plasma cutting, etc.); correctly positioned- positioning: devices and techniques; jigs and fixtures; restraining devices such as clamps and weights/blocks; setting up the joint in the correct position and alignment PC13. tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding PC14. use manual metal-arc welding and related equipment to include a. alternating current (AC) equipment b. direct current (DC) equipment **MMAW equipment**: e.g. transformers; rectifiers; generators; invertors; consumables – electrodes, dyes; welding accessories - holders, cables and accessories; ancillary equipment - (power saw, angle, pedestal and straight grinders, tong tester, etc.); electrode drying oven, etc. PC15. connect equipment to power source PC16. connect cables, electrode holders, return leads and ground clamps to appropriate terminal PC17. set, read and adjust amperage controls PC18. verify set up by running test and appropriately handle weld specimen (scrap plate) **Handling specimens**: handling hot materials; using chemicals for cleaning and etching; using equipment to fracture welds

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Carrying out welding operations	The user/individual on the job should be able to: PC19. strike and maintain a stable arc PC20. stop and properly re-start arc to avoid welding defects (scratch start, tapping techniques) PC21. manipulate electrode angle using various methods as per WPS PC22. maintain constant puddle by using appropriate travel speed PC23. remove slag in an appropriate manner (e.g. wire brush, hammer, etc.) PC24. weld the joint to the specified quality, dimensions and profile applicable to range of material from 1.5 mm – 24 mm **Materials**: mild or low carbon steel, austenitic stainless, low alloy steel, **Forms**: plate, sheet (1.5mm), structural section, other forms (hollow tubes, sections, shapes, etc.) PC25. produce range of welded joints to within the mentioned standard using single or multi-run welds (as appropriate) **Joints**: fillet and groove PC26. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to Level C of ISO 5817 **Weld quality standards**: required parameters for dimensional accuracy; weld finishes are built up to the full section of the weld; joins at stop/start positions merge smoothly; weld surface is: free from cracks, substantially free from porosity, free from any pronounced hump or crater, substantially free from shrinkage cavities, substantially free from trapped slag, substantially free from arcing or chipping marks; fillet welds are: equal in leg length, slightly convex in profile (where applicable), size of the fillet equivalent to the thickness of the material welded: weld contour is: of linear and of uniform profile; smooth and free from excessive undulations; regular and has an even ripple formation; welds are adequately fused, and there is minimal undercut, overlap and surface inclusions; tack welds are blended in to form part of the finished weld, without excessive hump; corner joints have minimal burn through to the underside of the joint or, where appropriate PC27. produce range of welded joints in various positions as per the WPS specified **Positions**: flat (PA) IG/1F, horizontal vertical (PB) 2F, horizontal (PC) 2G, vertical upwards (PF) 3F / 3G, vertical downwards (PG) 3F / 3G, 4G Plate (overhead) Plate to Pipe (Fixed) 5F, pipe welding 5G/5F and 6G PC28. shut down and make safe the welding equipment on completion of the welding activities
Testing for quality	The user/individual on the job should be able to: PC29. identify various weld defects, use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specification **Weld defects**: lack of continuity of the weld; uneven and irregular ripple formation; excessive spatter; incorrect weld size or profile; burn through; undercutting; overlap; inclusions; distortion; porosity; internal cracks; surface cracks; lack of fusion or incomplete fusion; lack of penetration; excessive

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	penetration; gouges; stray arc strikes; sharp edges; excessive convexity PC30. check that the welded joint conforms to the specification, by checking various quality parameters by visual inspection **Quality parameters**: dimensional accuracy; alignment/squareness; size and profile of weld; visual defects; NDT/DT tested defects **Visual inspections**: e.g. use of visual techniques, distance from workpiece, angle of observation, adequate lighting, low powered magnification, fillet weld gauges, etc. PC31. detect surface imperfections and deal with them appropriately PC32. carry out DPT tests to assess fine defect open to the surface not detected by visual inspection (VT)
Post-welding activities	The user/individual on the job should be able to: PC33. assist in preparation for non-destructive testing of the welds, for a range of tests **Non-destructive tests (NDT)**: Penetrant testing- dye penetrant (DPT), fluorescent penetrant (FPT); magnetic particle (MPT); radiographic (RT); ultrasonic (UT) PC34. prepare for destructive tests on weld specimens for fillet, butt and corner **Destructive tests (DT)**: macro examination; fractured test- nick break test; bend tests (such as face, root or side, as appropriate); mechanical (tensile and shear, impact); chemical
Dealing with contingencies	The user/individual on the job should be able to: PC35. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve
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. relevant legislation, standards, policies, and procedures followed in the company KA2. key purpose of the organization KA3. department structure and hierarchy protocols KA4. work flow and own role in the workflow KA5. dependencies and interdependencies in the workflow KA6. support functions and types of support available for incumbents in this role

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B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. health and safety, hazards and precautions associated with MMAW/SMAW welding **Safety precautions (MMAW/SMAW Welding)**: protection from live and other electrical components, including insulation, proper earthing, etc.; proper handling and placement of hot metal; taking account of spatter and related safe distance; adequate lighting; appropriate personal protective equipment- suitable aprons, welding gloves, respirators, safety boots, correctly fitting overalls, suitable eye shields/goggles, hard hat/helmet; protection of self and others from the effects of the welding arc; fume extraction/control measures; safety measures for elevated and trench workings (e.g. harness, etc.) KB2. applications of manual metal arc welding KB3. effects of exposure to the electric arc KB4. types of fire extinguishers and their suitable uses KB5. effects of exposure to welding fume KB6. methods of managing welding fume hazards KB7. personal protective equipment (PPE) and clothing to be worn during MMAW/SMAW welding **Personal protective equipment (PPE)**: (suitable aprons, welding gloves, respirators, safety boots, correctly fitting overalls, suitable eye shields/goggles, hard hat/helmet KB8. welding specific equipment requirements for MMAW/SMAW welding **MMAW equipment**: e.g. transformers; rectifiers; generators; invertors; consumables – electrodes, dyes; welding accessories - holders, cables and accessories; ancillary equipment - (power saw, angle, pedestal and straight grinders, tong tester, etc.); electrode drying oven, etc. KB9. main components and controls of welding equipment KB10. how to connect electrical components correctly KB11. type of current used and implication KB12. welding symbols used and their correct interpretation KB13. consumables used for MMAW/SMAW welding KB14. various types of electrodes (classification) based on covering **Electrodes:** rutile, basic, cellulosic, acid KB15. function of covering KB16. various defects associated with the MMAW/SMAW welding process **Weld defects**: lack of continuity of the weld; uneven and irregular ripple formation; excessive spatter; incorrect weld size or profile; burn through; undercutting; overlap; inclusions; distortion; porosity; internal cracks; surface cracks; lack of fusion or incomplete fusion; lack of penetration; excessive penetration; gouges; stray arc strikes; sharp edges; excessive convexity KB17. types of joint configurations **Joints**: fillet and groove (lap joints, tee fillet joints, corner joints, butt joints- square, single vee, double vee) KB18. factors that determine weld bead shape **Factors**: electrode angles and welding technique (push, perpendicular, drag); arc length; thickness of base metal; travel speed (slow, normal, fast) KB19. types of beads, their characteristics and uses (stringer, weave, weave

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	patterns) **Bead characteristics**: spatter deposits, roughness, evenness, fill, crater, overlap KB20. factors that affect weld quality **Quality standards**: required parameters for dimensional accuracy; weld finishes are built up to the full section of the weld; joins at stop/start positions merge smoothly; weld surface is (free from cracks; substantially free from porosity; free from any pronounced hump or crater; substantially free from shrinkage cavities; substantially free from trapped slag; substantially free from arcing or chipping marks); fillet welds are (equal in leg length, slightly convex in profile (where applicable), size of the fillet equivalent to the thickness of the material welded); weld contour is (of linear and of uniform profile; smooth and free from excessive undulations; regular and has an even ripple formations); welds are adequately fused, and there is minimal undercut, overlap and surface inclusions; tack welds are blended in to form part of the finished weld, without excessive hump; corner joints have minimal burn through to the underside of the joint or, where appropriate KB21. weld positions such as flat, horizontal, vertical and overhead KB22. types of equipment components such as electrode holders, work leads cables and ground clamps KB23. awareness and importance of cable size and length KB24. types of polarity such as AC and DC electrode negative and DC electrode positive for welding purposes KB25. various types of base metals used in welding and their implications KB26. type and thickness of base metals to be welded **Base metals**: e.g. mild or low carbon steel, austenitic stainless steel, etc. KB27. distortion and how to control distortion **Distortion (causes and control methods):** Causes: improper sequence of weld runs; direction of weld runs; heat input errors; lack of inaccuracy of jigs and fixture; Control Methods: sequence of welding as materials; proper direction; tacking and its frequency (where applicable; use clamping and jigs and fixtures (where applicable) KB28. magnetic arc blow or arc deflection, causes and methods to avoid or compensate KB29. storage requirements for consumable electrodes KB30. electrode classifications such as tensile strength, position and composition KB31. electrode types based on covering, their characteristics and uses KB32. purpose of re-drying and procedure for different classification of electrode KB33. welding process and method specification sheet, process qualification record (PQR) and related essential variables KB34. travel speed and heat inputs KB35. amperage requirements for different classification of electrodes and positions KB36. importance and implications of various diameters of electrodes KB37. gouging and back gouging principles, methods and procedures KB38. purpose and importance of pre-heating requirements for base metals KB39. purpose and importance of post-heating in welding KB40. methods to achieve pre-heat and post heat requirements

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	KB41. tools and methods to measure temperature for pre-heat and post-heat requirements such as thermal chalk, thermocouple, etc. KB42. significance of diffusible hydrogen for welds KB43. importance of maintaining welding standards specified for the job KB44. impact of a welding job done right, acceptable or non-acceptable KB45. types of visual inspection indicators and methods **Visual inspections:** e.g. use of visual techniques, distance from workpiece, angle of observation, adequate lighting, low powered magnification, fillet weld gauges, etc. KB46. types of NDT and DT inspection methods KB47. procedure to conduct DP testing KB48. common welder testing codes and their purpose **Testing codes**: ASME section IX, EN 287, ISO 9606, IS 731
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Communication**
	The user/ individual on the job needs to know and understand how to: SA1. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language SA2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language SA3. convey and share technical information clearly using appropriate language SA4. check and clarify task-related information SA5. liaise with appropriate authorities using correct protocol SA6. communicate with people in respectful form and manner in line with organizational protocol
	Numerical and computational skills
	The user/individual on the job needs to know and understand how to: SA7. undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages) SA8. use appropriate measuring techniques SA9. use and convert imperial and metric systems of measurements SA10. apply appropriate degree of accuracy to express numbers SA11. calculate tolerance in terms of limits of size SA12. check measurements, angles, orientation and slopes SA13. types of reference lines such as tangent lines, datum lines, centre lines and work points SA14. check square of material using corner-to-corner dimensions and triangulation (3-4-5) method SA15. select and use tools and equipment such as measuring tapes, levels, squares, protractors and dividers SA16. ability to check dimensions of components SA17. calculate the value of angles in a triangle

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	SA18. interpret straight line graphs using given data
	Learning
	The user/individual on the job needs to know and understand how to: SA19. participate in on-the-job and other learning, training and development interventions and assessments SA20. clarify task related information with appropriate personnel or technical adviser SA21. seek to improve and modify own work practices SA22. maintain current knowledge of application standards, legislation, codes of practice and product/process developments
B. Professional Skills	**Problem Solving**
	The user/individual on the job needs to know and understand how to: SB1. identify problems with work planning, procedures, output and behavior and their implications SB2. prioritize and plan for problem solving SB3. communicate problems appropriately to others SB4. identify sources of information and support for problem solving SB5. seek assistance and support from other sources to solve problems SB6. identify effective resolution techniques SB7. select and apply resolution techniques SB8. seek evidence for problem resolution
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB9. plan, prioritize and sequence work operations as per job requirements SB10. organize and analyze information relevant to work SB11. basic concepts of shop-floor work productivity including waste reduction, efficient material usage and optimization of time
	Initiative and Enterprise
	The user/individual on the job needs to know and understand how to: SB12. undertake and express new ideas and initiatives to others SB13. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses SB14. participate in improvement procedures including process, quality and internal/external customer/supplier relationships SB15. one's competencies in new and different situations and contexts to achieve more
	Self-Management
	The user/individual on the job needs to know and understand how to: SB16. exercise restraint while expressing dissent and during conflict situations SB17. avoid and manage distractions to be disciplined at work SB18. manage own time for achieving better results
	Teamwork

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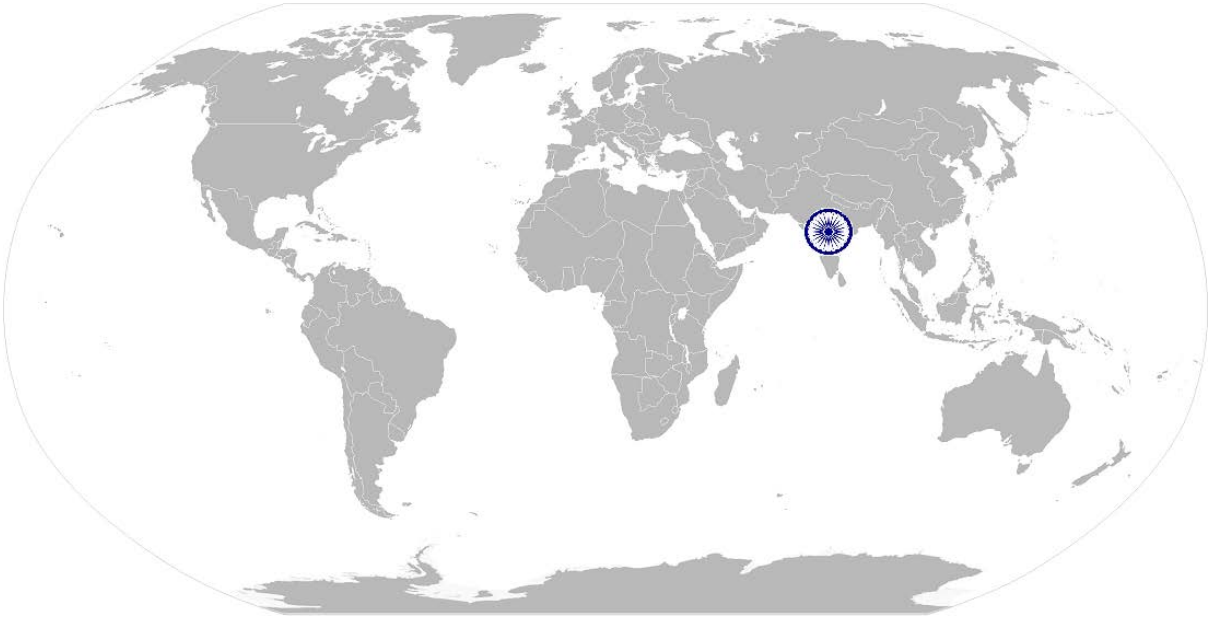
	The user/individual on the job needs to know and understand how to: SB19. work in a team in order to achieve better results SB20. identify and clarify work roles within a team SB21. communicate and cooperate with others in the team for better results SB22. seek assistance from fellow team members



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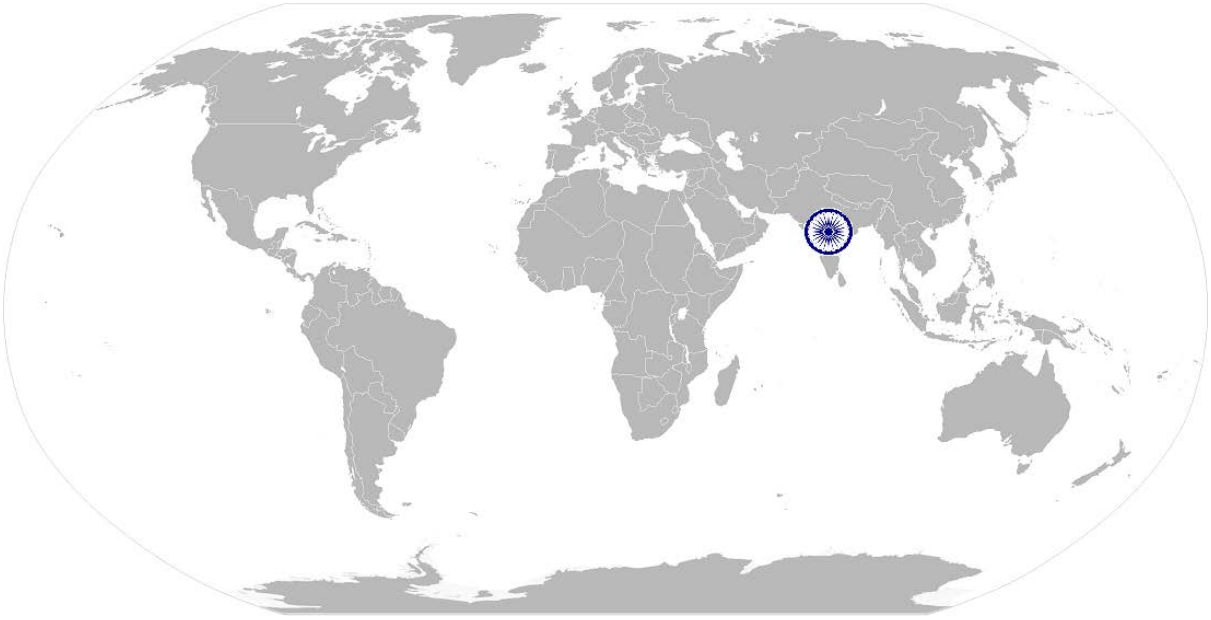
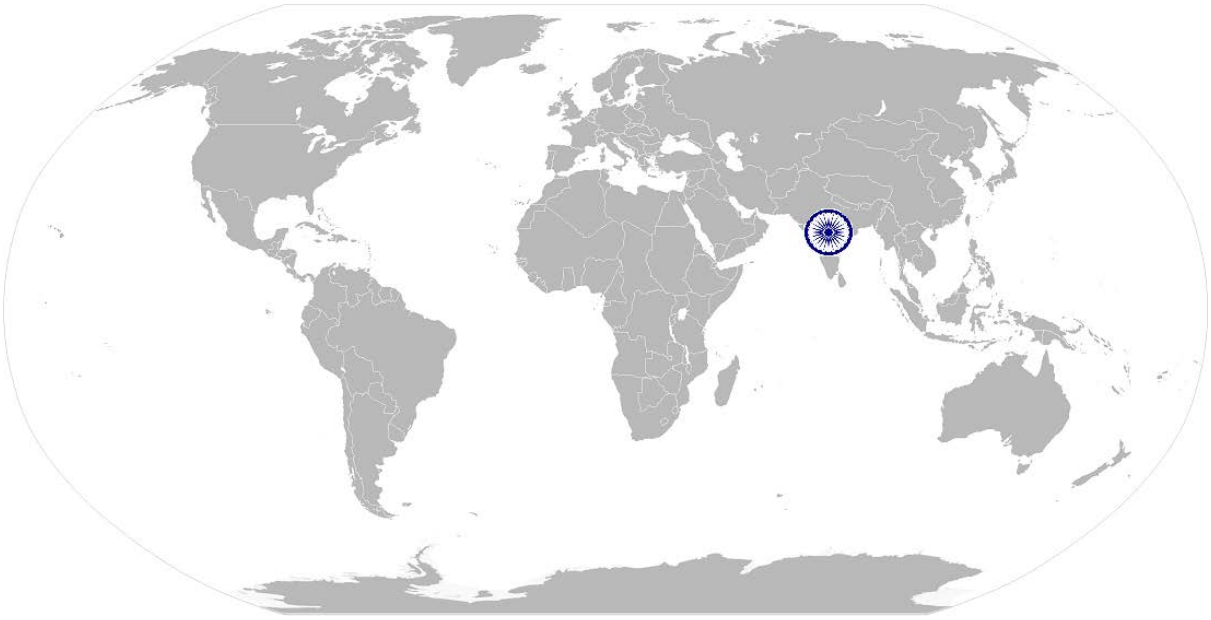
NOS Version Control

NOS Code	CSC/ N 0208		
Credits(NSQF)	TBD	Version number	1.0
Industry	Power	Drafted on	26/03/15
Industry Sub-sector	Power Generation	Last reviewed on	26/03/15
		Next review date	26/03/17



National Occupational Standard



Overview

This unit is about manual operations for performing basic tungsten inert gas (TIG) welding also known as gas tungsten arc welding (GTAW). The person would be able to independently carry out TIG (GTAW) weld operations for some welding joints in basic positions as per Welding Procedure Specification (WPS).

National Occupational Standard

CSC/ N 0212: Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding

Unit Code	**CSC / N 0212**
Unit Title (Task)	**Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding**
Description	This unit covers the performing of basic manual TIG (GTAW) welding for a range of standard welding job requirements. This involves welding different materials (carbon steel, low alloy steel) in various positions. The welder can prepare various joints including corner, fillet and tee. The candidate will be expected to work with a minimum of supervision, taking personal responsibility for own actions, quality and accuracy of the work.
Scope	This unit/task covers the following: • Working Safely • Preparing for welding operations • Carrying out welding operations • Testing for quality • Dealing with contingencies

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Working Safely	The user/individual on the job should be able to: PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines PC2. take necessary safety precautions for TIG welding operations
Preparing for welding operations	The user/individual on the job should be able to: PC3. interpret weld procedure data sheets specifications **Interpreting the WPS**: welding process (ISO Codes); parent metal; consumables; pre welding joint preparation (cleaning, edge preparation, assembly, pre-heat); welding parameters; welding positions (EN ISO 6947 – PA, PB, PC, PD, PE, PF, PG; ASME IX – I-6 G/1-6 F); number and arrangement of runs to fully fill/weld joints; electrode (W); filler wire; electrical conditions required (type of current, alternating [A.C.] direct [D.C.], electrode polarity (negative), welding current ranges; methods of arc ignition (scratch, high frequency, lift start); shielding gas (type, flow rate, pre-weld gas flow, post-weld gas flow); techniques (including autogenous); control of heat input; interpass/run cleaning/back gouging methods; root pass with back purging of gases on the root side of the welding; post welding activities (wiring brushing, removal of excess weld metal where required); post-weld heat treatment (normalising, stress relief) PC4. check that all measuring equipment is within calibration date PC5. check if welding machines e.g. transformer, inverters (AC/DC), rectifiers and generators have been made available by the authorized person PC6. check if welding torch, tungsten electrode and filler wire have been made available by the authorized person

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	PC7. prepare for the TIG welding process PC8. prepare the materials and joint in readiness for welding **Material and joint preparation**: made rust free; cleaned – free from scaling, paint, oil/grease; chemical cleaning; made dry and free from moisture; edges to be welded prepared as per job requirement (e.g. flat, square or beveled); use various machines and techniques for the above (e.g. chamfering machine, grinding and stripping, etc.); correctly positioned (Positioning: devices and techniques; jigs and fixtures; setting up the joint in the correct position and alignment) PC9. fit the welding shielding gases given by the authorised person, for a range of given applications PC10. plan the welding activities before they start them effectively and efficiently for achieving specifications as per WPS **Activities checks**: correct set-up of the joint; proper condition of electrical connections; welding return and earthing arrangements; operating parameters PC11. connect torches and the components **Torch components**: cables, water carrying tubes, ceramic nozzle, collet, collet holder, gas lens, teflon washers, bakelite cap, ceramic shields/nozzles PC12. connect and adjust regulators and flow meters to cylinders PC13. read, set and adjust current (amperage) as required PC14. set pre-purge with shielding gas as required PC15. prepare tungsten by sharpening or balling it to desired tip shape PC16. set and verify gas flow rates PC17. prepare and support the joint, using the appropriate methods PC18. tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding PC19. match feed and travel speed as required
Carrying out welding operations	The user/individual on the job should be able to: PC20. perform TIG welding operations using appropriate welding techniques to meet welding procedure specification requirements **Welding techniques**: fine adjustment of parameters (current and gas flow); selection of gas nozzle if required; selection of the outer nozzle; correct manipulation of the torch; blending in stops/starts and tack welds; starting techniques PC21. use correct technique for starting the arc (using HF (high frequency) unit, scratching the electrode on the job material, lifting the electrode immediately after touching the job material) PC22. use correct angle of torch and filler wire PC23. weld the joint to the specified quality, dimensions and profile PC24. use manual welding and related equipment, to carry out TIG welding processes PC25. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to Level B of ISO 5817

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	Weld quality check standards: required parameters for dimensional accuracy; weld finishes are built up to the full section of the weld; joins at stop/start positions merge smoothly; weld surface is (free from cracks; substantially free from porosity; free from any pronounced hump or crater; substantially free from shrinkage cavities; substantially free from arcing or chipping marks); fillet welds are: equal in leg length, slightly convex in profile (where applicable), size of the fillet equivalent to the thickness of the material welded; weld contour is (of linear and of uniform profile; smooth and free from excessive undulations; regular and has an even ripple formation); welds are adequately fused, and there is minimal undercut, overlap and surface inclusions; tack welds are blended in to form part of the finished weld, without excessive hump; corner joints have minimal burn through to the underside of the joint or, where appropriate PC26. use both methods to produce the various joints a) with filler wire b) without filler wire (autogenously) PC27. produce joints from various materials in different forms **Materials**: carbon steel, low alloy steel **Forms**: sheet (less than 1.5 mm), plate (8 mm), pipe/tube PC28. weld joints in good access situations, in select positions PC29. make sure that the work area is maintained and left in a safe and tidy condition
Testing for quality	The user/individual on the job should be able to: PC30. use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specification PC31. check that the welded joint conforms to the specification, by checking various quality parameters using visual inspection **Quality parameters**: dimensional accuracy; alignment/squareness; size and profile of weld; visual defects; NDT/DT tested defects **Types of visual inspections**: use of visual techniques, lighting, low powered magnification, fillet weld gauges, usage at temperature chalk PC32. identify various weld defects **Types of weld defects**: lack of continuity of the weld ; uneven and irregular ripple formation; incorrect weld size or profile; undercutting; overlap; inclusions; porosity; internal cracks; surface cracks; lack of fusion; lack of penetration; welding spatter; gouges; stray arc strikes; sharp edges PC33. detect surface imperfections and deal with them appropriately PC34. report any defect or imperfection identified to the authorised person PC35. shut down and make safe the welding equipment on completion of the welding activities
Dealing with contingencies	The user/individual on the job should be able to: PC36. detect equipment malfunctions and deal with them appropriately PC37. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve

CSC/ N 0212: Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding

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. relevant legislation, standards, policies, and procedures followed in the company KA2. key purpose of the organization KA3. department structure and hierarchy protocols KA4. work flow and own role in the workflow KA5. dependencies and interdependencies in the workflow KA6. support functions and types of support available for incumbents in this role
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. the types of fire extinguishers and their suitable uses in case of welding related fires KB2. the effects of exposure to welding fume KB3. range of welding equipment available **Welding equipment**: transformer (variable wave forms and wave balancing); rectifier (pulsing); inverter; generator; measuring equipment for electrical output and continuity (voltmeter/multi-meter, ammeter/shunts/coils, tong tester); equipment for current regulation; high frequency unit; torches; electrodes; filler wires; water cooling and circulation system for TIG torch (water cooled torch); return clamps; foot pedal; ancillary equipment (table grinders for tungsten electrode, wire brushes, linishers, hammer, power saw, angle, pedestal and straight grinders, chisel); other equipment **Shielding gases equipment**: cylinders; manifold systems; regulators (fixed, single stage, two-stage); gas flow meters; gas tubes and connectors; solenoid valves; economisers KB4. concepts and mechanisms of welding **Welding concepts and mechanisms**: relationship between wire feed speed control and welding current; power source characteristics (volt/ampere graph, flat characteristic, constant voltage output); types of current AC and DC and polarity; AC welding (square wave forms and wave balancing); DC pulsed TIG welding; return; earth; wire feed control (variable speed motor, direct control of wire feed rate) KB5. basic principles of TIG welding and functions of welding equipment **Principles**: the arc burns between a non- consumable tungsten electrode and the workpiece; exclusively inert gases (Argon, Helium) are used as shielding gases; TIG welding installation; for most applications an electrode with a negative polarity is used; for welding of aluminum, alternating current must be used ; for arc ignition a high-frequency high voltage is used KB6. different types of power source KB7. safe working practice, precautions and procedures to be followed when preparing and using TIG welding equipment **Safety precautions (TIG Welding)**: protection from live and other electrical components, including insulation, proper earthing, proper loading, etc.; proper handling and placement of hot metal; taking account of splatter and related safe distance; adequate lighting; appropriate personal protective equipment (suitable aprons, welding gloves, respirators, safety boots, correctly fitting overalls, suitable eye shields/goggles); protection of self and

CSC/ N 0212: Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding

	others from the effects of the welding arc; fume extraction/control measures; safety measures for elevated and trench working reduction in the local air concentration due to release of argon gas during welding in confined places KB8. hazards associated with TIG welding and safety precautions to minimize risk **Safety precautions (general)**: general workshop safety; fire prevention; general hazards; manual lifting; overhead lifting; surface conditions; stability of surrounding structures, furniture, etc. KB9. personal protective equipment to be worn for the welding activities KB10. correct handling and storage of gas cylinders KB11. manual TIG welding process KB12. type and thickness of base metals KB13. current types and polarity KB14. reasons for using shielding gases, and the types and application of the various gases **Shielding gases**: shielding gases for GTAW; applications for shielding gases/gas mixtures (argon, argon/helium mixtures, argon/hydrogen mixtures, nitrogen argon/nitrogen mixtures); gas pressure requirements; flow rates for applications; back purging KB15. impact of shielding gas composition and purity on welding quality KB16. use, impact and importance of gas pressures and flow rates in relationship to the type of material being welded and the consumables used **Welding consumables**: filler wires for different base materials, shielding gas KB17. pre- and post-flow purge and its importance KB18. importance and application of back purging KB19. types of welded joints to be produced **Types of joints**: fillet lap joints, tee fillet joints, corner joints, butt joints (square, single vee, double vee, single j (for higher thickness), double j) KB20. terminology used for the appropriate welding positions **Welding Positions**: flat (PA) IG/1F, horizontal vertical (PB) 2F, horizontal (PC) 2G, vertical upwards (PF) 3F / 3G, vertical downwards (PG) 3F / 3G, Plate to Pipe (Fixed) 5F, Pipe to Pipe 5G, Pipe welding at inclined position 6G KB21. how to prepare the materials in readiness for the welding activity KB22. how to set up and restrain the joint, and the tools and techniques to be used KB23. appropriate tack welding size and spacing (in relationship to material thickness) KB24. checks to be made prior to welding **Activities checks**: correct set-up of the joint; proper condition of electrical connections; welding return and earthing arrangements; operating parameters KB25. techniques of operating the welding equipment to produce a range of joints in the various joint positions KB26. effects of the electrical characteristics of the TIG welding arc KB27. purpose and importance of pre-heating requirements for base metals KB28. purpose and importance of post-heating in welding KB29. methods to achieve pre-heat and post heat requirements KB30. tools and methods to measure temperature for pre-heat and post-heat requirements such as thermal chalk, thermocouple, etc.

CSC/ N 0212: Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding

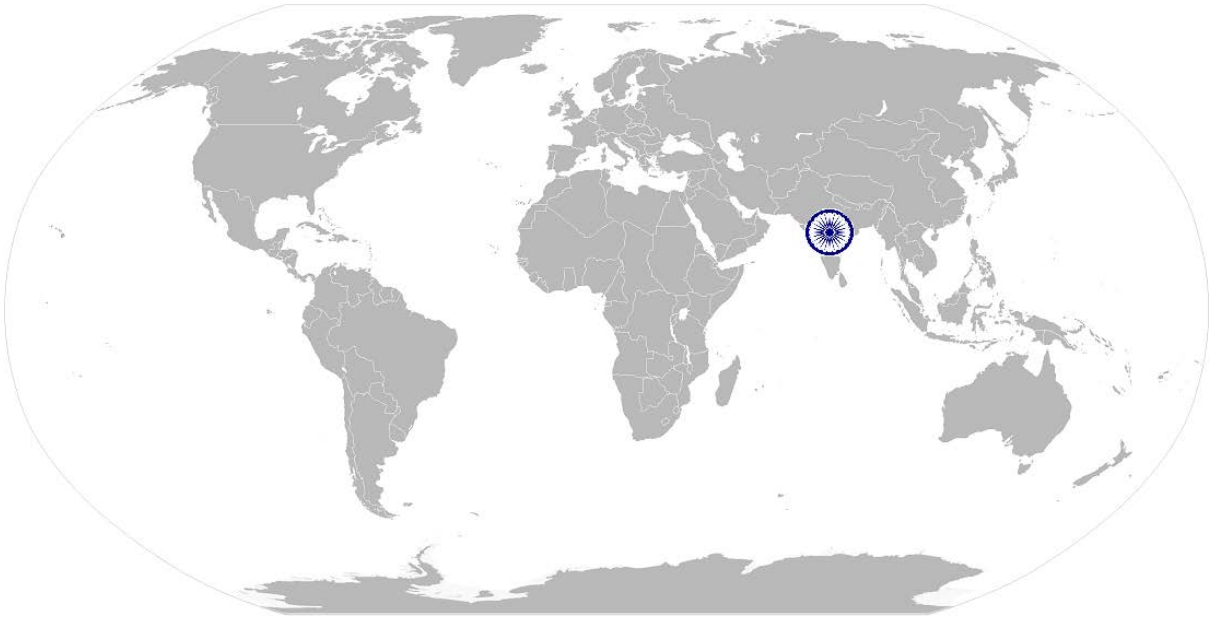
	KB31. how to control distortion (such as welding sequence; deposition technique) KB32. problems that can occur with the welding activities KB33. how to close down the welding equipment safely and correctly KB34. how to prepare the welds for examination KB35. various procedures for visual examination of the welds **Types of visual inspections**: use of visual techniques, lighting, low powered magnification, fillet weld gauges, usage at temperature chalk KB36. handling of specimens for tests and methods of removing a test piece of weld from a suitable position in the joint **Handling specimens for tests:** handling hot materials**;** using chemicals for cleaning and etching**;** using equipment to fracture welds KB37. safe working practices and procedures to be adopted when preparing the welds for examination KB38. importance of leaving the work area and equipment in a safe condition on completion of the welding activities
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Communication**
	The user/ individual on the job needs to know and understand how to: SA1. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language SA2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language SA3. convey and share technical information clearly using appropriate language SA4. check and clarify task-related information SA5. liaise with appropriate authorities using correct protocol SA6. communicate with people in respectful form and manner in line with organizational protocol
	Numerical and computational skills
	The user/individual on the job needs to know and understand how to: SA7. undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages) SA8. use appropriate measuring techniques SA9. use and convert imperial and metric systems of measurements SA10. apply appropriate degree of accuracy to express numbers SA11. use and understand tolerance in terms of limits of size SA12. check measurements, angles, orientation and slopes SA13. types of reference lines such as tangent lines, datum lines, centre lines and work points SA14. check square of material using corner-to-corner dimensions and triangulation (3-4-5) method SA15. select and use tools and equipment such as measuring tapes, levels, squares, protractors and dividers SA16. ability to check dimensions of components

CSC/ N 0212: Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding

	SA17. calculate the value of angles in a triangle
	Learning
	The user/individual on the job needs to know and understand how to: SA18. participate in on-the-job and other learning, training and development interventions and assessments SA19. clarify task related information with appropriate personnel or technical adviser SA20. seek to improve and modify own work practices SA21. maintain current knowledge of application standards, legislation, codes of practice and product/process developments
B. Professional Skills	**Problem Solving**
	The user/individual on the job needs to know and understand how to: SB1. identify problems with work planning, procedures, output and behavior and their implications SB2. prioritize and plan for problem solving SB3. communicate problems appropriately to others SB4. identify sources of information and support for problem solving SB5. seek assistance and support from other sources to solve problems SB6. identify effective resolution techniques SB7. select and apply resolution techniques SB8. seek evidence for problem resolution
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB9. plan, prioritize and sequence work operations as per job requirements SB10. organize and analyze information relevant to work SB11. basic concepts of shop-floor work productivity including waste reduction, efficient material usage and optimization of time
	Initiative and Enterprise
	The user/individual on the job needs to know and understand how to: SB12. undertake and express new ideas and initiatives to others SB13. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses SB14. participate in improvement procedures including process, quality and internal/external customer/supplier relationships SB15. enhance one's competencies in new and different situations and contexts to achieve more
	Self-Management
	The user/individual on the job needs to know and understand how to: SB16. exercise restraint while expressing dissent and during conflict situations SB17. avoid and manage distractions to be disciplined at work SB18. manage own time for achieving better results
	Teamwork

CSC/ N 0212: Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding

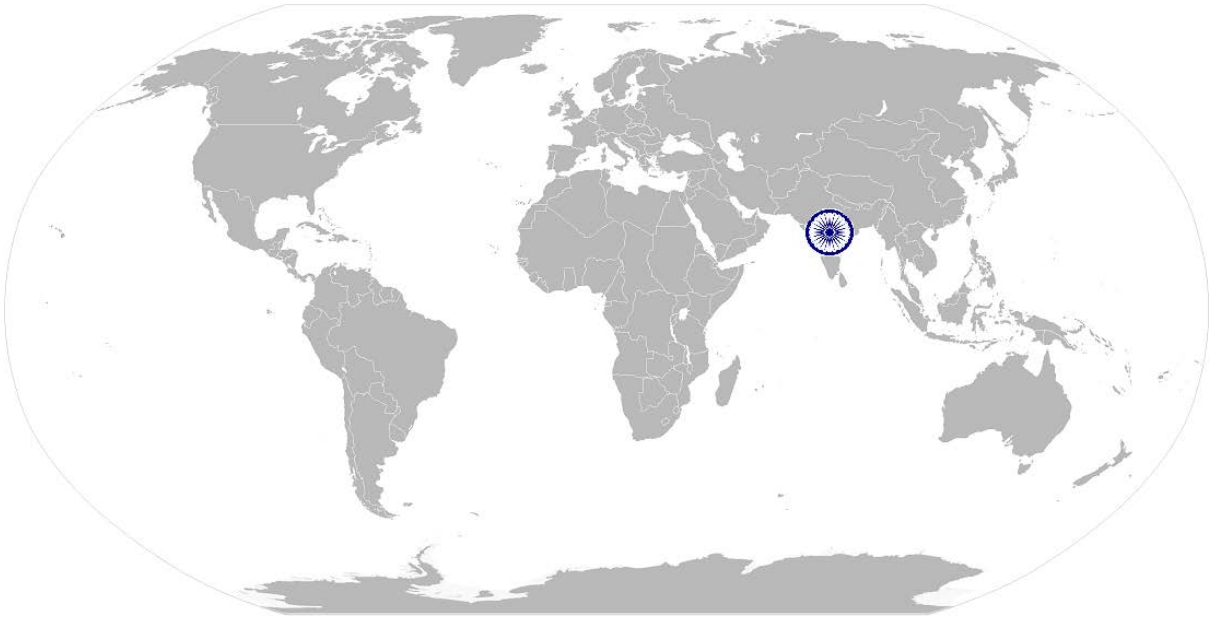
	The user/individual on the job needs to know and understand how to: SB19. work in a team in order to achieve better results SB20. identify and clarify work roles within a team SB21. communicate and cooperate with others in the team SB22. seek assistance from fellow team members



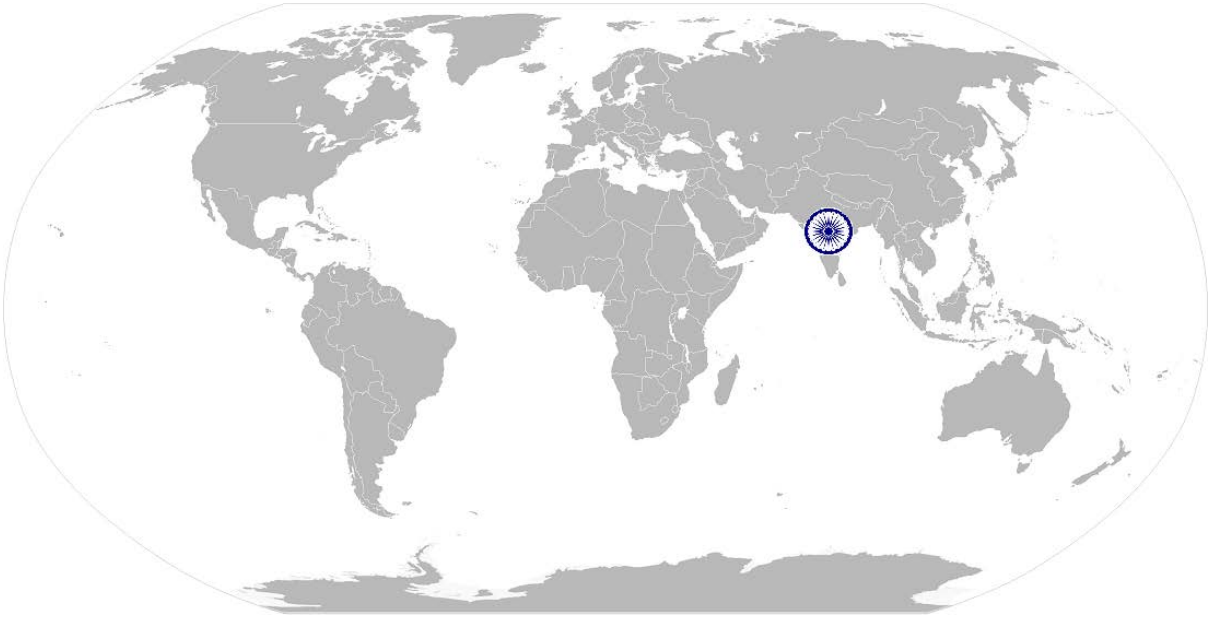
CSC/ N 0212: Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding

NOS Version Control

NOS Code	CSC / N 0212		
Credits(NSQF)	TBD	Version number	1.0
Industry	Power	Drafted on	26/03/15
Industry Sub-sector	Power Generation	Last reviewed on	26/03/15
		Next review date	26/03/17



National Occupational Standard



Overview

This unit covers operations for performing stud welding to secure studs and pins to metal surfaces to attach materials such as boilers surfaces, insulation and refractories. The person would be able to independently carry out stud weld operations for welding studs and pins as per welding procedure specifications (WPS).

CSC/ N 0210: Weld stud joints using stud welding equipment/machines

National Occupational Standard

Unit Code	**CSC / N 0210**
Unit Title (Task)	**Welding stud joints using stud welding equipment/machines**
Description	This unit is about performing stud welding to secure studs and pins to metal surfaces to attach materials such as boilers, surfaces, insulation and refractories. This can be done through manual processes or with machines in downward position. This involves setting-up and preparing for operations interpreting the right information from the WPS, obtaining the right consumables and raw materials, etc. The candidate will be expected to work with a minimum of supervision, taking personal responsibility for own actions, quality and accuracy of the work. The candidate will have knowledge and understanding pertaining to the stud welding process, consumables used, setting up of equipment, health and safety requirements, and assessing weld quality through visual inspection. The candidate will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.
Scope	This unit/task covers the following: • Work safely • Prepare for welding operations • Carry out welding operations • Test of output • Dealing with contingencies

Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Work safely	The user/individual on the job should be able to: PC1. work safely at all times, complying with health and safety and other relevant regulations and guidelines PC2. stop machine/equipment in case of emergencies and start when safe using correct procedure PC3. operate machine/equipment safety devices in line with set procedures PC4. stop the machine/equipment in a timely and safe manner during an emergency
Prepare for welding operations	The user/individual on the job should be able to: PC5. interpret stud welding information from welding procedure data sheets specifications PC6. set up stud welding machine/equipment for operations as per requirement PC7. ensure portable equipment power leads are undamaged and securely connected PC8. check if all machinery and equipment is calibrated and approved for use PC9. check if base metal plates are approved for stud welding process PC10. check if all equipment mechanical and electrical systems operate correctly PC11. identify maintenance requirements for various equipment/machine parts

CSC/ N 0210: Weld stud joints using stud welding equipment/machines

	PC12. ensure welding material surface is appropriately prepared with required surface pre-treatment **Preparation of surface**: clean; rust free; free from paint, oil, grease, moisture and other contaminants; use abrasives for surface preparation (abrasive wheel, wire brush or wheel, drill burr or end mill) PC13. match consumables to welding process PC14. identify different types and sizes of common fasteners and ferrules PC15. remove damaged and defective materials, equipment and consumables from operations PC16. select required amount of materials PC17. set up, check, adjust and operate stud welding machines PC18. set up the equipment parameters in accordance with instructions and the welding procedure specifications **Equipment parameters**: cable length size to be equal and return clamp as close to weld point as possible; gun capacity (stud diameter); polarity; stud extension; amperage; time setting; plunge; lift PC19. check supplies of components and consumables are adequate and correctly prepared PC20. check that the parent material, components, consumables and joint preparation comply with specifications PC21. produce test specimen by welding stud to approved specimen plates PC22. weld position, nature of base metal and stud surfaces, current, and time shall be recorded during specimen testing PC23. test specimen through approved tests and record results PC24. adjust parameters as per test results to achieve desired output including plunge, lift, time and current PC25. confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out
Carry out welding operations	The user/individual on the job should be able to: PC26. follow the relevant joining procedure and work instructions PC27. carry out and monitor the machine/equipment operations in accordance with specifications and job instructions PC28. select positions of stud placement by looking at specifications, marked layout, drawing layout or provided templates PC29. monitor the process operation and make adjustments to parameters, in order to produce welded components covering different components and different material thicknesses PC30. level and square gun to base metal before starting the weld PC31. stud weld threaded and unthreaded fasteners accurately PC32. stud weld fasteners of different diameters in downward position
Test of output	The user/individual on the job should be able to: PC33. produce welded components which meet all the required quality parameters PC34. ensure stud welds are correctly pitched out and located PC35. meet the required dimensional accuracy within specified tolerances PC36. achieve the rate of output as specified

	PC37. support carrying out of destructive and non-destructive tests **Non-destructive tests (NDT)**: visual inspection; fillet formation, fillet height, flow or bend of filet into base material; after-weld length; 'wetting' – flash around the stud with no undercut **Destructive tests (DT)**: Mechanical (tensile test, bend test, torque test)
Dealing with contingencies	The user/individual on the job should be able to: PC38. detect equipment malfunctions and deal with them appropriately PC39. deal promptly and effectively with problems within own control and seek timely and appropriate assistance from relevant personnel as per organizational procedure PC40. shut down the equipment to a safe condition on conclusion of welding activities
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. relevant legislation, standards, policies, and procedures followed in the company KA2. key purpose of the organization KA3. department structure and hierarchy protocols KA4. work flow and own role in the workflow KA5. dependencies and interdependencies in the workflow KA6. support functions and types of support available for incumbents in this role
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. safe working practices, precautions and procedures to be observed when operating stud welding equipment **Safety precautions**: protection from live and other electrical components, including insulation, proper earthing, proper loading, etc., using machine guards and safety devices, safety from sparks, adequate lighting, appropriate personal protective equipment (PPE): suitable aprons, welding gloves (hole free, dry and insulating), safety boots (hole free), correctly fitting overalls, suitable eye shields/goggles; protection of self and others from the effects of the welding arc; fume extraction/control measures; safety measures for elevated and trench working KB2. hazards associated with stud welding equipment and how they can be minimized KB3. basic principles of stud welding **Basic principles**: types of machines; heat and pressure to form a weld; heating effect of welding current; welding and pressure cycles; machine functions; principal features of the welded joint KB4. terminology used in welding KB5. key components and features of the equipment used **Key components**: constant current (CC) power source, stud welding gun, weld cable with stud gun control card, control cable, controls for adjusting to diameter, work/ground cable with "c" clamp type connector KB6. types and thicknesses of base metals for welding purposes

CSC/ N 0210: Weld stud joints using stud welding equipment/machines

	KB7. power sources, types and implications for welding KB8. types and sizes of studs and pins used in stud welding KB9. types, components and operation of stud guns for welding **Types of guns**: portable, hand-held pistol grip configuration; fixed, production gun, mounted within an automatic fastener loading system **Components of gun**: leg screw, chuck adaptor, set screw, ferrule, ferrule grip, foot screws, foot, legs, chuck, plunge KB10. types and sizes of ferrules used in stud welding KB11. applications of stud welding such as duct work, boilers and bridges KB12. how to test stud welding equipment set up for readiness KB13. how to adjust stud welding machine as required for achieving specified output KB14. importance of levelling and squaring gun to base metal while stud welding KB15. ability to detect stud welding equipment malfunction KB16. importance of holding the gun steady during the weld KB17. importance of not actuating the trigger twice during a stud weld KB18. importance of correct plunge and lift in stud welding KB19. show variation in the parameters influence weld features, quality and output KB20. how to extract the information required from the drawings and welding procedure specifications KB21. operation of the stud welding machine controls and their function KB22. fine tuning parameters in stud welding operations to maintain quality; recognition of problems and action to be taken KB23. problems that can occur with the welding activities; materials and weld defects and how to rectify them or deal with them appropriately **Problems**: misaligned weld, poor weld (missing in large measure), uneven weld, after weld height of the stud not as per requirement, hot weld, cold weld, hang up weld KB24. importance of self-inspection of completed weld work KB25. organizational quality systems (standards to be achieved; production records to be kept) used as applicable to the job requirements KB26. extent of their own authority and whom to seek help from for problems that cannot be resolved by self KB27. reporting lines and procedures, line supervision and technical experts KB28. types of fire extinguishers and their suitable uses in case of welding related fires
Skills (S) [Optional]	
A. Core Skills/ Generic Skills	**Communication**
	The user/ individual on the job needs to know and understand how to: SA1. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language SA2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language SA3. convey and share technical information clearly using appropriate language SA4. check and clarify task-related information

CSC/ N 0210: Weld stud joints using stud welding equipment/machines

	SA5. liaise with appropriate authorities using correct protocol SA6. communicate with people in respectful form and manner in line with organizational protocol
	Numerical and computational skills
	The user/individual on the job needs to know and understand how to: SA7. undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages) SA8. use appropriate measuring techniques SA9. use and convert British and metric systems of measurements SA10. apply appropriate degree of accuracy to express numbers SA11. calculate tolerance in terms of limits of size SA12. check measurements, angles, orientation and slopes SA13. types of reference lines such as tangent lines, datum lines, centre lines and work points SA14. check square of material using corner-to-corner dimensions and triangulation (3-4-5) method SA15. select and use tools and equipment such as measuring tapes, levels, squares, protractors and dividers SA16. ability to check dimensions of components- SA17. calculate the value of angles in a triangle SA18. interpret straight line graphs using given data
	Learning
	The user/individual on the job needs to know and understand how to: SA19. participate in on-the-job and other learning, training and development interventions and assessments SA20. clarify task related information with appropriate personnel or technical adviser SA21. seek to improve and modify own work practices SA22. maintain current knowledge of application standards, legislation, codes of practice and product/process developments
B. Professional Skills	**Problem Solving**
	The user/individual on the job needs to know and understand how to: SB1. identify problems with work planning, procedures, output and behavior and their implications SB2. prioritize and plan for problem solving SB3. communicate problems appropriately to others SB4. identify sources of information and support for problem solving SB5. seek assistance and support from other sources to solve problems SB6. identify effective resolution techniques SB7. select and apply resolution techniques SB8. seek evidence for problem resolution
	Plan and Organize
	The user/individual on the job needs to know and understand how to: SB9. plan, prioritize and sequence work operations as per job requirements

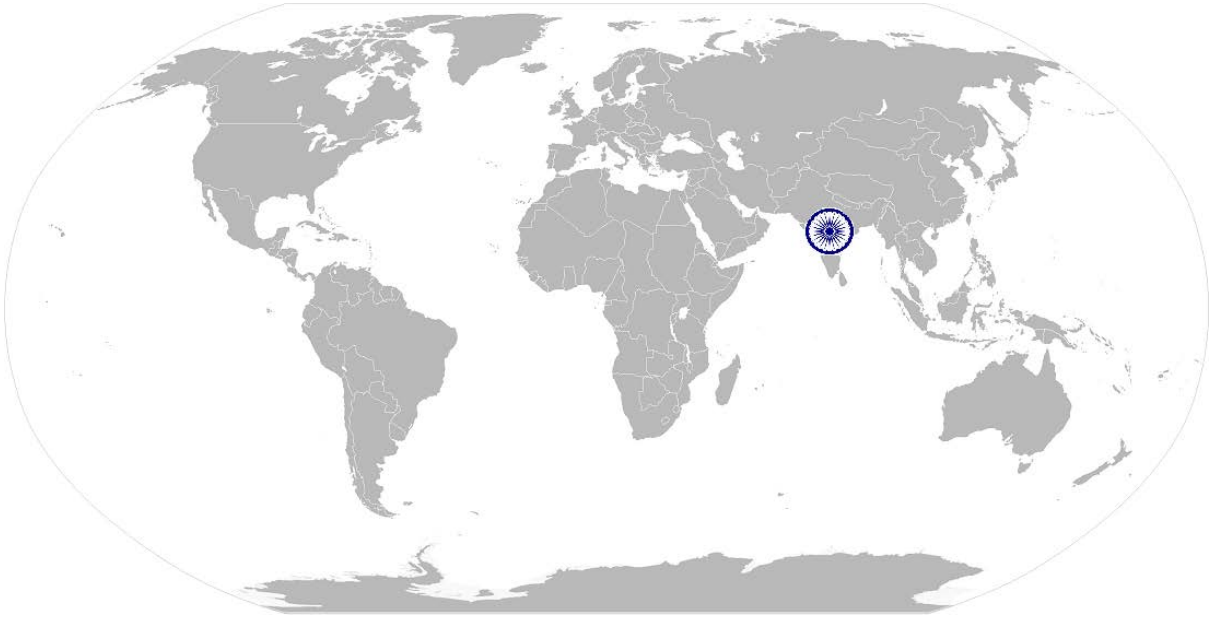
CSC/ N 0210: Weld stud joints using stud welding equipment/machines

	SB10. organize and analyze information relevant to work SB11. basic concepts of shop-floor work productivity including waste reduction, efficient material usage and optimization of time
	Initiative and Enterprise
	The user/individual on the job needs to know and understand: SB12. importance and impact of initiative and enterprise for achieving better results for self, others and organization SB13. how to undertake and express new ideas and initiatives to others SB14. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses SB15. participate in improvement procedures including process, quality and internal/external customer/supplier relationships SB16. one's competencies can and should be applied in new and different situations and contexts to achieve more
	Self-Management
	The user/individual on the job needs to know and understand: SB17. importance of taking responsibility for own work outcomes SB18. importance of adherence to work timings, dress code and other organizational policies SB19. importance of following laid down rules, procedures, instructions and policies SB20. importance of exercising restraint while expressing dissent and during conflict situations SB21. how to avoid and manage distractions to be disciplined at work SB22. importance of time management for achieving better results
	Teamwork
	The user/individual on the job needs to know and understand how to: SB23. work in a team in order to achieve better results SB24. identify and clarify work roles within a team SB25. communicate and cooperate with others in the team SB26. seek assistance from fellow team members

CSC/ N 0210: Weld stud joints using stud welding equipment/machines

NOS Version Control

NOS Code	CSC / N 0210		
Credits(NSQF)	TBD	Version number	1.0
Industry	Power	Drafted on	26/03/15
Industry Sub-sector	Power Generation	Last reviewed on	26/03/15
		Next review date	26/03/17



PSS/ N 2001: Use basic health and safety practices for power related work

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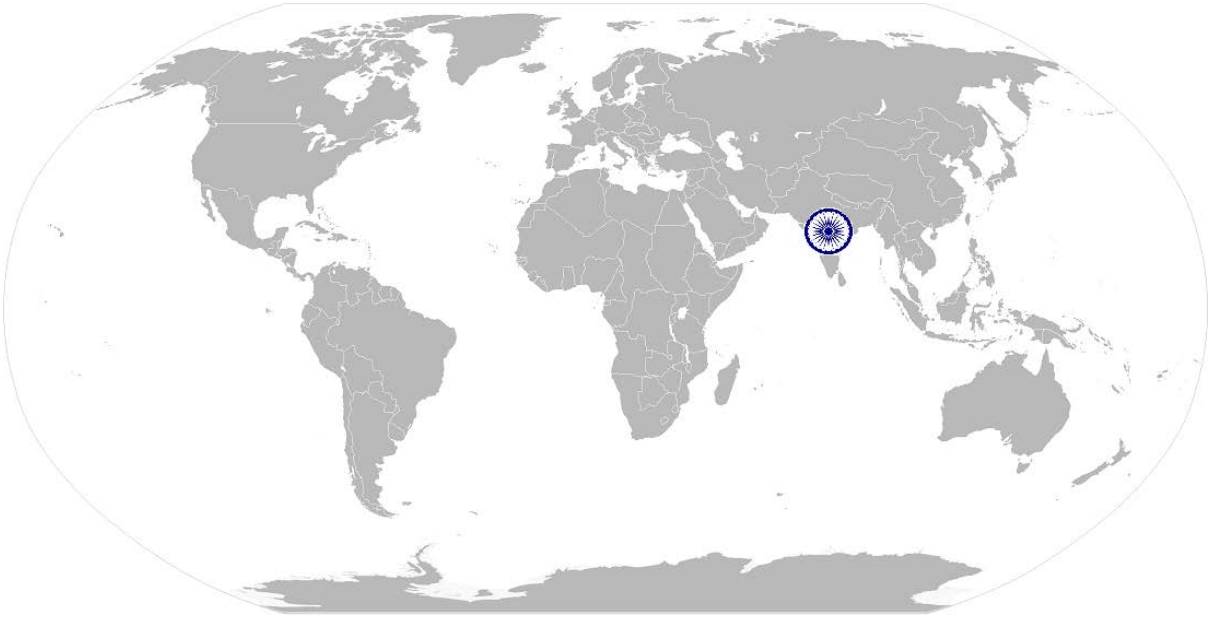
National Occupational Standard



Overview

This unit covers health, safety and security for power related work. This includes procedures and practices that candidates need to follow to help maintain a healthy, safe and secure work environment in a power plant, power station/substation or on the field while working on power equipment.

PSS/ N 2001: Use basic health and safety practices for power related work

National Occupational Standard

Unit Code	**PSS / N 2001**
Unit Title (Task)	**Use basic health and safety practices for power related work**
Description	This unit covers health, safety and security for power related work. This includes procedures and practices that candidates need to follow to help maintain a healthy, safe and secure work environment in a power plant, power station/substation or on the field while working on power equipment. It covers responsibilities towards self, others, assets and the environment. It includes understanding of risks and hazards in the workplace, along with common techniques to minimize risk, deal with accidents, emergencies, etc. It covers knowledge of fire safety, common first aid applications, safe practices and emergency procedures.
Scope	This unit/task covers the following: • Health and safety • Fire safety • Emergencies, rescue and first-aid procedures
Performance Criteria(PC) w.r.t. the Scope	
Element	**Performance Criteria**
Health and safety	The user/individual on the job should be able to: PC1. use protective clothing/equipment for specific tasks and work conditions **Protective clothing**: leather or asbestos gloves, flame proof aprons, flame proof overalls buttoned to neck, cuffless (without folds), trousers, reinforced footwear, helmets/hard hats, cap and shoulder covers, ear defenders/plugs, safety boots, knee pads, particle masks, glasses/goggles/visors **Equipment**: hand and face shields, machine guards, residual current devices, shields, dust sheets, respirator PC2. state the name and location of people responsible for health and safety in the workplace PC3. state the names and location of documents that refer to health and safety in the workplace PC4. identify job-site hazardous work and state possible causes of risk or accident in the workplace **Hazards**: electrical hazards (dealing with high voltage equipment, power supply and points, loose and naked cables and wires, electrical machines and appliances, etc.); sharp edged and heavy tools; heated metals; oxyfuel and gas cylinders; welding radiation; hazardous surfaces(sharp, slippery, uneven, chipped, broken, etc.); hazardous substances(chemicals, gas, oxy-fuel, fumes, dust, hazardous waste materials, etc.); physical hazards(working at heights, working in windy

PSS/ N 2001: Use basic health and safety practices for power related work

	or moist areas, large and heavy objects and machines, sharp and piercing objects, moving objects and part of machinery, tolls and machines, intense light, load noise, abnormal temperature; obstructions in corridors, by doors, blind turns, over stacked shelves and packages, etc.); working in high temperatures **Possible causes of risk and accident**: physical actions; not following instructions; inattention; sickness and incapacity (such as drunkenness); health hazards (such as untreated injuries and contagious illness); not taking safety precautions PC5. follow electrical safe working procedures such as Tag out/Lock out, PTW (Permit To Work), PC6. follow warning signs (danger, out of service, etc.) while working with electrical systems PC7. use standard safe working practices when working at heights, confined areas and trenches PC8. test any electrical equipment and system using insulated testing devices before touching them PC9. ensure positive isolation of electrical equipment & system as per given standards PC10. recognize any abnormalities in electrical equipment or system installed alarm annunciation and/or noticing parameters from gauge/ indicator installed **Parameters**: temperature, pressure, flow& current PC11. carry out safe working practices while dealing with hazards to ensure the safety of self and others **Safe working practices**: using protective clothing and equipment; putting up and reading safety signs; handle tools in the correct manner and store and maintain them properly; keep work area clear of clutter, spillage and unsafe object lying casually; while working with electricity take all electrical precautions like insulated clothing, adequate equipment insulation, use of control equipment, dry work area, switch off the power supply when not required, etc.; safe lifting and carrying practices; use equipment that is working properly and is well maintained; take due measures for safety while working at heights, etc. including safety harness, fall arrestors, guardrails, proper work positioning, do not jump or overload, etc.; take due measures for safety while working in confined spaces or trenches, etc. PC12. state methods of accident prevention in the work environment of the job role **Methods of accident prevention**: training in health and safety procedures; using health and safety procedures; use of equipment and working practices (such as safe carrying procedures); safety notices, advice; instruction from colleagues and supervisors PC13. state location of general health and safety equipment in the workplace **General health and safety equipment**: fire extinguishers; first aid equipment; safety instruments and clothing; safety installations(e.g.

	fire exits, exhaust fans) PC14. inspect for faults, set up and safely use of scaffolds and elevated platforms and ladders **Faults**: corrosion of metal components, deterioration, splits and cracks timber components, imbalance, loose rungs, missing/ unfixed nuts or bolts, etc. **Set up**: firm/level base, clip/lash down, leaning at the correct angle, appropriate load as per capacity, etc. PC15. lift, carry and transport heavy objects & tools safely using correct procedures from storage to workplace and vice versa PC16. inspect power plant and its equipment routinely for any signs of oil, water and/or steam leakage PC17. store flammable materials and machine lubricating oil safely and correctly PC18. check that the emission and pollution control devices are working properly in line with environmental policy standards PC19. apply good housekeeping practices at all times **Good housekeeping practices**: clean/tidy work areas, removal/disposal of waste products, protect surfaces PC20. identify common hazard signs displayed in various areas **Various areas**: on chemical containers; equipment; packages; inside buildings; in open areas and public spaces, etc. PC21. retrieve and/or point out documents that refer to health and safety in the workplace **Documents**: fire notices, accident reports, safety instructions for equipment and procedures, company notices and documents, legal documents (e.g. government notices) PC22. inform relevant authorities about any abnormal situation/behavior of any equipment/system promptly
Fire safety	The user/individual on the job should be able to: PC23. use the various appropriate fire extinguishers on different types of fires correctly **Types of fires**: Class A: e.g. ordinary solid combustibles, such as wood, paper, cloth, plastic, charcoal, etc.; Class B: flammable liquids; Class C: e.g. combustible gases, such as gasoline, propane, diesel fuel, tar, cooking oil, and similar substances; Class D: combustible chemicals and metals such as magnesium, titanium, and sodium (These fires burn at extremely high temperatures and require special suppression agents) Class E: e.g. electrical equipment such as appliances, wiring, breaker panels, etc. (These categories of fires become Class A, B, C and D fires when the electrical equipment that initiated the fire is no longer receiving electricity;) PC24. demonstrate rescue techniques applied during fire hazard PC25. demonstrate good housekeeping in order to prevent fire hazards PC26. demonstrate the correct use of a fire extinguisher

PSS/ N 2001: Use basic health and safety practices for power related work

Emergencies, rescue and first-aid procedures	The user/individual on the job should be able to: PC27. demonstrate how to free a person from electrocution PC28. administer appropriate first aid to victims where required e.g. in case of bleeding, burns, choking, electric shock, poisoning etc. PC29. demonstrate basic techniques of bandaging PC30. respond promptly and appropriately to an accident situation or medical emergency in real or simulated environments PC31. perform and organize loss minimization or rescue activity during an accident in real or simulated environments PC32. administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock, before the arrival of emergency services in real or simulated cases PC33. demonstrate the artificial respiration and the CPR Process PC34. participate in emergency procedures **Emergency procedures**: raising alarm, safe/efficient, evacuation, correct means of escape, correct assembly point, roll call, correct return to work PC35. complete a written accident/incident report or dictate a report to another person, and send report to person responsible **Incident Report includes details of**: name, date/time of incident, date/time of report, location, environment conditions, persons involved, sequence of events, injuries sustained, damage sustained, actions taken, witnesses, supervisor/manager notified PC36. demonstrate correct method to move injured people and others during an emergency
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. names (and job titles if applicable), and where to find, all the people responsible for health and safety in a workplace. KA2. names and location of documents that refer to health and safety in the workplace.
B. Technical Knowledge	The user/individual on the job needs to know and understand: KB1. meaning of “hazards” and “risks” KB2. health and safety hazards commonly present in the work environment and related precautions KB3. possible causes of risk, hazard or accident in the workplace and why risk and/or accidents are possible KB4. possible causes of risk and accident **Possible causes of risk and accident**: physical actions; not following instructions; inattention; sickness and incapacity (such as drunkenness); health hazards (such as untreated injuries and contagious illness); not taking safety precautions KB5. methods of accident prevention **Methods of accident prevention**: training in health and safety

PSS/ N 2001: Use basic health and safety practices for power related work

	procedures; using health and safety procedures; use of equipment and working practices (such as safe carrying procedures); safety notices, advice; instruction from colleagues and supervisors KB6. safe working practices when working with tools and machines KB7. safe working practices while working at various hazardous sites KB8. where to find all the general health and safety equipment in the workplace KB9. various dangers associated with the use of electrical equipment KB10. positive isolation of electrical equipment and system KB11. safe handling and disposal of hazardous power plant wastes KB12. use of emission and pollution control devices and measures taken to control pollution KB13. various safety procedures and equipment used to work at heights, trenches and confined places KB14. safe working practices specific to working with electrical equipment & system e.g. lock out/ tag out, PTW, etc. KB15. preventative and remedial actions to be taken in the case of exposure to toxic materials **Exposure:** ingested, contact with skin, inhaled **Preventative action**: ventilation, masks, protective clothing/ equipment); **Remedial action:** immediate first aid, report to supervisor **Toxic materials:** solvents, flux, lead KB16. importance of using protective clothing/equipment and other insulated work gear while handling electrical system and equipment KB17. precautionary activities taken to prevent fire accident KB18. various causes of fire **Causes of fires**: heating of metal; spontaneous ignition; sparking; electrical heating; loose fires (smoking, welding, etc.); chemical fires; etc. KB19. techniques of using the different fire extinguishers KB20. different methods of extinguishing fire KB21. different materials used for extinguishing fire **Materials**: sand, water, foam, CO2, dry powder KB22. emergency rescue techniques applied during a fire hazard KB23. various types of safety signs and what they mean KB24. appropriate basic first aid treatment relevant to the condition e.g. shock, electrical shock, bleeding, breaks to bones, minor burns, resuscitation, poisoning, eye injuries KB25. content of written accident report KB26. potential injuries and ill health associated with incorrect manual handing KB27. safe lifting, carrying and transporting practices KB28. personal safety, health and dignity issues relating to the movement of a person by others KB29. potential impact to a person who is moved incorrectly
Skills (S) [Optional]	

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A. Core Skills/ Generic Skills	**Reading and Writing Skills**
	The user/individual on the job needs to know and understand how to: SA1. read and comprehend basic content to read labels, charts, signages SA2. read and comprehend basic English to read manuals of operations SA3. read and write an accident/incident report in local language or English
	Oral Communication (Listening and Speaking skills)
	The user/individual on the job needs to know and understand how to: SA4. question coworkers appropriately in order to clarify instructions and other issues SA5. give clear instructions to coworkers, subordinates others
	Decision Making
	The user/individual on the job needs to know and understand how to: SA6. make appropriate decisions pertaining to the concerned area of work with respect to intended work objective, span of authority, responsibility, laid down procedure and guidelines
B. Professional Skills	**Plan and Organize**
	The user/individual on the job needs to know and understand how to: SB1. plan and organize their own work schedule, work area, tools, equipment and materials to maintain decorum and for improved productivity
	Working with others
	The user/individual on the job needs to know and understand how to: SB2. remain congenial while discussing and debating issues with co-workers SB3. follow appropriate protocols for communication based on situation, hierarchy, organizational culture and practice SB4. ask for, provide and receive required assistance where possible to ensure achievement of work related objectives SB5. thank coworkers for any assistance received SB6. offer appropriate respect based on mutuality and respect for fellow worksmanship and authority
	Problem Solving
	The user/individual on the job needs to know and understand how to: SB7. think through the problem, evaluate the possible solution(s) and suggest an optimum /best possible solution(s) SB8. identify immediate or temporary solutions to resolve delays SB9. identify sources of support that can be availed of for problem solving for various kind of problems SB10. seek appropriate assistance from other sources to resolve problems SB11. report problems that you cannot resolve to appropriate authority
	Analytical Thinking

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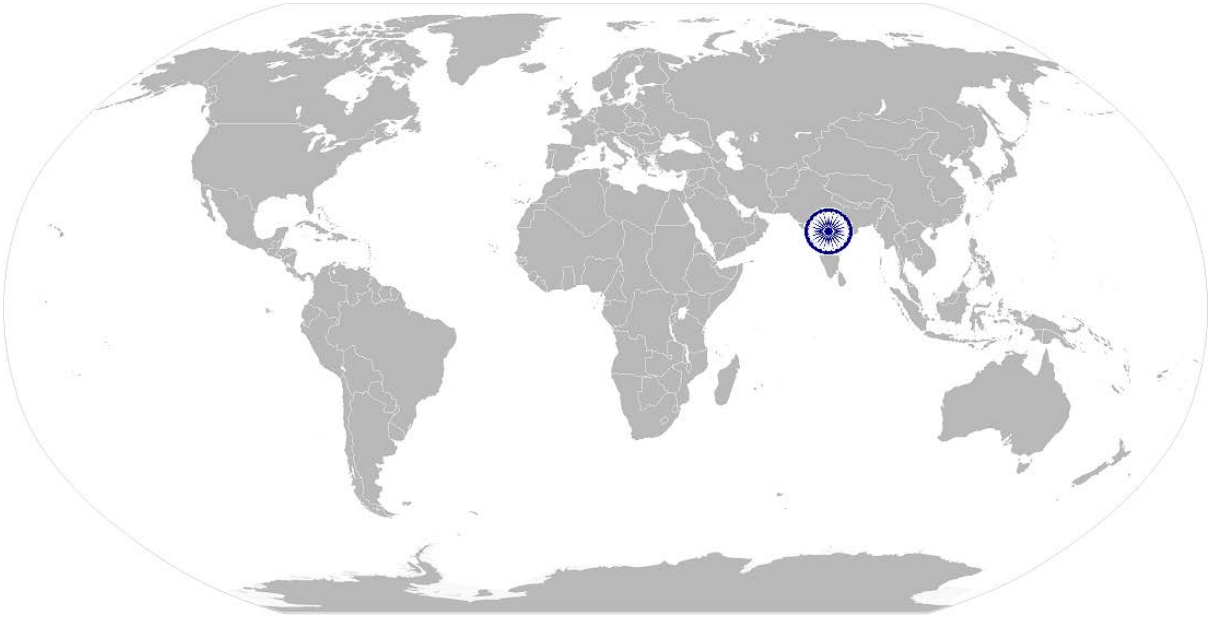
	The user/individual on the job needs to know and understand how to: SB12. identify cause and effect relations in their area of work SB13. use cause and effect relations to anticipate potential problems and their solution

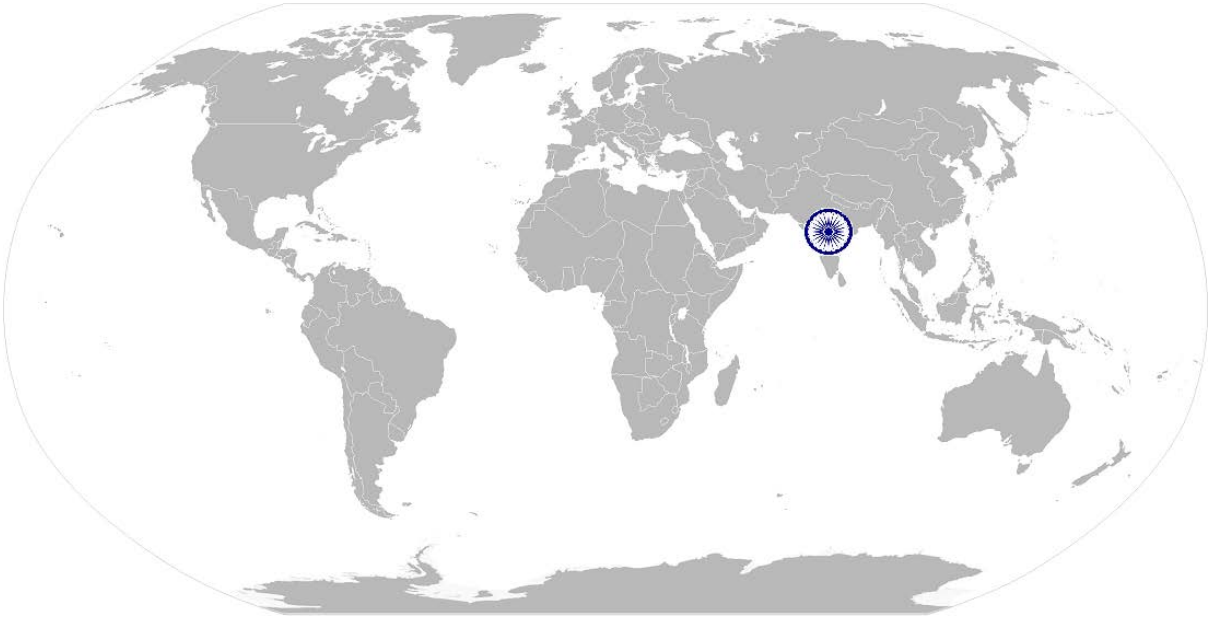


PSS/ N 2001: Use basic health and safety practices for power related work

NOS Version Control

NOS Code	PSS / N 2001		
Credits (NSQF)	TBD	Version number	1.0
Industry	Power	Drafted on	26/03/15
Industry Sub-sector	Generation, Transmission, Distribution, Renewable energy, Equipment manufacturing	Last reviewed on	26/03/15
		Next review date	26/03/17

National Occupational Standard



Overview

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

CSC/ N 1336: Work effectively with others

National Occupational Standard

Unit Code	**CSC / N 1336**
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. These cover areas such as communication etiquette, discipline, listening, handling conflict and grievances.
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 receive information and instructions from the supervisor and fellow workers, getting clarification where required PC2. accurately pass on information to authorized persons who require it and within agreed timescale and confirm its receipt PC3. give information to others clearly, at a pace and in a manner that helps them to understand PC4. display helpful behavior by assisting others in performing tasks in a positive manner, where required and possible PC5. consult with and assist others to maximize effectiveness and efficiency in carrying out tasks PC6. display appropriate communication etiquette while working **Communication etiquette:** do not use abusive language; use appropriate titles and terms of respect; do not eat or chew while talking (vice versa)etc. PC7. display active listening skills while interacting with others at work PC8. use appropriate tone, pitch and language to convey politeness, assertiveness, care and professionalism PC9. demonstrate responsible and disciplined behaviors at the workplace **Disciplined behaviors:** e.g. punctuality; completing tasks as per given time and standards; not gossiping and idling time; eliminating waste, honesty, etc. PC10. escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict

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 company 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

CSC/ N 1336: Work effectively with others

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 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. importance of ethics for professional success KB12. importance of discipline for professional success KB13. what constitutes disciplined behavior for a working professional KB14. common reasons for interpersonal conflict KB15. importance of developing effective working relationships for professional success KB16. expressing and addressing grievances appropriately and effectively KB17. importance and ways of managing interpersonal conflict effectively
Skills (S) [Optional]	

CSC/ N 1336: Work effectively with others

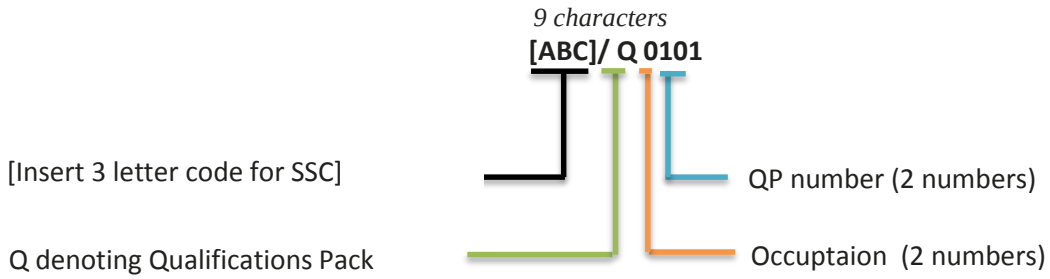
NOS Version Control

NOS Code	CSC / N 1336		
Credits(NSQF)	TBD	Version number	1.0
Industry	Power	Drafted on	26/03/15
Industry Sub-sector	Generation, Transmission, Distribution, Renewable Energy, Power Equipment Manufacturing	Last reviewed on	26/03/15
		Next review date	26/03/17

Annexure

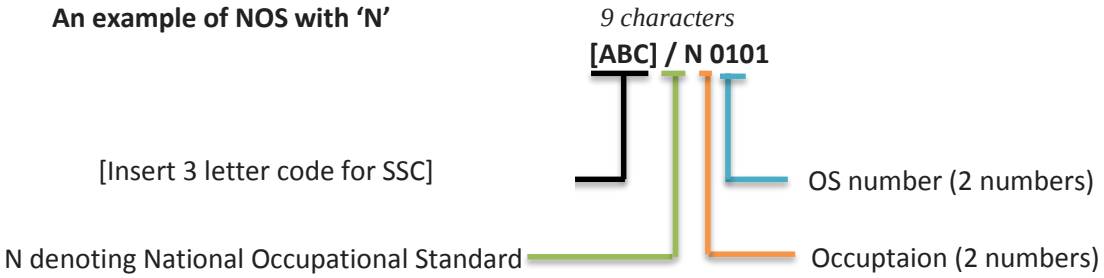
Nomenclature for QP and NOS

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
Generation	01-10
Transmission	01-10
Distribution	01-10
Renewable Energy	01-10
Power Equipment Manufacturing	01-10

Sequence	Description	Example
Three letters	Power	PSS
Slash	/	/
Next letter	Whether **Q**P or **N**OS	N
Next two numbers	Occupation code	01
Next two numbers	OS number	01

CRITERIA FOR ASSESSMENT OF TRAINEES

Job Role Power Plant High Pressure Welder

Qualification Pack PSS/ Q 0401

Sector Skill Council Power

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. Individual assessment agencies will create unique question papers for theory part for each candidate at each examination/training center (as per assessment criteria below)
4. Individual assessment agencies will create unique evaluations for skill practical for every student at each examination/training center based on this criteria
5. To pass the Qualification Pack, every trainee should score a minimum of 70% in every NOS
6. In case of successfully passing only certain number of NOS's, the trainee is eligible to take subsequent assessment on the balance NOS's to pass the Qualification Pack

				Mark Allocation	
		Total Mark (400+100)	**Out of**	**Theory**	**Skills Practical**
PSS/ N 0401 Perform welding for pressure vessels, boilers and high pressure pipes in power plants	PC1. comply with health and safety, environmental and other relevant regulations and guidelines at work	**100**	5	2	3
	PC2. adhere to procedures and guidelines for personal protective equipment (PPE) and other relevant safety regulations while performing broaching operations		5	2	3
	PC3. ensure work area is clean and safe from hazards		2	0	2
	PC4. ensure that all tools, equipment, power sources, power tool cables, extension leads are in a safe and usable condition		2	0	2
	PC5. ensure that all machines and machine tools are secured at all times		2	0	2
	PC6. determine job requirement from job specification documents or WPS obtained from valid sources		3	1	2

	PC7. recognize physically , the different equipment installed within the plant premises and identify function of the individual equipment		3	1	2
	PC8. interpret weld procedure data sheets specifications		3	1	2
	PC9. select welding machines e.g. transformer, inverters (AC/DC), rectifiers and generators, according to the materials and task		3	1	2
	PC10. identify and evaluate properties and limitations of various thermal welding and mechanical jointing systems for the job		4	2	2
	PC11. establish the type of welding to be done and procedures to complete the pipe fitting or assembling operations		3	1	2
	PC12. perform trail weld and confirm that specifications are achieved by selected welding procedure		5	2	3
	PC13. plan the sequence of activities and resources required		3	0	3
	PC14. identify and obtain materials or components to be welded and the applicable parent metal group in accordance with applicable data		3	1	2
	PC15. identify and obtain welding equipment as per the weld type established		3	1	2
	PC16. inspect the equipment for serviceability and correctly set up in accordance with standard operating procedures		5	1	4
	PC17. prepare the material for welding		2	0	2
	PC18. prepare/determine suitable datums from which to mark out (e.g. choosing a machine face or filing a flat face as a datum)		2	0	2
	PC19. apply a marking medium to enhance clarity of the marking out		3	0	3
	PC20. use an appropriate method of marking out		3	1	2
	PC21. use a range of marking out equipment (e.g. rules, squares, scribers, vernier instruments)		2	0	2

	PC22. mark out a range of features required to perform the welding		2	0	2
	PC23. perform various types of welding of cutting as per requirements		5	2	3
	PC24. produce joints from various materials in different forms		4	1	3
	PC25. perform groove and fillet weld in various positions		4	1	3
	PC26. ensure welds are deposited correctly as per specifications.		3	1	2
	PC27. select and apply appropriate distortion prevention measures for the weld type and material to ensure that distortions are rectified as required		4	1	3
	PC28. achieve joint quality, tolerances and acceptance levels that clears the following tests as laid out in ASME Pressure Vessel Code Sections I – XI, BS EN ISO5817		3	1	2
	PC29. co-ordinate with the fitter while performing the weld		2	0	2
	PC30. prepare the welded assembly and welded surface for quality tests to be conducted		3	1	2
	PC31. shut down and make safe the welding equipment on completion of the welding activities		2	0	2
	PC32. make sure that the work area is maintained and left in a safe and tidy condition		2	0	2
		Total	**100**	**25**	**75**
CSC/ N 0208: Manually weld carbon steel/ low alloy steel and austenitic stainless steel in all positions using Metal Arc Welding / Shielded Metal Arc Welding	PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines	**100**	3	1	2
	PC2. adhere to procedures or systems in place for health and safety, personal protective equipment (PPE) and other relevant safety regulations		4	1	3
	PC3. check the condition of, and correctly connect, welding leads, earthing arrangements and electrode holder		2	0	2
	PC4. deal with any faults or differential as per laid procedures		2	0	2

	PC5. follow fume extraction safety procedures		3	1	2
	PC6. read and interpret routine information on written job instructions, welding procedure specifications (WPS) and standard operating procedures		3	1	2
	PC7. select welding machines (e.g. transformers, rectifiers, inverters and generators, etc.) according to the task		2	0	2
	PC8. select type and size of electrodes according to classification and specifications		3	1	2
	PC9. re-dry electrodes as per electrode classification requirement		3	1	2
	PC10. prepare the work area for the welding activities		2	0	2
	PC11. perform measurements for joint preparation and routine MMAW		3	0	3
	PC12. prepare the materials and joint in readiness for welding		2	0	2
	PC13. tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding		3	1	2
	PC14. use manual metal-arc welding and related equipment to include a. alternating current (AC) equipment b. direct current (DC) equipment		3	0	3
	PC15. connect equipment to power source		3	0	3
	PC16. connect cables, electrode holders, return leads and ground clamps to appropriate terminal		2	0	2
	PC17. set, read and adjust amperage controls		3	1	2
	PC18. verify setup by running test and appropriately handle weld specimen/scrap-plate		3	1	2
	PC19. strike and maintain a stable arc		2	0	2
	PC20. stop and properly re-start arc to avoid welding defects (scratch start, tapping techniques)		2	0	2

	PC21. manipulate electrode angle using various methods as per WPS		3	1	2
	PC22. maintain constant puddle by using appropriate travel speed		2	0	2
	PC23. remove slag in an appropriate manner (e.g. wire brush, hammer, etc.)		2	0	2
	PC24. weld the joint to the specified quality, dimensions and profile applicable to range of material from 1.5 mm – 24 mm		5	1	4
	PC25. produce range of welded joints to within the mentioned standard using single or multi-run welds (as appropriate)		5	1	4
	PC26. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to Level C of ISO 5817		4	1	3
	PC27. produce range of welded joints in various positions as per the WPS specified		3	0	3
	PC28. shut down and make safe the welding equipment on completion of the welding activities		2	0	2
	PC29. identify various weld defects, use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specification		4	1	3
	PC30. check that the welded joint conforms to the specification, by checking various quality parameters by visual inspection		4	1	3
	PC31. detect surface imperfections and deal with them appropriately		2	0	2
	PC32. carry out DPT tests to assess fine defect open to the surface not detected by visual inspection (VT)		3	1	2
	PC33. assist in preparation for non-destructive testing of the welds, for a range of tests		3	1	2

	PC34. prepare for destructive tests on weld specimens for fillet, butt and corner		2	0	2
	PC35. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve		3	0	3
		Total	**100**	**17**	**83**
CSC/ N 0212 Perform basic manual Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) welding	PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines	**100**	3	1	2
	PC2. take necessary safety precautions for TIG welding operations		2	0	2
	PC3. interpret weld procedure data sheets specifications		3	1	2
	PC4. check that all measuring equipment is within calibration date		2	0	2
	PC5. check if welding machines e.g. transformer, inverters (AC/DC), rectifiers and generators have been made available by the authorized person		2	1	1
	PC6. check if welding torch, tungsten electrode and filler wire have been made available by the authorized person		2	1	1
	PC7. prepare for the TIG welding process		2	1	1
	PC8. prepare the materials and joint in readiness for welding		2	0	2
	PC9. fit the welding shielding gases given by the authorised person, for a range of given applications		2	0	2
	PC10. plan the welding activities before they start them effectively and efficiently for achieving specifications as per WPS		2	0	2
	PC11. connect torches and the components		2	0	2
	PC12. connect and adjust regulators and flow meters to cylinders		3	1	2
	PC13. read, set and adjust current (amperage) as required		3	1	2
	PC14. set pre-purge with shielding gas		2	1	1

	as required				
	PC15. prepare tungsten by sharpening or balling it to desired tip shape		3	1	2
	PC16. set and verify gas flow rates		2	1	1
	PC17. prepare and support the joint, using the appropriate methods		3	1	2
	PC18. tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding		2	0	2
	PC19. match feed and travel speed as required		2	0	2
	PC20. perform TIG welding operations using appropriate welding techniques to meet welding procedure specification requirements		5	1	4
	PC21. use correct technique for starting the arc (using HF (high frequency) unit, scratching the electrode on the job material, lifting the electrode immediately after touching the job material)		4	2	2
	PC22. use correct angle of torch and filler wire		4	1	3
	PC23. weld the joint to the specified quality, dimensions and profile		4	1	3
	PC24. use manual welding and related equipment, to carry out TIG welding processes		4	1	3
	PC25. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to Level B of ISO 5817		4	1	3
	PC26. use both methods to produce the various joints a) with filler wire b) without filler wire (autogenously)		4	2	2
	PC27. produce joints from various materials in different forms		2	0	2
	PC28. weld joints in good access situations, in select positions		3	1	2
	PC29. make sure that the work area is maintained and left in a safe and tidy condition		2	0	2

	PC30. use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specification		4	2	2
	PC31. check that the welded joint conforms to the specification, by checking various quality parameters using visual inspection		3	1	2
	PC32. identify various weld defects		3	1	2
	PC33. detect surface imperfections and deal with them appropriately		2	1	1
	PC34. report any defect or imperfection identified to the authorised person		2	0	2
	PC35. shut down and make safe the welding equipment on completion of the welding activities		2	0	2
	PC36. detect equipment malfunctions and deal with them appropriately		2	0	2
	PC37. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve		2	0	2
		Total	**100**	**26**	**74**
CSC/ N 0210: Weld stud joints using stud welding equipment/machines	PC1. work safely at all times, complying with health and safety and other relevant regulations and guidelines	**100**	3	1	2
	PC2. stop machine/equipment in case of emergencies and start when safe using correct procedure		3	1	2
	PC3. operate machine/equipment safety devices in line with set procedures		3	1	2
	PC4. stop the machine/equipment in a timely and safe manner during an emergency		2	0	2
	PC5. interpret stud welding information from welding procedure data sheets specifications		2	1	1
	PC6. set up stud welding machine/equipment for operations as		3	1	2

	per requirement				
	PC7. ensure portable equipment power leads are undamaged and securely connected		2	0	2
	PC8. check if all machinery and equipment is calibrated and approved for use		2	0	2
	PC9. check if base metal plates are approved for stud welding process		2	0	2
	PC10. check if all equipment mechanical and electrical systems operate correctly		2	0	2
	PC11. identify maintenance requirements for various equipment/machine parts		1	0	1
	PC12. ensure welding material surface is appropriately prepared with required surface pre-treatment		2	0	2
	PC13. match consumables to welding process		1	0	1
	PC14. identify different types and sizes of common fasteners and ferrules		1	0	1
	PC15. remove damaged and defective materials, equipment and consumables from operations		2	0	2
	PC16. select required amount of materials		1	0	1
	PC17. set up, check, adjust and operate stud welding machines		3	0	3
	PC18. set up the equipment parameters in accordance with instructions and the welding procedure specifications		4	1	3
	PC19. check supplies of components and consumables are adequate and correctly prepared		2	0	2
	PC20. check that the parent material, components, consumables and joint preparation comply with specifications		4	1	3
	PC21. produce test specimen by welding stud to approved specimen plates		3	0	3
	PC22. weld position, nature of base metal and stud surfaces, current, and time shall be recorded during specimen		2	0	2

	testing				
	PC23. test specimen through approved tests and record results		3	0	3
	PC24. adjust parameters as per test results to achieve desired output including plunge, lift, time and current		3	0	3
	PC25. confirm that the machine is set up and operating correctly, ready for the joining operations to be carried out		2	0	2
	PC26. follow the relevant joining procedure and work instructions		3	1	2
	PC27. carry out and monitor the machine/equipment operations in accordance with specifications and job instructions		4	1	3
	PC28. select positions of stud placement by looking at specifications, marked layout, drawing layout or provided templates		3	0	3
	PC29. monitor the process operation and make adjustments to parameters, in order to produce welded components covering different components and different material thicknesses		3	0	3
	PC30. level and square gun to base metal before starting the weld		3	0	3
	PC31. stud weld threaded and unthreaded fasteners accurately		3	0	3
	PC32. stud weld fasteners of different diameters in downward position		3	0	3
	PC33. produce welded components which meet all the required quality parameters		4	1	3
	PC34. ensure stud welds are correctly pitched out and located		2	0	2
	PC35. meet the required dimensional accuracy within specified tolerances		4	1	3
	PC36. achieve the rate of output as specified		2	0	2
	PC37. support carrying out of destructive and non-destructive tests		2	0	2

	PC38. detect equipment malfunctions and deal with them appropriately		2	0	2
	PC39. deal promptly and effectively with problems within own control and seek timely and appropriate assistance from relevant personnel as per organizational procedure		3	0	3
	PC40. shut down the equipment to a safe condition on conclusion of welding activities		1	0	1
		Total	**100**	**11**	**89**
PSS/ N 2001 (Use basic health and safety practices at the workplace)	PC1. use protective clothing/equipment for specific tasks and work conditions	**100**	3	0	3
	PC2. state the name and location of people responsible for health and safety in the workplace		2	0	2
	PC3. state the names and location of documents that refer to health and safety in the workplace		2	0	2
	PC4. identify job-site hazardous work and state possible causes of risk or accident in the workplace		3	1	2
	PC5. follow electrical safe working procedures such as Tag out/Lock out, PTW (Permit To Work),		3	1	2
	PC6. follow warning signs (danger, out of service, etc.) while working with electrical systems		3	1	2
	PC7. use standard safe working practices when working at heights, confined areas and trenches		3	1	2
	PC8. test any electrical equipment and system using insulated testing devices before touching them		3	1	2
	PC9. ensure positive isolation of electrical equipment & system as per given standards		3	1	2
	PC10. recognize any abnormalities in electrical equipment or system installed alarm annunciation and/or noticing parameters from gauge/ indicator installed		3	1	2
	PC11. carry out safe working practices while dealing with hazards to ensure the		3	1	2

	safety of self and others				
	PC12. state methods of accident prevention in the work environment of the job role		2	0	2
	PC13. state location of general health and safety equipment in the workplace		2	0	2
	PC14. inspect for faults, set up and safely use of scaffolds and elevated platforms and ladders		2	0	2
	PC15. lift, carry and transport heavy objects & tools safely using correct procedures from storage to workplace and vice versa		3	1	2
	PC16. inspect power plant and its equipment routinely for any signs of oil, water and/or steam leakage		3	0	3
	PC17. store flammable materials and machine lubricating oil safely and correctly		2	0	2
	PC18. check that the emission and pollution control devices are working properly in line with environmental policy standards		5	2	3
	PC19. apply good housekeeping practices at all times		3	1	2
	PC20. identify common hazard signs displayed in various areas		2	0	2
	PC21. retrieve and/or point out documents that refer to health and safety in the workplace		2	0	2
	PC22. inform relevant authorities about any abnormal situation/behavior of any equipment/system promptly		3	0	3
	PC23. use the various appropriate fire extinguishers on different types of fires correctly		4	1	3
	PC25. demonstrate good housekeeping in order to prevent fire hazards		3	1	2
	PC26. demonstrate the correct use of a fire extinguisher		3	1	2
	PC27. demonstrate how to free a person from electrocution		3	1	2

	PC28. administer appropriate first aid to victims where required e.g. in case of bleeding, burns, choking, electric shock, poisoning etc.		3	0	3
	PC29. demonstrate basic techniques of bandaging		3	1	2
	PC30. respond promptly and appropriately to an accident situation or medical emergency in real or simulated environments		3	1	2
	PC31. perform and organize loss minimization or rescue activity during an accident in real or simulated environments		3	1	2
	PC32. administer first aid to victims in case of a heart attack or cardiac arrest due to electric shock, before the arrival of emergency services in real or simulated cases		3	1	2
	PC33. demonstrate the artificial respiration and the CPR Process		3	1	2
	PC34. participate in emergency procedures		3	1	2
	PC35. complete a written accident/incident report or dictate a report to another person, and send report to person responsible		3	1	2
	PC36. demonstrate correct method to move injured people and others during an emergency		3	1	2
		Total	**100**	**24**	**76**
CSC/ N 1336 (Work effectively with others)	PC1. accurately receive information and instructions from the supervisor and fellow workers, getting clarification where required	**100**	10	3	7
	PC2. accurately pass on information to authorized persons who require it and within agreed timescale and confirm its receipt		10	3	7
	PC3. give information to others clearly, at a pace and in a manner that helps them to understand		10	3	7
	PC4. display helpful behavior by assisting others in performing tasks in a positive manner, where required and possible		10	3	7

	PC5. consult with and assist others to maximize effectiveness and efficiency in carrying out tasks		10	3	7
	PC6. display appropriate communication etiquette while working		10	3	7
	PC7. display active listening skills while interacting with others at work		10	3	7
	PC8. use appropriate tone, pitch and language to convey politeness, assertiveness, care and professionalism		10	3	7
	PC9. demonstrate responsible and disciplined behaviors at the workplace		10	3	7
	PC10. escalate grievances and problems to appropriate authority as per procedure to resolve them and avoid conflict		10	3	7
		Total	**100**	**30**	**70**