Qualification Pack

Senior Manual Metal Arc Welder/ Shielded Metal Arc Welder

Optional NOS

QP Code: CSC/Q0208

Version: 3.0

NSQF Level: 4

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Qualification Pack

CSC/Q0208: Senior Manual Metal Arc Welder/ Shielded Metal Arc Welder

Brief Job Description

The incumbent in the job is responsible for supervising and performing MMAW/SMAW process to produce various joints on different materials (carbon steel, low alloy steel and austenitic stainless steel) and post-welding activities such as inspection of equipment condition, gauging, testing and inspection of welded work pieces.

Personal Attributes

The job holder must have an eye for detail as well as the patience and discipline required to carry out detailed and repetitive tasks. The candidate should be able to read and understand technical manuals, instructions and warnings.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. CSC/N0208: Supervise and perform Manual Metal Arc Welding (MMAW)/ Shielded Metal Arc Welding (SMAW)
2. CSC/N0201: Manually cut metal and metal alloys using oxy-fuel gases
3. CSC/N0207: Manually cut metal materials using plasma arc
4. CSC/N1335: Follow the health and safety practices at the work
5. CSC/N1336: Coordinate with co-workers to achieve work efficiency

Options*(Not mandatory):*

Option : Optional NOS

1. CSC/N0211: Weld joints by Submerged Arc Welding process

Qualification Pack (QP) Parameters

Sector	Capital Goods

Qualification Pack

Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Welding and Cutting
Country	India
NSQF Level	4
Credits	16
Aligned to NCO/ISCO/ISIC Code	NCO-2015/7212.0200
Minimum Educational Qualification & Experience	10th grade pass (with 2 years of relevant experience OR 11th Grade Pass with 1 year of relevant experience OR 10th grade pass and pursuing continuous schooling OR 8th pass plus 2-year NTC plus 1-Year NAC plus 1-Year CITS OR 10th grade pass with two years of any combination of NTC/NAC/CITS or equivalent OR Pursuing 2nd year of 3-year regular Diploma (after 10th) OR Completed 2nd year of 3-year diploma (after 10th) OR 12th grade pass OR Shielded Metal Arc Welder NSQF Level 3 with 3 years of relevant experience)
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	NA
Next Review Date	31/03/2025
NSQC Approval Date	31/03/2022
Version	3.0
Reference code on NQR	QG-04-CG-00192-2023-V1.1-CGSC
NQR Version	1

CSC/N0208: Supervise and perform Manual Metal Arc Welding (MMAW)/ Shielded Metal Arc Welding (SMAW)

Description

This unit is about supervising and performing MMAW/SMAW process and post-welding operations as per the given specifications and standards specified by the organisation .

Scope

The scope covers the following :

- Prepare for welding operations
- Perform MMAW/SMAW operations
- Manage post-welding operations

Elements and Performance Criteria

Prepare for welding operations

To be competent, the user/individual on the job must be able to:

PC1. identify the work to be done and product specifications by interpreting the product drawing, Welding Procedure Specification (WPS) and job orders

PC2. prepare plan and schedule to meet the production target and give instructions to welders and helpers about the processes required to be performed for achieving the same

PC3. select the tools, welding machines, measuring instruments, accessories, consumables and input materials (i.e. carbon steel, low alloy steel and austenitic stainless steel) as per the SOP and job requirements

PC4. ensure that all the tools, welding machines, measuring instruments, accessories, consumables and input materials (carbon steel, low alloy steel and austenitic stainless steel) required for the job are in stock, functioning properly and are available on the shop floor

PC5. ensure that input materials are as per the requirements and meet required quality

PC6. plan the welding activities before starting the actual process as per WPS

PC7. guide the welders and helpers in setting of the MMAW machine and its parameters as per the WPS and SOP

PC8. check that welding apparatus is set for operation, workpieces and fixtures are installed on apparatus and aligned with the electrodes properly as per the job requirements

PC9. ensure that electrodes distance, contact area, pressure, application etc. are maintained as specified in Work Instructions (WI)

PC10. verify set up by running test weld on the specimen (scrap plate)

PC11. obtain clearance from quality control for weld joint before welding

Perform MMAW/SMAW operations

To be competent, the user/individual on the job must be able to:

PC12. follow safety precautions during welding work as per SOP and organizational guidelines

PC13. strike and maintain a stable arc by applying correct technique (i.e. scratch start, tapping techniques) and to avoid welding defects

PC14. weld the first component and inspect it for conformance to required specifications by using precision gauges

PC15. check the output for quality and correct the welding machine settings to meet the required quality output

PC16. support the welders and helpers in performing MMAW process using appropriate welding techniques as per SOP

PC17. supervise the welding operations and mass production process of component to ensure delivery as per plan

PC18. monitor that welders and helpers are producing joints of the specified dimensional accuracy and required weld quality

PC19. ensure that welding operators and technicians are following the do's and don'ts of the manufacturing process as defined in SOPs/WI

PC20. ensure the welding process parameters (air pressure, electrode force, electrode distance, gas flow, etc.) are within standards by reading the various gauges and correct them if not within standards

PC21. support the welders and helpers in comparing the dimensions of the final welded piece as prescribed in the WPS and engineering drawing

Manage post-welding operations

To be competent, the user/individual on the job must be able to:

PC22. conduct random sampling and quality checks on the finished products and report the same to the relevant authorities or take action for its improvement

PC23. support the welders and helpers in conducting visual inspection, destructive and non-destructive tests on the work pieces

PC24. ensure that the welders and helpers are segregating and storing the welded components properly by following organisational procedures

PC25. ensure that the welders and helpers are disposing scrap or waste material in accordance with the company policies and environmental regulations

PC26. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction

PC27. prepare and maintain records related to welding and maintenance conducted

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant legislation, standards, policies, and procedures followed in the organization

KU2. the basic principle of welding process

KU3. MMAW welding and its process flow

KU4. various types of welding joints (i.e. fillet lap joints, tee fillet joints, corner joints, butt joints (square, single, vee, double vee)) and welding positions (i.e. 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)

KU5. how to read and interpret WPS, welding drawings and symbols

KU6. • welding specific equipment requirements for MMAW/SMAW welding
• MMAW equipment: transformers, rectifiers, generators, invertors;
• Consumables – electrodes, dyes;
• Welding accessories - holders, cables, welding torch and accessories;
• Ancillary equipment - power saw, angle, pedestal and straight grinders, tong tester; etc.

KU7. SOP recommended by the manufacturer for using tools, measuring instruments, accessories, MMAW welding machine etc. during the welding process

KU8. main components and controls of welding equipment

KU9. type of current used and implication

KU10. ISO colour codes for welding apparatus such as gas cylinder, hoses, electric cables, etc.

KU11. joint preparation process: 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; setting up joint in correct position & alignmentimpact of various welding parameters like voltage, current, gas flow rate, speed, pressure, torch angle, cycle time, electrode distance etc. on the quality and quantity of welding

KU12. various materials used for MMAW and their properties

KU13. SOP recommended by the organisation for operating MMAW machine and its accessories

KU14. use, impact and importance of gas pressures and flow rates in relationship to the type of material being welded and the consumables used

KU15. purpose and importance of pre-heating requirements for base metals

KU16. • 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)

KU17. SOP recommended by the organisation for checking irregularities in the product/work piece

KU18. • factors that affect weld quality standards
• 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 etc.

KU19. • 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

KU20. how to control distortion (such as welding sequence; deposition technique)

KU21. Various testing techniques like visual, destructive and non-destructive

KU22. safety requirements during the welding work

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. Read and interpret drawings, work instructions, equipment manuals and process documents
GS2. communicate the welding process requirements to the supervisor and co-workers
GS3. attentively listen and comprehend the information given by the supervisor/team members
GS4. write any work related information in English/regional language
GS5. recognise a workplace problem and take suitable action
GS6. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently
GS7. plan and organize tools, machines and consumables for carrying out welding job
GS8. complete the assigned tasks with minimum supervision
GS9. report to the supervisor or deal with a colleague individually, depending on the type of concern

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare for welding operations	**12**	**19**	**-**	**8**
PC1. identify the work to be done and product specifications by interpreting the product drawing, Welding Procedure Specification (WPS) and job orders	1	2	-	1
PC2. prepare plan and schedule to meet the production target and give instructions to welders and helpers about the processes required to be performed for achieving the same	1	3	-	1
PC3. select the tools, welding machines, measuring instruments, accessories, consumables and input materials (i.e. carbon steel, low alloy steel and austenitic stainless steel) as per the SOP and job requirements	3	2	-	2
PC4. ensure that all the tools, welding machines, measuring instruments, accessories, consumables and input materials (carbon steel, low alloy steel and austenitic stainless steel) required for the job are in stock, functioning properly and are available on the shop floor	2	3	-	1
PC5. ensure that input materials are as per the requirements and meet required quality	1	1	-	-
PC6. plan the welding activities before starting the actual process as per WPS	1	1	-	-
PC7. guide the welders and helpers in setting of the MMAW machine and its parameters as per the WPS and SOP	1	2	-	1
PC8. check that welding apparatus is set for operation, workpieces and fixtures are installed on apparatus and aligned with the electrodes properly as per the job requirements	1	2	-	1
PC9. ensure that electrodes distance, contact area, pressure, application etc. are maintained as specified in Work Instructions (WI)	1	1	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. verify set up by running test weld on the specimen (scrap plate)	-	1	-	-
PC11. obtain clearance from quality control for weld joint before welding	-	1	-	-
Perform MMAW/SMAW operations	**11**	**19**	**-**	**6**
PC12. follow safety precautions during welding work as per SOP and organizational guidelines	-	1	-	-
PC13. strike and maintain a stable arc by applying correct technique (i.e. scratch start, tapping techniques) and to avoid welding defects	1	2	-	-
PC14. weld the first component and inspect it for conformance to required specifications by using precision gauges	2	4	-	2
PC15. check the output for quality and correct the welding machine settings to meet the required quality output	1	2	-	-
PC16. support the welders and helpers in performing MMAW process using appropriate welding techniques as per SOP	2	3	-	1
PC17. supervise the welding operations and mass production process of component to ensure delivery as per plan	1	2	-	1
PC18. monitor that welders and helpers are producing joints of the specified dimensional accuracy and required weld quality	1	2	-	1
PC19. ensure that welding operators and technicians are following the do's and don’ts of the manufacturing process as defined in SOPs/WI	1	-	-	-
PC20. ensure the welding process parameters (air pressure, electrode force, electrode distance, gas flow, etc.) are within standards by reading the various gauges and correct them if not within standards	1	1	-	1
PC21. support the welders and helpers in comparing the dimensions of the final welded piece as prescribed in the WPS and engineering drawing	1	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Manage post-welding operations	**7**	**12**	**-**	**6**
PC22. conduct random sampling and quality checks on the finished products and report the same to the relevant authorities or take action for its improvement	1	2	-	1
PC23. support the welders and helpers in conducting visual inspection, destructive and non-destructive tests on the work pieces	2	5	-	2
PC24. ensure that the welders and helpers are segregating and storing the welded components properly by following organisational procedures	1	2	-	1
PC25. ensure that the welders and helpers are disposing scrap or waste material in accordance with the company policies and environmental regulations	1	1	-	-
PC26. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction	1	1	-	1
PC27. prepare and maintain records related to welding and maintenance conducted	1	1	-	1
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0208
NOS Name	Supervise and perform Manual Metal Arc Welding (MMAW)/ Shielded Metal Arc Welding (SMAW)
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Welding and Cutting
NSQF Level	4
Credits	3
Version	3.0
Last Reviewed Date	NA
Next Review Date	31/03/2025
NSQC Clearance Date	31/03/2022

CSC/N0201: Manually cut metal and metal alloys using oxy-fuel gases

Description

This unit is about performing gas cutting and post-cutting operations as per the given work order and the standards specified by the organization.

Scope

The scope covers the following :

- Prepare for cutting operations
- Perform oxy-gas cutting operations
- Perform post-cutting operations

Elements and Performance Criteria

Prepare for cutting operations

To be competent, the user/individual on the job must be able to:

PC1. identify the cutting work to be done by interpreting the engineering drawing, Welding Procedure Specification (WPS) and job orders

PC2. identify the tools, cutting torch, machine, measuring instruments, accessories, consumables and input materials (mild carbon steel, high tensile and special steels, other materials) as per the requirements mentioned in WPS or drawing

PC3. select and arrange the right material, equipment, fixtures, accessories such as regulators, hoses and valve and consumables such as shielding gas etc. as per the SOP and job requirements

PC4. select the correct type of nozzle, consumables, gases and oxy-gas cutting equipment required for the job by following WPS and drawing

PC5. check the input material, tools, equipment and accessories for any defects, leakages and that they are as per the required quality standards

PC6. prepare the work area for cutting activities

PC7. set the oxy-gas cutting apparatus and its parameters as per the WPS and SOP

PC8. ensure that a flashback arrestor is fitted with the apparatus

PC9. use correct technique for lighting, adjusting and extinguishing the arc

PC10. adjust torch valve for the type of flame such as neutral, carburizing and oxidizing

PC11. mark the correct measurements on the workpiece by using appropriate tools and measuring instruments as specified in drawing or WPS

Perform oxy-gas cutting operations

To be competent, the user/individual on the job must be able to:

PC12. follow safety precautions during cutting work as per SOP and organizational guidelines

PC13. start the gas cutting machine for cutting operations

PC14. adjust cylinder valves and regulator for operating pressure to achieve required specifications

PC15. perform oxy-gas cutting process as per SOP and produce items/cut shapes to the dimensions and profiles specified in WPS and drawing

PC16. perform various cutting operations correctly and produce thermal cuts in various forms of material (metal of 3mm and above) which meet specified quality criteria i.e. dimensional accuracy is within the tolerances specified on the drawing/specification, or within +/- 2mm; angled/radial cuts are within specification requirements; cuts are clean and smooth and free from flutes; no drags

PC17. recognize and correct burn-back and flashback

PC18. measure the final workpiece and compare with the dimensions as prescribed in the WPS and engineering drawing

PC19. shut down the cutting equipment and remove the workpiece after completion of cutting activities

Perform post-cutting operations

To be competent, the user/individual on the job must be able to:

PC20. check the work pieces as per the work instructions for product quality

PC21. identify defects in the completed workpiece by using appropriate methods and equipment

PC22. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair

PC23. clean and store all the tools, machine and equipment after completion of work

PC24. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction

PC25. dispose scrap or waste material in accordance with the company policies and environmental regulations

PC26. report to the supervisor about any problems faced or anticipated during the complete process

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant legislation, standards, policies, and procedures followed in the organization

KU2. the basic principle of oxy-gas process and its process flow

KU3. SOP recommended by the manufacturer for using tools, measuring instruments, accessories, gas cutting apparatus etc. during the cutting process

KU4. various materials such as mild steel, high tensile/special steel and other appropriate metal and their properties used for gas cutting

KU5. various forms of material used for cutting are plate, rolled section, pipe/tube, solid bars etc.

KU6. different cutting gases used in oxy-gas cutting and their selection criteria

KU7. various cutting operations i.e. Downhand straight cuts (freehand), Making straight cuts (track guided), Cutting regular shapes, Cutting irregular shapes, Making angled cuts, Cutting chamfers, Making radial cuts, Gouging, flushing, Bevelled edge - weld preparations and cutting out holes

KU8. ISO colour codes for cutting apparatus such as gas cylinder, hoses, electric cables, etc.

KU9. impact of various cutting parameters on the quality and quantity of output

KU10. holding methods that are used to aid thermal cutting

KU11. types of flames and their implication for cutting

KU12. various quality check parameters i.e. shape and length of the draglines, smoothness of the sides, sharpness of the top edges and amount of slag adhering to the metal

KU13. effects of oil, grease, scale or dirt on the cutting process

KU14. various types of cutting defects such as distortion, grooved, fluted or ragged cuts, poor draglines, rounded edges, tightly adhering slag, etc. and their remedies

KU15. effects of oil, grease, scale or dirt on the cutting process

KU16. emergency procedures for backfires, flashback and other fires

KU17. safety requirements during the cutting work

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. read and interpret drawings, work instructions, equipment manuals and process documents

GS2. communicate the welding process requirements to the supervisor and co-workers

GS3. attentively listen and comprehend the information given by the supervisor/team members

GS4. write any work related information in English/regional language

GS5. recognise a workplace problem and take suitable action

GS6. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS7. plan and organize tools, machines and consumables for carrying out welding job

GS8. complete the assigned tasks with minimum supervision

GS9. report to the supervisor or deal with a colleague individually, depending on the type of concern

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare for cutting operations	**15**	**21**	**-**	**9**
PC1. identify the cutting work to be done by interpreting the engineering drawing, Welding Procedure Specification (WPS) and job orders	1	2	-	1
PC2. identify the tools, cutting torch, machine, measuring instruments, accessories, consumables and input materials (mild carbon steel, high tensile and special steels, other materials) as per the requirements mentioned in WPS or drawing	3	2	-	2
PC3. select and arrange the right material, equipment, fixtures, accessories such as regulators, hoses and valve and consumables such as shielding gas etc. as per the SOP and job requirements	2	3	-	1
PC4. select the correct type of nozzle, consumables, gases and oxy-gas cutting equipment required for the job by following WPS and drawing	1	2	-	1
PC5. check the input material, tools, equipment and accessories for any defects, leakages and that they are as per the required quality standards	2	2	-	1
PC6. prepare the work area for cutting activities	1	2	-	-
PC7. set the oxy-gas cutting apparatus and its parameters as per the WPS and SOP	1	2	-	1
PC8. ensure that a flashback arrestor is fitted with the apparatus	1	-	-	1
PC9. use correct technique for lighting, adjusting and extinguishing the arc	1	2	-	1
PC10. adjust torch valve for the type of flame such as neutral, carburizing and oxidizing	1	2	-	-
PC11. mark the correct measurements on the workpiece by using appropriate tools and measuring instruments as specified in drawing or WPS	1	2	-	-
Perform oxy-gas cutting operations	**9**	**17**	**-**	**6**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. follow safety precautions during cutting work as per SOP and organizational guidelines	-	1	-	-
PC13. start the gas cutting machine for cutting operations	1	2	-	1
PC14. adjust cylinder valves and regulator for operating pressure to achieve required specifications	1	2	-	1
PC15. perform oxy-gas cutting process as per SOP and produce items/cut shapes to the dimensions and profiles specified in WPS and drawing	2	4	-	1
PC16. perform various cutting operations correctly and produce thermal cuts in various forms of material (metal of 3mm and above) which meet specified quality criteria i.e. dimensional accuracy is within the tolerances specified on the drawing/specification, or within +/- 2mm; angled/radial cuts are within specification requirements; cuts are clean and smooth and free from flutes; no drags	2	4	-	2
PC17. recognize and correct burn-back and flashback	1	1	-	1
PC18. measure the final workpiece and compare with the dimensions as prescribed in the WPS and engineering drawing	1	2	-	-
PC19. shut down the cutting equipment and remove the workpiece after completion of cutting activities	1	1	-	-
Perform post-cutting operations	**6**	**12**	**-**	**5**
PC20. check the work pieces as per the work instructions for product quality	1	2	-	1
PC21. identify defects in the completed workpiece by using appropriate methods and equipment	2	3	-	1
PC22. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair	1	1	-	1
PC23. clean and store all the tools, machine and equipment after completion of work	1	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC24. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction	1	2	-	1
PC25. dispose scrap or waste material in accordance with the company policies and environmental regulations	-	1	-	-
PC26. report to the supervisor about any problems faced or anticipated during the complete process	-	1	-	-
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0201
NOS Name	Manually cut metal and metal alloys using oxy-fuel gases
Sector	Capital Goods
Sub-Sector	Machine Tools, Process Plant Machinery, Dies, Moulds and Press Tools, Electrical and Power Machinery, Plastics Manufacturing Machinery, Light Engineering Goods, Textile Manufacturing Machinery
Occupation	Welding and Cutting
NSQF Level	2
Credits	2
Version	3.0
Last Reviewed Date	NA
Next Review Date	31/03/2025
NSQC Clearance Date	31/03/2022

CSC/N0207: Manually cut metal materials using plasma arc

Description

This unit is about performing plasma arc cutting and post-cutting operations as per the given work order and the standards specified by the organization

Scope

The scope covers the following :

- Prepare for cutting operations
- Perform plasma arc cutting operations
- Perform post-cutting operations

Elements and Performance Criteria

Prepare for cutting operations

To be competent, the user/individual on the job must be able to:

PC1. identify the cutting work to be done by interpreting the engineering drawing, Cutting Procedure Specification (CPS) and job orders

PC2. identify the tools, plasma cutting equipment, measuring instruments, accessories, consumables and input materials (mild steel; high alloy steel; stainless steel; aluminium and its alloys; other appropriate metal) as per the requirements mentioned in WPS or drawing

PC3. select and arrange the right material, plasma cutting equipment, fixtures, accessories such as cutting guides, regulators, hoses and valve and consumables such as plasma cutting gas etc. as per the SOP and job requirements

PC4. select the correct type of nozzle, consumables, gases and plasma cutting equipment required for the job by following the WPS and drawing

PC5. check the input material, tools, equipment and accessories for any defects, leakages and that they are as per the required quality standards

PC6. prepare the work area for cutting activities

PC7. set the plasma arc cutting apparatus and its parameters as per the WPS and SOP

PC8. use the correct procedure for lighting, adjusting and extinguishing the arc

PC9. mark the correct measurements on the workpiece by using appropriate tools and measuring instruments as specified in drawing or CPS

Perform plasma arc cutting operations

To be competent, the user/individual on the job must be able to:

PC10. follow safety precautions during cutting work as per SOP and organizational guidelines

PC11. start the plasma cutting machine for cutting operations

PC12. perform plasma arc cutting process as per SOP and produce items/cut shapes to the dimensions and profiles specified in CPS and drawing

PC13. perform various cutting operations correctly and produce thermal cuts in various forms of material which meet specified quality criteria i.e. dimensional accuracy is within the tolerances specified on the drawing/specification, or within +/- 1mm; angled/radial cuts are within specification requirements; cuts are clean and smooth and free from flutes; no drags

PC14. ensure correct angles of torch and right speed for cutting during the cutting operations

PC15. measure the final workpiece and compare with the dimensions as prescribed in the CPS and engineering drawing

PC16. shut down the cutting equipment and remove the workpiece after completion of cutting activities

Perform post-cutting operations

To be competent, the user/individual on the job must be able to:

PC17. check the work pieces as per the work instructions for product quality

PC18. identify defects in the completed workpiece by using appropriate methods and equipment

PC19. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair

PC20. clean and store all the tools, machine and equipment after completion of work

PC21. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction

PC22. dispose scrap or waste material in accordance with the company policies and environmental regulations

PC23. report to the supervisor about any problems faced or anticipated during the complete process

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant legislation, standards, policies, and procedures followed in the organization

KU2. the basic principle of plasma arc cutting process and its process flow

KU3. SOP recommended by the manufacturer for using tools, measuring instruments, accessories, plasma arc cutting apparatus etc. during the cutting process

KU4. various materials such as mild steel, high tensile/special steel and other appropriate metal and their properties used for plasma arc cutting

KU5. various forms of material used for cutting are plate, rolled section, pipe/tube, solid bars etc.

KU6. Types of gases: Primary Plasma Gas – used to create the plasma arc (Nitrogen, Argon, Hydrogen, Compressed air); Secondary Shielding Gas – used to protect the cut metals from oxidation (CO2, Compressed Air)

KU7. types of regulators such as low- and high-pressure, and single- and two-stage

KU8. nozzle type as per type and thickness of base materials

KU9. • importance of torch to arc distance in relation to thickness of materials, types of torches and gases
• Torches: air plasma, oxygen injected, duel gas

KU10. factors that impact nozzle life

KU11. cutting techniques: stand-off, circle cutting, profile cutting, edge, stenting hole, piercing technique

KU12. various cutting operations i.e. Down-hand straight cuts (freehand), Making straight cuts (track guided), Cutting regular shapes, Cutting irregular shapes, Making angled cuts, Cutting chamfers, Making radial cuts, Gouging/flushing, Bevelled edge – weld preparations and Cutting out holes

KU13. ISO colour codes for cutting apparatus such as gas cylinder, hoses, electric cables, etc.

KU14. impact of various cutting parameters on the quality and quantity of output

KU15. holding methods that are used to aid thermal cutting

KU16. various quality check parameters i.e. shape and length of the draglines, smoothness of the sides, sharpness of the top edges and amount of slag adhering to the metal

KU17. various types of cutting defects such as distortion, grooved, fluted or ragged cuts, poor draglines, rounded edges, tightly adhering slag, etc. and their remedies

KU18. effects of oil, grease, scale or dirt on the cutting process

KU19. gouging and back gouging principles, methods and procedures

KU20. safety requirements during the cutting work

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. read and interpret drawings, work instructions, equipment manuals and process documents

GS2. communicate the welding process requirements to the supervisor and co-workers

GS3. attentively listen and comprehend the information given by the supervisor/team members

GS4. write any work related information in English/regional language

GS5. recognise a workplace problem and take suitable action

GS6. analyse and apply the information gathered from observation, experience, reasoning or communication to act efficiently

GS7. plan and organize tools, machines and consumables for carrying out welding job

GS8. complete the assigned tasks with minimum supervision

GS9. report to the supervisor or deal with a colleague individually, depending on the type of concern

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare for cutting operations	**15**	**21**	**-**	**9**
PC1. identify the cutting work to be done by interpreting the engineering drawing, Cutting Procedure Specification (CPS) and job orders	1	2	-	1
PC2. identify the tools, plasma cutting equipment, measuring instruments, accessories, consumables and input materials (mild steel; high alloy steel; stainless steel; aluminium and its alloys; other appropriate metal) as per the requirements mentioned in WPS or drawing	4	3	-	2
PC3. select and arrange the right material, plasma cutting equipment, fixtures, accessories such as cutting guides, regulators, hoses and valve and consumables such as plasma cutting gas etc. as per the SOP and job requirements	2	3	-	2
PC4. select the correct type of nozzle, consumables, gases and plasma cutting equipment required for the job by following the WPS and drawing	1	2	-	1
PC5. check the input material, tools, equipment and accessories for any defects, leakages and that they are as per the required quality standards	2	2	-	1
PC6. prepare the work area for cutting activities	1	2	-	-
PC7. set the plasma arc cutting apparatus and its parameters as per the WPS and SOP	2	3	-	1
PC8. use the correct procedure for lighting, adjusting and extinguishing the arc	1	2	-	1
PC9. mark the correct measurements on the workpiece by using appropriate tools and measuring instruments as specified in drawing or CPS	1	2	-	-
Perform plasma arc cutting operations	**9**	**17**	**-**	**6**
PC10. follow safety precautions during cutting work as per SOP and organizational guidelines	-	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC11. start the plasma cutting machine for cutting operations	1	2	-	1
PC12. perform plasma arc cutting process as per SOP and produce items/cut shapes to the dimensions and profiles specified in CPS and drawing	2	3	-	1
PC13. perform various cutting operations correctly and produce thermal cuts in various forms of material which meet specified quality criteria i.e. dimensional accuracy is within the tolerances specified on the drawing/specification, or within +/- 1mm; angled/radial cuts are within specification requirements; cuts are clean and smooth and free from flutes; no drags	2	4	-	2
PC14. ensure correct angles of torch and right speed for cutting during the cutting operations	2	4	-	2
PC15. measure the final workpiece and compare with the dimensions as prescribed in the CPS and engineering drawing	1	2	-	-
PC16. shut down the cutting equipment and remove the workpiece after completion of cutting activities	1	1	-	-
Perform post-cutting operations	**6**	**12**	**-**	**5**
PC17. check the work pieces as per the work instructions for product quality	1	2	-	1
PC18. identify defects in the completed workpiece by using appropriate methods and equipment	2	3	-	1
PC19. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair	1	1	-	1
PC20. clean and store all the tools, machine and equipment after completion of work	1	2	-	1
PC21. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction	1	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC22. dispose scrap or waste material in accordance with the company policies and environmental regulations	-	1	-	-
PC23. report to the supervisor about any problems faced or anticipated during the complete process	-	1	-	-
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0207
NOS Name	Manually cut metal materials using plasma arc
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Welding and Cutting
NSQF Level	4
Credits	2
Version	3.0
Last Reviewed Date	NA
Next Review Date	31/03/2025
NSQC Clearance Date	31/03/2022

CSC/N1335: Follow the health and safety practices at the work

Description

This OS unit is about following the appropriate health and safety practices at work. It covers responsibilities towards self and others to ensure a safe work environment.

Scope

The scope covers the following :

- Maintain personal health and safety
- Assist in hazard management
- Check the first aid box, firefighting and safety equipment
- Assist in waste management
- Follow the fire safety guidelines
- Follow the emergency and first-aid procedures
- Carry out relevant documentation and review

Elements and Performance Criteria

Maintain personal health and safety

To be competent, the user/individual on the job must be able to:

PC1. follow the recommended practices to ensure protection from infections and transmission to others, such as the use of hand sanitiser and face mask

PC2. check the work conditions, assess the potential health and safety risks, and take appropriate measures to mitigate them

PC3. select and use the appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions

PC4. follow the recommended techniques while lifting and moving heavy objects to avoid injury

PC5. follow the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment

Assist in hazard management

To be competent, the user/individual on the job must be able to:

PC6. identify existing and potential hazards at work

PC7. assess the potential risks and injuries associated with the identified hazards

PC8. coordinate with the supervisor or other relevant personnel to prevent or minimise the identified hazards

PC9. handle hazardous materials safely and store them in the designated storage

Check the first aid box, firefighting and safety equipment

To be competent, the user/individual on the job must be able to:

PC10. check the first aid box to ensure it is updated with the relevant first aid supplies

PC11. check and test the firefighting and various safety equipment to ensure they are in usable condition

PC12. coordinate with the supervisor for the repair and replacement of firefighting and safety equipment

Assist in waste management

To be competent, the user/individual on the job must be able to:

PC13. segregate waste into appropriate categories

PC14. recycle the recyclable waste appropriately

PC15. dispose of the non-recyclable waste in an environment-friendly manner, complying with the applicable regulations

Follow the fire safety guidelines

To be competent, the user/individual on the job must be able to:

PC16. use the appropriate type of fire extinguisher to extinguish different types of fires safely

PC17. follow the recommended practices for a safe rescue during a fire emergency

PC18. coordinate with the fire department to request assistance to extinguish a serious fire

Follow the emergency and first-aid procedures

To be competent, the user/individual on the job must be able to:

PC19. follow the organisational health and safety guidelines during workplace emergencies to ensure own and co-workers' safety

PC20. follow the recommended practices to minimise loss to organisational property during an emergency

PC21. follow the recommended procedure to free a person from electrocution

PC22. administer appropriate first aid to the injured personnel

PC23. perform Cardiopulmonary Resuscitation (CPR) on a potential victim of cardiac arrest

PC24. coordinate with the emergency services to request medical assistance for seriously injured/ ill personnel requiring professional medical attention or hospitalisation

Carry out relevant documentation and review

To be competent, the user/individual on the job must be able to:

PC25. carry out appropriate documentation following a health and safety incident at work, including all the required information

PC26. coordinate with the relevant personnel to review health and safety conditions at work regularly or following an incident

PC27. assist in implementing appropriate changes to improve the health and safety conditions at work

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the recommended practices to be followed to ensure protection from infections and transmission to others, such as the use of hand sanitiser and face mask

KU2. the importance and process of checking the work conditions, assessing the potential health and safety risks, and take appropriate measures to mitigate them

KU3. the importance and process of selecting and using the appropriate PPE relevant to the task and work conditions

KU4. the recommended techniques to be followed while lifting and moving heavy objects to avoid injury

KU5. the importance of following the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment

KU6. the importance and process of identifying existing and potential hazards at work

KU7. the process of assessing the potential risks and injuries associated with the various hazards

KU8. how to prevent or minimise different types of hazards

KU9. how to handle and store hazardous materials safely

KU10. the importance of ensuring the first aid box is updated with the relevant first aid supplies

KU11. the process of checking and testing the firefighting and various safety equipment to ensure they are in a usable condition

KU12. the criteria for segregating waste into appropriate categories

KU13. the appropriate methods for recycling the recyclable waste

KU14. the process of disposing of the non-recyclable waste safely and the applicable regulations

KU15. Use of different types of fire extinguishers to extinguish different types of fires

KU16. the recommended practices to be followed for a safe rescue during a fire emergency

KU17. how to request assistance from the fire department to extinguish a serious fire

KU18. the appropriate practices to be followed during workplace emergencies to ensure safety and minimise loss to organisational property

KU19. common health and safety hazards present in a work environment, associated risks, and how to mitigate them

KU20. safe working practices to be followed while working at various hazardous sites and using electrical equipment

KU21. the importance of ensuring easy access to firefighting and safety equipment

KU22. the appropriate preventative and remedial actions to be taken in the case of exposure to toxic materials, such as poisonous chemicals and gases

KU23. various causes of fire in different work environments and the recommended precautions to be taken to prevent fire accidents

KU24. different methods of extinguishing fire

KU25. different materials used for extinguishing fire, such as sand, water, foam, CO_2, dry powder, etc.

KU26. the applicable rescue techniques to be followed during a fire emergency

KU27. the importance of placing safety signs and instructions at strategic locations in a workplace and following them

KU28. different types of first aid treatment to be provided for different types of injuries

KU29. potential injuries associated with incorrect manual handling

KU30. how to move an injured person safely

KU31. various hazards associated with the use of various machinery, tools, implements, equipment and materials

KU32. the importance of ensuring no obstruction and free access to fire exits

KU33. how to free a person from electrocution safely

KU34. how to administer appropriate first aid to an injured person

KU35. how to perform Cardiopulmonary Resuscitation (CPR)

KU36. the importance of coordinating with the emergency services to request urgent medical assistance for persons requiring professional medical attention or hospitalisation

KU37. the appropriate documentation to be carried out following a health and safety incident at work, and the relevant information to be included

KU38. the importance and process of reviewing the health and safety conditions at work regularly or following an incident

KU39. the importance and process of implementing appropriate changes to improve the health and safety conditions at work

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. maintain work-related notes and records

GS2. communicate clearly and politely with co-workers and clients

GS3. read the relevant literature to get the latest updates about the field of work

GS4. listen attentively to understand the information being shared

GS5. plan and prioritise tasks to ensure timely completion

GS6. take quick decisions to deal with workplace emergencies and accidents

GS7. identify possible disruptions to work and take appropriate preventive measures

GS8. coordinate with the co-workers to achieve the work objectives

GS9. evaluate all possible solutions to a problem to select the best one

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Maintain personal health and safety	**7**	**12**	**-**	**-**
PC1. follow the recommended practices to ensure protection from infections and transmission to others, such as the use of hand sanitiser and face mask	2	3	-	-
PC2. check the work conditions, assess the potential health and safety risks, and take appropriate measures to mitigate them	1	2	-	-
PC3. select and use the appropriate Personal Protective Equipment (PPE) relevant to the task and work conditions	1	2	-	-
PC4. follow the recommended techniques while lifting and moving heavy objects to avoid injury	1	3	-	-
PC5. follow the manufacturer's instructions and workplace safety guidelines while working on heavy machinery, tools and equipment	2	2	-	-
Assist in hazard management	**4**	**10**	**-**	**-**
PC6. identify existing and potential hazards at work	1	1	-	-
PC7. assess the potential risks and injuries associated with the identified hazards	1	3	-	-
PC8. coordinate with the supervisor or other relevant personnel to prevent or minimise the identified hazards	1	3	-	-
PC9. handle hazardous materials safely and store them in the designated storage	1	3	-	-
Check the first aid box, firefighting and safety equipment	**3**	**7**	**-**	**-**
PC10. check the first aid box to ensure it is updated with the relevant first aid supplies	1	2	-	-
PC11. check and test the firefighting and various safety equipment to ensure they are in usable condition	1	3	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. coordinate with the supervisor for the repair and replacement of firefighting and safety equipment	1	2	-	-
Assist in waste management	**3**	**8**	**-**	**-**
PC13. segregate waste into appropriate categories	1	3	-	-
PC14. recycle the recyclable waste appropriately	1	3	-	-
PC15. dispose of the non-recyclable waste in an environment-friendly manner, complying with the applicable regulations	1	2	-	-
Follow the fire safety guidelines	**3**	**12**	**-**	**-**
PC16. use the appropriate type of fire extinguisher to extinguish different types of fires safely	1	4	-	-
PC17. follow the recommended practices for a safe rescue during a fire emergency	1	4	-	-
PC18. coordinate with the fire department to request assistance to extinguish a serious fire	1	4	-	-
Follow the emergency and first-aid procedures	**7**	**12**	**-**	**-**
PC19. follow the organisational health and safety guidelines during workplace emergencies to ensure own and co-workers' safety	1	2	-	-
PC20. follow the recommended practices to minimise loss to organisational property during an emergency	1	3	-	-
PC21. follow the recommended procedure to free a person from electrocution	1	2	-	-
PC22. administer appropriate first aid to the injured personnel	1	2	-	-
PC23. perform Cardiopulmonary Resuscitation (CPR) on a potential victim of cardiac arrest	1	2	-	-
PC24. coordinate with the emergency services to request medical assistance for seriously injured/ ill personnel requiring professional medical attention or hospitalisation	2	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Carry out relevant documentation and review	**3**	**9**	**-**	**-**
PC25. carry out appropriate documentation following a health and safety incident at work, including all the required information	1	3	-	-
PC26. coordinate with the relevant personnel to review health and safety conditions at work regularly or following an incident	1	3	-	-
PC27. assist in implementing appropriate changes to improve the health and safety conditions at work	1	3	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N1335
NOS Name	Follow the health and safety practices at the work
Sector	Capital Goods
Sub-Sector	Machine Tools, Process Plant Machinery, Dies, Moulds and Press Tools, Electrical and Power Machinery, Plastics Manufacturing Machinery, Light Engineering Goods, Textile Manufacturing Machinery
Occupation	Machining
NSQF Level	3
Credits	TBD
Version	2.0
Last Reviewed Date	26/05/2022
Next Review Date	31/03/2024
NSQC Clearance Date	31/03/2021

CSC/N1336: Coordinate with co-workers to achieve work efficiency

Description

This OS unit is about working in coordination with co-workers to achieve the work objectives efficiently. It also covers practising inclusion at work.

Scope

The scope covers the following :

- Work effectively with co-workers
- Communicate effectively with co-workers
- Practice inclusion at work

Elements and Performance Criteria

Work effectively with co-workers

To be competent, the user/individual on the job must be able to:

PC1. plan daily tasks at work to ensure their timely completion and efficient use of time

PC2. carry out work responsibilities adhering to the limits of authority

PC3. follow the supervisor's instructions to ensure adherence to the applicable quality standards and timescales

PC4. coordinate with the co-workers to achieve the work objectives efficiently

PC5. prepare the relevant documents and reports as per the supervisor's instructions, providing appropriate information clearly and systematically

PC6. coordinate with the supervisor or relevant personnel to deal with out of authority tasks and concerns

PC7. mentor and assist subordinates in the execution of their work responsibilities

PC8. identify possible disruptions to work through coordination with the relevant stakeholders and take appropriate preventive measures

PC9. use various resources efficiently to ensure maximum utilisation and minimum wastage

PC10. follow the recommended practices to avoid and resolve conflicts at work

PC11. follow the relevant organisational policies to ensure disciplined behaviour with maximum productivity at work

Communicate effectively with co-workers

To be competent, the user/individual on the job must be able to:

PC12. follow the organisational policy for the efficient and timely dissemination of information to the authorised personnel

PC13. communicate clearly and politely to ensure effective communication with co-workers

PC14. follow the appropriate techniques for active listening during interactions

Practice inclusion at work

To be competent, the user/individual on the job must be able to:

PC15. empathise with Persons with Disabilities (PwD)

PC16. adopt gender-neutral behaviour at work

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the importance and process of effective communication in the workplace
KU2. the barriers to effective communication and how to overcome them
KU3. the importance of teamwork in an organisation's and individual's success
KU4. the importance of active listening in the work environment
KU5. the appropriate techniques to be followed for active listening
KU6. importance of avoiding casual expletives and unpleasant terms while communicating professional circles
KU7. the importance of maintaining discipline and ethical behaviour at work
KU8. the common reasons for interpersonal conflict and how to resolve them
KU9. the importance of developing effective work relationships for professional success
KU10. how expressing and addressing grievances appropriately and effectively
KU11. the importance and process of planning daily tasks to ensure their timely completion and efficient use of time
KU12. the importance of adhering to the limits of authority at work
KU13. the importance of following the applicable quality standards and timescales at work
KU14. the importance of coordinating with the co-workers to achieve the work objectives efficiently
KU15. the relevant documentation requirements
KU16. the importance of providing appropriate information clearly and systematically in work documents
KU17. the escalation matrix to be followed to deal with out of authority tasks and concerns
KU18. the importance and process of mentoring and assisting subordinates in the execution of their work responsibilities
KU19. how to identify possible disruptions to work prevent them
KU20. how to use various resources efficiently to ensure maximum utilisation and minimum wastage
KU21. the recommended practices to be followed at work to avoid and resolve conflicts at work
KU22. the importance and process of efficient and timely dissemination of information to the authorised personnel
KU23. how to communicate clearly and politely to ensure effective communication
KU24. the importance of following the recommended practices to ensure an inclusive environment for PwD and all genders at work

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. maintain work-related notes and records

GS2. read work-related and other relevant literature
GS3. communicate politely and -professionally
GS4. listen attentively to understand the information or instructions being shared
GS5. plan and prioritise tasks to ensure timely completion
GS6. take prompt decisions to deal with workplace emergencies and accidents
GS7. evaluate all possible solutions to a problem to select the best one

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Work effectively with co-workers	**20**	**43**	**-**	**-**
PC1. plan daily tasks at work to ensure their timely completion and efficient use of time	2	4	-	-
PC2. carry out work responsibilities adhering to the limits of authority	2	4	-	-
PC3. follow the supervisor's instructions to ensure adherence to the applicable quality standards and timescales	2	4	-	-
PC4. coordinate with the co-workers to achieve the work objectives efficiently	2	4	-	-
PC5. prepare the relevant documents and reports as per the supervisor's instructions, providing appropriate information clearly and systematically	2	4	-	-
PC6. coordinate with the supervisor or relevant personnel to deal with out of authority tasks and concerns	2	4	-	-
PC7. mentor and assist subordinates in the execution of their work responsibilities	2	4	-	-
PC8. identify possible disruptions to work through coordination with the relevant stakeholders and take appropriate preventive measures	2	4	-	-
PC9. use various resources efficiently to ensure maximum utilisation and minimum wastage	2	4	-	-
PC10. follow the recommended practices to avoid and resolve conflicts at work	1	4	-	-
PC11. follow the relevant organisational policies to ensure disciplined behaviour with maximum productivity at work	1	3	-	-
Communicate effectively with co-workers	**6**	**15**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. follow the organisational policy for the efficient and timely dissemination of information to the authorised personnel	2	5	-	-
PC13. communicate clearly and politely to ensure effective communication with co-workers	2	5	-	-
PC14. follow the appropriate techniques for active listening during interactions	2	5	-	-
Practice inclusion at work	**4**	**12**	**-**	**-**
PC15. empathise with Persons with Disabilities (PwD)	2	6	-	-
PC16. adopt gender-neutral behaviour at work	2	6	-	-
NOS Total	**30**	**70**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N1336
NOS Name	Coordinate with co-workers to achieve work efficiency
Sector	Capital Goods
Sub-Sector	Machine Tools, Dies, Moulds and Press Tools, Plastics Manufacturing Machinery, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Machining
NSQF Level	3
Credits	TBD
Version	2.0
Last Reviewed Date	26/05/2022
Next Review Date	31/03/2024
NSQC Clearance Date	31/03/2021

CSC/N0211: Weld joints by Submerged Arc Welding process

Description

This unit is about performing submerged arc welding (SAW) process to produce welding joints on fabricated metal products as per welding procedure specification (WPS)

Scope

The scope covers the following :

- Prepare for welding operations
- Perform welding operations
- Perform post-welding activities

Elements and Performance Criteria

Prepare for welding operations

To be competent, the user/individual on the job must be able to:

PC1. identify the work to be done and product specifications by interpreting the product drawing, Welding Procedure Specification (WPS), Procedure Qualification Record (PQR) and job orders

PC2. identify the tools, SAW machines, measuring instruments, accessories, consumables and input materials (i.e. carbon steel, aluminum and stainless steel) as per the requirements mentioned in WPS or drawing

PC3. select and arrange the right material, equipment, fixtures, accessories, welding torch and consumables i.e. wire feed rolls; flux supply and hopper; indicators; wire reel etc. as per the SOP and job requirements

PC4. check the tools and equipment for any defects and that they are functioning properly

PC5. ensure that input materials are clean, free from contaminants and ready for use

PC6. select suitable wire/flux combination and re-dry it at the suitable temperature as per manufacturers guidelines

PC7. • set the SAW machine and its parameters as per the WPS and SOP
• Welding parameters and mechanisms: electrical parameters (type, amperage, voltage); welding speed; flux dispensing and recovery mechanisms; safety devices; wire feed rate; electrode stick-out; single pass or multi-pass; mechanical functions (handling, loading, work holding, transfer mode etc.

PC8. ensure that welding material surface is appropriately prepared with required heat treatment methods

PC9. verify set up by running test welds specimen

Perform welding operations

To be competent, the user/individual on the job must be able to:

PC10. follow safety precautions during welding work as per SOP and organizational guidelines

PC11. fill the flux in the hopper and direct the nozzle or gravity feed over weld line

PC12. position the welding line parallel to carriage and turn the control levers or push buttons to align the electrode and the welding head over the weld joint for linear joints

PC13. adjust length of radial arm to position electrode over weld joint for radial joints

PC14. clamp cylindrical work pieces onto turning rolls under stationary head for circular joints

PC15. start the SAW machine for welding operations

PC16. adjust welding head to set specified angle of electrode

PC17. perform SAW process in all welding positions on specified materials and forms as per SOP and produce joints and components covering different joint configurations, specified quality, dimensions and profile

PC18. ensure correct work and travel angles, flow rate, travel speed, current, voltage, and slope, and synchronize feed of wire and electrode extensions as required for the job

PC19. adjust wire stick-out and machine setup to vary size, location, and penetration of bead

PC20. monitor the machine operations in accordance with specifications and job instructions

PC21. monitor the process operation and machine functions, and make adjustments as required to welding parameters and mechanisms within their permitted authority and tolerance

PC22. remove extra material, slag, spatter etc. by using brush, chipping hammers, hand scraper grinders etc., from the welded component

PC23. shut down the welding equipment and remove the component after completion of welding activities

Perform post-welding activities

To be competent, the user/individual on the job must be able to:

PC24. check the welded component and ensure that it is meeting the required quality and dimensional accuracy within specified tolerances

PC25. identify various weld defects by conducting visual inspection, destructive and non-destructive tests on the work pieces

PC26. re-weld the defective joints, using manual welding equipment

PC27. store the weldments securely as per requirement by following organizational procedures

PC28. clean and store all the tools, machine and equipment after completion of work

PC29. dispose scrap or waste material in accordance with the company policies and environmental regulations

PC30. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction

PC31. report to the supervisor about any problems faced or anticipated during the complete process

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. relevant legislation, standards, policies, and procedures followed in the organization

KU2. basic principles and fundamentals of mechanized and automated submerged arc welding (SAW

KU3. how to extract the necessary information from drawings and welding procedure specifications; welding symbols and abbreviations used

KU4. effects of dilution on fully fused joints in dissimilar metals

KU5. • key components and features of the equipment used in SAW
• Key components and features: power source; electrical parameters such as arc voltage, current, wire dispensing and feed mechanisms; flux dispensing and recovery; control and storage of consumables; how variations in the parameters influence weld features, quality and output)

KU6. • various weld features and appropriate related terminology
• Features: face, root, HAZ (heat affected zone), convex fillet profile, concave fillet profile, mitred fillet profile, root face, root gap, root radius (U butt profile), land (U butt profile), bevel angle, included angle, weld width, leg length(s), fusion zone (depth of fusion), excess weld metal, penetration, throat thickness, fusion line (boundary)

KU7. • characteristics of an electric arc used for welding purposes
• Electric arc: voltage distribution across the arc; heat generation of the weld joint; arc characteristics (alternating current [A.C.], direct current [D.C.]); effects and influence of magnetic fields; factors that influence metal transfer (surface tension, gravity, electromagnet [Lorentz] force

KU8. uses, classification and considerations for usage of consumables such as fluxes and wires

KU9. • effects of fluxes and electrode coverings/cores upon welding processes
• Effects: facilitates arc striking; stabilizes the arc; protects filler metal from atmospheric contamination during transfer; protects deposited metal from contamination; provides appropriate weld contour; prevents rapid cooling of weld metal (thermal blanket effect); provides a flux for the molten pool to remove oxides and impurities

KU10. importance of speed, voltage and amperage on weld parameters (depth, deposition rate, width)

KU11. • type and thickness of base metals and its impact on welding operations
• Base metals: carbon steel and stainless steel

KU12. flux preparation methods (e.g.. fused, agglomerated) and its importance (Flux characteristics: basic, acid, neutral)

KU13. pre-weld heat, inter-pass and post weld-heat treatment requirements

KU14. purpose and importance of pre-heating requirements for base metals

KU15. methods such as annealing and tempering to achieve pre-heat and post heat requirements for welding

KU16. tools and methods to measure temperature for pre-heat and post-heat requirements such as thermal chalk, thermocouple, etc.

KU17. significance of diffusible hydrogen for welds and how it is measured

KU18. use and features of SAW equipment such as drive rolls, contact tips and barrels

KU19. functions and impact of sub-arc tractors

KU20. different welding cable sizes, use and impact

KU21. uses of cables and ground clamps

KU22. use, features and impact of power sources such as AC and DC

KU23. operation of the machine controls and their function

KU24. how to set up and align the work piece, and the equipment to be used

KU25. how to recognize problems and action to be taken

KU26. problems that can occur with the welding activities (distortion, material and weld defects)

KU27. methods of distortion control and rectification

KU28. residual stress and its effect on welding

KU29. how to prepare the welds for examination

KU30. how to check the welded joints for uniformity, alignment, position, weld size and profile

KU31. various procedures for visual examination of the welds for cracks

KU32. • types and requirements for non-destructive and destructive tests
• Non-destructive tests (NDT): visual inspection, radiographic (RT), ultrasonic (UT);
• Destructive tests (DT): sample preparations to perform DT, metallographic, mechanical (tensile, guided bend, charpy, impact), chemical

KU33. safety requirements during the welding work

Generic Skills (GS)

User/individual on the job needs to know how to:

GS1. read and interpret drawings, work instructions, equipment manuals and process documents

GS2. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language

GS3. communicate with people in respectful form and manner in line with organizational protocol

GS4. plan, prioritize and sequence work operations as per job requirements

GS5. organize and analyse information relevant to work

GS6. avoid and manage distractions to be disciplined at work

GS7. manage own time for achieving better results

GS8. work in a team in order to achieve better results

GS9. communicate and cooperate with others in the team for better results

GS10. seek assistance from fellow team members

GS11. identify problems with work planning, procedures, output and behaviour and their implications

GS12. prioritize and plan for problem solving

GS13. communicate problems appropriately to others

GS14. identify sources of information and support for problem solving

GS15. identify effective resolution techniques

GS16. undertake and express new ideas and initiatives to others

GS17. enhance ones competencies in new and different situations and contexts to achieve more

GS18. seek to improve and modify own work practices

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Prepare for welding operations	**12**	**17**	**-**	**8**
PC1. identify the work to be done and product specifications by interpreting the product drawing, Welding Procedure Specification (WPS), Procedure Qualification Record (PQR) and job orders	1	2	-	1
PC2. identify the tools, SAW machines, measuring instruments, accessories, consumables and input materials (i.e. carbon steel, aluminum and stainless steel) as per the requirements mentioned in WPS or drawing	3	2	-	2
PC3. select and arrange the right material, equipment, fixtures, accessories, welding torch and consumables i.e. wire feed rolls; flux supply and hopper; indicators; wire reel etc. as per the SOP and job requirements	1	2	-	1
PC4. check the tools and equipment for any defects and that they are functioning properly	1	2	-	1
PC5. ensure that input materials are clean, free from contaminants and ready for use	1	1	-	-
PC6. select suitable wire/flux combination and re-dry it at the suitable temperature as per manufacturers guidelines	1	2	-	1
PC7. • set the SAW machine and its parameters as per the WPS and SOP • Welding parameters and mechanisms: electrical parameters (type, amperage, voltage); welding speed; flux dispensing and recovery mechanisms; safety devices; wire feed rate; electrode stick-out; single pass or multi-pass; mechanical functions (handling, loading, work holding, transfer mode etc.	2	3	-	1
PC8. ensure that welding material surface is appropriately prepared with required heat treatment methods	1	1	-	1
PC9. verify set up by running test welds specimen	1	2	-	-
Perform welding operations	**11**	**20**	**-**	**7**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. follow safety precautions during welding work as per SOP and organizational guidelines	-	1	-	-
PC11. fill the flux in the hopper and direct the nozzle or gravity feed over weld line	1	2	-	-
PC12. position the welding line parallel to carriage and turn the control levers or push buttons to align the electrode and the welding head over the weld joint for linear joints	1	2	-	1
PC13. adjust length of radial arm to position electrode over weld joint for radial joints	1	1	-	-
PC14. clamp cylindrical work pieces onto turning rolls under stationary head for circular joints	1	1	-	1
PC15. start the SAW machine for welding operations	1	1	-	1
PC16. adjust welding head to set specified angle of electrode	2	3	-	2
PC17. perform SAW process in all welding positions on specified materials and forms as per SOP and produce joints and components covering different joint configurations, specified quality, dimensions and profile	1	2	-	1
PC18. ensure correct work and travel angles, flow rate, travel speed, current, voltage, and slope, and synchronize feed of wire and electrode extensions as required for the job	1	2	-	1
PC19. adjust wire stick-out and machine setup to vary size, location, and penetration of bead	1	1	-	-
PC20. monitor the machine operations in accordance with specifications and job instructions	1	1	-	-
PC21. monitor the process operation and machine functions, and make adjustments as required to welding parameters and mechanisms within their permitted authority and tolerance	-	1	-	-
PC22. remove extra material, slag, spatter etc. by using brush, chipping hammers, hand scraper grinders etc., from the welded component	-	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC23. shut down the welding equipment and remove the component after completion of welding activities	-	1	-	-
Perform post-welding activities	**7**	**13**	**-**	**5**
PC24. check the welded component and ensure that it is meeting the required quality and dimensional accuracy within specified tolerances	1	2	-	1
PC25. identify various weld defects by conducting visual inspection, destructive and non-destructive tests on the work pieces	2	3	-	2
PC26. re-weld the defective joints, using manual welding equipment	1	2	-	-
PC27. store the weldments securely as per requirement by following organizational procedures	1	1	-	1
PC28. clean and store all the tools, machine and equipment after completion of work	1	2	-	1
PC29. dispose scrap or waste material in accordance with the company policies and environmental regulations	-	1	-	-
PC30. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction	1	1	-	-
PC31. report to the supervisor about any problems faced or anticipated during the complete process	-	1	-	-
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	CSC/N0211
NOS Name	Weld joints by Submerged Arc Welding process
Sector	Capital Goods
Sub-Sector	Machine Tools, Textile Manufacturing Machinery, Process Plant Machinery, Electrical and Power Machinery, Light Engineering Goods
Occupation	Welding and Cutting
NSQF Level	4
Credits	4
Version	3.0
Last Reviewed Date	NA
Next Review Date	31/03/2025
NSQC Clearance Date	31/03/2022

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

1. Criteria for assessment for the Qualification Pack will be created by CGSC.

2. Performance Criteria (PC) have been assigned marks proportional to its importance in NOS. SSC will also lay down proportion of marks for Theory and Skills Practical for each PC.

3. The assessment for the theory part will/may be based on knowledge bank of questions approved CGSC.

4. Assessment will be conducted for all compulsory NOS, and where applicable, on the selected elective/option NOS/set of NOS.

5. Assessment Agencies will create Assessor Guides comprising of Theory and Practical Assessment Set and Guidelines for each examination/training centre (as per assessment criteria below). The same will be approved by CGSC for adequacy.

6. To successfully attain Certification on the Qualification Pack, the trainee must score a minimum of 70% in each Core NOS and minimum of 70% in all non-core NOS. In addition, a candidate needs to attain a minimum overall pass percentage of 70% for certification.

7. In case of unsuccessful completion, the trainee may seek reassessment on the Qualification Pack.

Minimum Aggregate Passing % at QP Level : 70

(**Please note**: Every Trainee should score a minimum aggregate passing percentage as specified above, to successfully clear the Qualification Pack assessment.)

Assessment Weightage

Compulsory NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
CSC/N0208.Supervise and perform Manual Metal Arc Welding (MMAW)/ Shielded Metal Arc Welding (SMAW)	30	50	-	20	100	20
CSC/N0201.Manually cut metal and metal alloys using oxy-fuel gases	30	50	-	20	100	20
CSC/N0207.Manually cut metal materials using plasma arc	30	50	-	20	100	20
CSC/N1335.Follow the health and safety practices at the work	30	70	-	-	100	20
CSC/N1336.Coordinate with co-workers to achieve work efficiency	30	70	-	-	100	20
Total	**150**	**290**	**-**	**60**	**500**	**100**

Optional: 1 Optional NOS

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
CSC/N0211.Weld joints by Submerged Arc Welding process	30	50	-	20	100	20

Qualification Pack

National Occupational Standards	Theory Marks	Practical Marks	Project Marks	Viva Marks	Total Marks	Weightage
Total	**30**	**50**	**-**	**20**	**100**	**20**

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
MMAW	Manual Metal Arc Welding
SMAW	Shielded Metal Arc Welding
WPS	Welding Procedure Speciation
IS	Indian Standards
EN	European Standards
ASME	American Society Of Mechanical Engineers
AC / DC	Alternating Current / Direct Current
VT	Visual Testing
NDT	Non-Destructive Testing
DT	Destructive Testing
RT	Radiographic Testing
UT	Ultrasonic Testing
DPT	Dye Penetration Testing
MPT	Magnetic Particle Testing
FPT	Fluorescent Penetrant Testing
CO2	Carbon Dioxide
CPR	Cardiac Pulmonary Resuscitation
ISO	International Organization For Standardization
PQR	Process Qualification Record

Glossary

Sector	Sector is a conglomeration of different business operations having similar business and interests. It may also be defined as a distinct subset of the economy whose components share similar characteristics and interests.
Sub-sector	Sub-sector is derived from a further breakdown based on the characteristics and interests of its components.
Occupation	Occupation is a set of job roles, which perform similar/ related set of functions in an industry.
Job role	Job role defines a unique set of functions that together form a unique employment opportunity in an organisation.
Occupational Standards (OS)	OS specify the standards of performance an individual must achieve when carrying out a function in the workplace, together with the Knowledge and Understanding (KU) they need to meet that standard consistently. Occupational Standards are applicable both in the Indian and global contexts.
Performance Criteria (PC)	Performance Criteria (PC) are statements that together specify the standard of performance required when carrying out a task.
National Occupational Standards (NOS)	NOS are occupational standards which apply uniquely in the Indian context.
Qualifications Pack (QP)	QP comprises the set of OS, together with the educational, training and other criteria required to perform a job role. A QP is assigned a unique qualifications pack code.
Unit Code	Unit code is a unique identifier for an Occupational Standard, which is denoted by an 'N'
Unit Title	Unit title gives a clear overall statement about what the incumbent should be able to do.
Description	Description gives a short summary of the unit content. This would be helpful to anyone searching on a database to verify that this is the appropriate OS they are looking for.
Scope	Scope is a set of statements specifying the range of variables that an individual may have to deal with in carrying out the function which have a critical impact on quality of performance required.

Knowledge and Understanding (KU)	Knowledge and Understanding (KU) are statements which together specify the technical, generic, professional and organisational specific knowledge that an individual needs in order to perform to the required standard.
Organisational Context	Organisational context includes the way the organisation is structured and how it operates, including the extent of operative knowledge managers have of their relevant areas of responsibility.
Technical Knowledge	Technical knowledge is the specific knowledge needed to accomplish specific designated responsibilities.
Core Skills/ Generic Skills (GS)	Core skills or Generic Skills (GS) are a group of skills that are the key to learning and working in today's world. These skills are typically needed in any work environment in today's world. These skills are typically needed in any work environment. In the context of the OS, these include communication related skills that are applicable to most job roles.
Electives	Electives are NOS/set of NOS that are identified by the sector as contributive to specialization in a job role. There may be multiple electives within a QP for each specialized job role. Trainees must select at least one elective for the successful completion of a QP with Electives.
Options	Options are NOS/set of NOS that are identified by the sector as additional skills. There may be multiple options within a QP. It is not mandatory to select any of the options to complete a QP with Options.