Qualification Pack

Metal Fabricator - Iron and Steel

QP Code: ISC/Q0914

Version: 1.0

NSQF Level: 4

Indian Iron & Steel Sector Skill Council || Plot no.B-7, Action Area-III, 5th Floor, Room no.509, Near Hazra Kalibari, Opposite Uni World City, New Town, Kolkata, West Bengal
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Contents

ISC/Q0914: Metal Fabricator - Iron and Steel

Brief Job Description

Perform manual fabrication operations for Steel like material cutting using oxy fuel gas cutting, welding using multiple welding processes like SMAW, Tungsten Inert Arc Welding (GTAW) and Metal Inert Gas Welding for welding joints in all positions as per Welding Procedure Specification.

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. ISC/N0008: Use basic health and safety practices at the workplace
2. ISC/N0009: Work effectively with others
3. ISC/N0910: Perform oxy-gas cutting and post-cutting operations
4. ISC/N0943: Perform Arc welding and post-welding operations
5. ISC/N0911: Perform GTAW welding and post-welding operations
6. ISC/N0944: Perform MIG welding and post-welding operations
7. DGT/VSQ/N0102: Employability Skills (60 Hours)

Qualification Pack (QP) Parameters

Sector	Iron and Steel
Sub-Sector	Iron Making, Sponge Iron, Re-Rollers
Occupation	Mechanical Maintenance
Country	India
NSQF Level	4
Credits	16

Aligned to NCO/ISCO/ISIC Code	NCO-2015/NIL
Minimum Educational Qualification & Experience	11th grade pass OR 10th grade pass plus 1-year NTC/ NAC OR 8th grade pass plus 2-year NTC plus 1 Year NAC OR Basic Literacy and Numeracy (Previous relevant Qualification of NSQF Level 3.0 with minimum education as 5th Grade pass with 2 years of experience in relevant field) OR 10th grade pass and pursuing continuous schooling (2 years of experience in relevant field OR)
Minimum Level of Education for Training in School	Not Applicable
Pre-Requisite License or Training	NA
Minimum Job Entry Age	18 Years
Last Reviewed On	NA
Next Review Date	NA
NSQC Approval Date	
Version	1.0

ISC/N0008: Use basic health and safety practices at the workplace

Description

This OS unit is about following safety and adopting sustainable practices for optimising use of resources.

Scope

The scope covers the following :

- Maintain safe and secure working environment
- Emergencies, rescue and first aid procedures
- Health and hygiene
- Housekeeping and waste management
- Material and energy conservation

Elements and Performance Criteria

Maintain safe and secure working environment

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

PC1. identify hazardous activities and the possible causes of risks or accidents in the workplace

PC2. follow safe working practices while dealing with hazards to ensure safety of self and others

PC3. use appropriate protective clothing/equipment for specific tasks and work

PC4. follow appropriate safety practices while working in and around trenches, elevated places and confined areas

PC5. lift heavy objects safely using correct procedures

PC6. carry out routine check of the machine for identifying potential hazards

PC7. report any identified breaches in health, safety and security policies and procedures to the designated person

Emergencies, rescue and first aid procedures

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

PC8. use appropriate type of fire extinguisher

PC9. apply appropriate rescue techniques during fire hazard

PC10. provide appropriate first aid procedure to victims wherever required eg.in case of bleeding, burns, choking, electric shock etc.

PC11. follow emergency procedures such as raising alarm, safe evacuation etc.

PC12. attend safety training and fire drills to respond promptly during an emergency

Health and hygiene

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

PC13. follow regular cleaning and disinfection practices at work place using appropriate techniques and materials

PC14. follow hand hygiene practices at work place using appropriate techniques and materials

PC15. report regarding the contagious illness of self or people in close contact

PC16. avoid contact with ill people and self-isolate in a similar situation

Housekeeping and waste management

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

PC17. follow the fundamentals of 5S for housekeeping

PC18. ensure good housekeeping in order to prevent hazards and accidents

PC19. store the material, tools and equipment in the correct location and in good condition

PC20. segregate waste into different categories

PC21. identify recyclable, non-recyclable and hazardous waste

PC22. dispose non-recyclable, recyclable and reusable waste appropriately at identified location

Material and energy conservation

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

PC23. identify ways to optimize usage of material in various tasks/activities/processes

PC24. check for spills/leakages in various tasks/activities/processes

PC25. plug spills/leakages and escalate to appropriate authority if unable to rectify

PC26. check if the equipment/machine is functioning normally before commencing work and rectify wherever required

PC27. ensure electrical equipment and appliances are properly connected and turned off when not in use

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. organisation procedures for health, safety and security, individual role and responsibilities in this context

KU2. the organisation's emergency procedures for different emergency situations and the importance of following the same

KU3. evacuation procedures for workers and visitors

KU4. how and when to report hazards

KU5. potential hazards, risks and threats based on the nature of work

KU6. preventative and remedial actions to be taken in case of exposure to toxic material

KU7. various types of fire extinguisher

KU8. various types of safety signs and their meaning

KU9. appropriate first aid treatment relevant to different condition e.g. bleeding, minor burns, eye injuries etc.

KU10. relevant standards, procedures and policies related to 5S followed in the company

KU11. the various materials used and their storage norms

KU12. efficient utilisation of material and water

KU13. basics of electricity and prevalent energy efficient devices

KU14. common practices of conserving electricity

KU15. categorisation of waste into dry, wet, recyclable, non-recyclable and items of single-use plastics

KU16. usage of different colors of dustbins

KU17. waste management techniques

Generic Skills (GS)

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

GS1. read safety instructions/guidelines
GS2. modify work practices to improve them
GS3. ask for clarifications from superior about the job requirement
GS4. work with supervisors/team members to carry out work related tasks
GS5. complete tasks efficiently and accurately within stipulated time
GS6. inform/report to concerned person in case of any problem
GS7. make timely decisions for efficient utilization of resources
GS8. write reports such as accident report, in at least English/regional language
GS9. be punctual and utilize time efficiently

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Maintain safe and secure working environment	**10**	**14**	**-**	**6**
PC1. identify hazardous activities and the possible causes of risks or accidents in the workplace	2	2	-	1
PC2. follow safe working practices while dealing with hazards to ensure safety of self and others	2	3	-	1
PC3. use appropriate protective clothing/equipment for specific tasks and work	1	2	-	1
PC4. follow appropriate safety practices while working in and around trenches, elevated places and confined areas	2	1	-	-
PC5. lift heavy objects safely using correct procedures	1	2	-	1
PC6. carry out routine check of the machine for identifying potential hazards	1	2	-	1
PC7. report any identified breaches in health, safety and security policies and procedures to the designated person	1	2	-	1
Emergencies, rescue and first aid procedures	**6**	**9**	**-**	**5**
PC8. use appropriate type of fire extinguisher	1	1	-	1
PC9. apply appropriate rescue techniques during fire hazard	1	2	-	1
PC10. provide appropriate first aid procedure to victims wherever required eg.in case of bleeding, burns, choking, electric shock etc.	2	2	-	1
PC11. follow emergency procedures such as raising alarm, safe evacuation etc.	1	2	-	1
PC12. attend safety training and fire drills to respond promptly during an emergency	1	2	-	1
Health and hygiene	**2**	**6**	**-**	**2**
PC13. follow regular cleaning and disinfection practices at work place using appropriate techniques and materials	1	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC14. follow hand hygiene practices at work place using appropriate techniques and materials	1	2	-	1
PC15. report regarding the contagious illness of self or people in close contact	-	1	-	-
PC16. avoid contact with ill people and self-isolate in a similar situation	-	1	-	-
Housekeeping and waste management	**7**	**12**	**-**	**5**
PC17. follow the fundamentals of 5S for housekeeping	2	3	-	2
PC18. ensure good housekeeping in order to prevent hazards and accidents	1	2	-	-
PC19. store the material, tools and equipment in the correct location and in good condition	1	2	-	-
PC20. segregate waste into different categories	1	2	-	1
PC21. identify recyclable, non-recyclable and hazardous waste	1	1	-	1
PC22. dispose non-recyclable, recyclable and reusable waste appropriately at identified location	1	2	-	1
Material and energy conservation	**5**	**9**	**-**	**2**
PC23. identify ways to optimize usage of material in various tasks/activities/processes	1	2	-	-
PC24. check for spills/leakages in various tasks/activities/processes	1	2	-	1
PC25. plug spills/leakages and escalate to appropriate authority if unable to rectify	1	2	-	1
PC26. check if the equipment/machine is functioning normally before commencing work and rectify wherever required	1	2	-	-
PC27. ensure electrical equipment and appliances are properly connected and turned off when not in use	1	1	-	-
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ISC/N0008
NOS Name	Use basic health and safety practices at the workplace
Sector	Iron and Steel
Sub-Sector	Steel, Sponge Iron, Ferro Alloys, Re-Rollers, Refractory
Occupation	Mechanical Maintenance, Raw Material Handling , Product Quality Control, Refractory Maintenance, Furnace Operation, Fitter, Cold Rolling Mill Operations, Electrical Maintenance, Mechanical Maintenance
NSQF Level	3
Credits	TBD
Version	2.0
Last Reviewed Date	NA
Next Review Date	31/03/2025
NSQC Clearance Date	31/03/2022

ISC/N0009: Work effectively with others

Description

This OS unit is about communicating with colleagues/superiors and others, either in own work group or in other work groups within organisation.

Scope

The scope covers the following :

- Communicate effectively with colleagues and others
- Interact with supervisor
- Follow appropriate behaviour at work place

Elements and Performance Criteria

Communicate effectively with colleagues and others

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

PC1. coordinate with colleagues to share work, as per the workload in order to achieve team goals

PC2. maintain clear communication with colleagues and others, wherever needed, through all means i.e. face-to-face, telephonic or written

PC3. adjust communication styles to reflect gender and persons with disability (PwD) sensitivity

PC4. respect all colleagues and co-workers

PC5. resolve conflicts by communicating with colleagues and other departments

Interact with supervisor

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

PC6. identify work requirements by receiving instructions from reporting supervisor

PC7. escalate problems to supervisors that cannot be handled

PC8. report the completed work

PC9. interact with the reporting supervisor about any possible hazards and safety concerns

Follow appropriate behaviour at work place

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

PC10. extend help to people with Disability (PwD) at workplace, if required

PC11. empathize with people with disability

PC12. adopt a gender neutral behavior

PC13. adopt responsible and disciplined behaviours at the workplace

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the importance of effective communication and establishing good working relationships with colleagues and supervisor

KU2. different methods of communication as per the circumstances

KU3. importance of teamwork in organization and individual success
KU4. various components of effective communication
KU5. barriers to effective communication
KU6. common reasons for interpersonal conflict
KU7. what constitutes disciplined behaviour for a working professional
KU8. gender concepts, issues & legislation
KU9. organisational policies and procedures related to gender equality
KU10. challenges faced by PWD and the ways to help them overcome the same

Generic Skills (GS)

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

GS1. read instructions/guidelines/procedures
GS2. listen effectively and orally communicate information
GS3. ask for clarification and advice from the concerned person
GS4. maintain positive and effective relationships with colleagues
GS5. evaluate the possible solution(s) to the problem
GS6. spot and communicate potential areas of disruptions in the work process and report the same
GS7. complete written work with attention to detail
GS8. check that the work meets customer requirements

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Communicate effectively with colleagues and others	**13**	**20**	**-**	**9**
PC1. coordinate with colleagues to share work, as per the workload in order to achieve team goals	3	5	-	2
PC2. maintain clear communication with colleagues and others, wherever needed, through all means i.e. face-to-face, telephonic or written	5	7	-	3
PC3. adjust communication styles to reflect gender and persons with disability (PwD) sensitivity	3	4	-	2
PC4. respect all colleagues and co-workers	1	2	-	1
PC5. resolve conflicts by communicating with colleagues and other departments	1	2	-	1
Interact with supervisor	**8**	**14**	**-**	**6**
PC6. identify work requirements by receiving instructions from reporting supervisor	2	3	-	1
PC7. escalate problems to supervisors that cannot be handled	2	3	-	2
PC8. report the completed work	2	3	-	1
PC9. interact with the reporting supervisor about any possible hazards and safety concerns	2	5	-	2
Follow appropriate behaviour at work place	**9**	**16**	**-**	**5**
PC10. extend help to people with Disability (PwD) at workplace, if required	2	4	-	2
PC11. empathize with people with disability	2	4	-	1
PC12. adopt a gender neutral behavior	2	4	-	1
PC13. adopt responsible and disciplined behaviours at the workplace	3	4	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ISC/N0009
NOS Name	Work effectively with others
Sector	Iron and Steel
Sub-Sector	Steel, Sponge Iron, Ferro Alloys, Re-Rollers, Refractory
Occupation	Mechanical Maintenance, Raw Material Handling , Product Quality Control, Refractory Maintenance, Furnace Operation, Fitter, Operations, Coke Making, Mechanical Maintenance
NSQF Level	3
Credits	TBD
Version	2.0
Last Reviewed Date	NA
Next Review Date	31/03/2025
NSQC Clearance Date	31/03/2022

ISC/N0910: Perform oxy-gas cutting and post-cutting operations

Description

This NOS unit is about performing all 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 :

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

Elements and Performance Criteria

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

PC7. ensure that a flashback arrestor is fitted with the apparatus

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

PC9. adjust torch valve for type of flame such as neutral, carburizing and oxidizing

PC10. 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:

PC11. start the gas cutting machine for cutting operations

PC12. adjust cylinder valves and regulator for operating pressure to achieve required specifications

PC13. perform oxy-gas cutting process as per SOP and produce items/cut shapes to the dimensions and profiles specified in WPS and drawing

PC14. perform various cutting operations correctly and produce thermal cuts in various forms of material (metal of 3mm and above)

PC15. recognize and correct burn-back and flashback

PC16. measure the final workpiece and compare with the dimensions as prescribed in the WPS and engineering drawing

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 and maintain records of each category

PC20. tag and store the right quality pieces by following organisational policies and procedures

PC21. clean and store all the tools, machine and equipment after completion of work

PC22. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction

PC23. remove chips from different machine areas and dispose scrap or waste material in accordance with the company policies and environmental regulations

PC24. 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 standards and procedures followed in the company

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. 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

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

KU14. effects of oil, grease, scale or dirt on the cutting process

KU15. emergency procedures for backfires, flashback and other fires

KU16. safety requirements during the cutting work

Generic Skills (GS)

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

GS1. read signals, work instructions, equipment manuals and process documents
GS2. communicate the process requirements to the supervisor and co-workers
GS3. attentively listen and comprehend the information given by the supervisor/team members
GS4. write 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 organise work according to the work requirements
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
Preparing for cutting operations	**13**	**19**	**-**	**10**
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 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	-	2
PC4. select the correct type of nozzle, consumables, gases and oxy-gas 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	1	2	-	1
PC6. set the oxy-gas cutting apparatus and its parameters as per the WPS and SOP	1	2	-	1
PC7. ensure that a flashback arrestor is fitted with the apparatus	1	-	-	1
PC8. use correct technique for lighting, adjusting and extinguishing the arc	1	2	-	1
PC9. adjust torch valve for type of flame such as neutral, carburizing and oxidizing	1	2	-	-
PC10. 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	**8**	**15**	**-**	**6**
PC11. start the gas cutting machine for cutting operations	1	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. adjust cylinder valves and regulator for operating pressure to achieve required specifications	1	2	-	1
PC13. 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
PC14. perform various cutting operations correctly and produce thermal cuts in various forms of material (metal of 3mm and above)	2	4	-	2
PC15. recognize and correct burn-back and flashback	1	1	-	1
PC16. measure the final workpiece and compare with the dimensions as prescribed in the WPS and engineering drawing	1	2	-	-
Perform post-cutting operations	**9**	**16**	**-**	**4**
PC17. check the work pieces as per the work instructions for product quality	2	3	-	1
PC18. identify defects in the completed workpiece by using appropriate methods and equipment	1	2	-	1
PC19. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair and maintain records of each category	1	2	-	-
PC20. tag and store the right quality pieces by following organisational policies and procedures	1	2	-	-
PC21. clean and store all the tools, machine and equipment after completion of work	1	2	-	1
PC22. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction	1	2	-	1
PC23. remove chips from different machine areas and dispose scrap or waste material in accordance with the company policies and environmental regulations	1	2	-	-
PC24. report to the supervisor about any problems faced or anticipated during the complete process	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
NOS Total	**30**	**50**	**-**	**20**

National Occupational Standards (NOS) Parameters

NOS Code	ISC/N0910
NOS Name	Perform oxy-gas cutting and post-cutting operations
Sector	Iron and Steel
Sub-Sector	Steel, Sponge Iron, Ferro Alloys, Re-Rollers, Refractory
Occupation	Iron Making
NSQF Level	4
Credits	TBD
Version	2.0
Last Reviewed Date	NA
Next Review Date	31/03/2025
NSQC Clearance Date	31/03/2022

ISC/N0943: Perform Arc welding and post-welding operations

Description

This unit is about performing Arc welding, manual metal arc welding (MMAW) for producing various types of joints on steel and alloy steels as per the given specifications and standards specified by the organisation.

Scope

The scope covers the following :

- Prepare for welding operations
- Perform Arc/ MMAW/SMAW operations
- Perform 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. identify the tools, welding machines, measuring instruments, accessories, consumables and input materials (i.e. carbon, low alloy steel etc.) 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. electrode, filler wire, shielding gas etc. as per the SOP and job requirements

PC4. check the input material, tools and equipment for any defects and that they are as per the required quality standards

PC5. prepare the work area for the welding activities

PC6. prepare the materials (i.e. plate(1.5 - 24mm)/ sheet (1.5mm)) and joint for welding process

PC7. set the MMAW machine and its parameters as per the WPS and SOP

PC8. re-dry electrodes as per electrode classification requirement

PC9. install the work pieces and fixture on the apparatus and align them with the electrodes as per the job requirements

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

Perform MMAW/SMAW operations

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

PC11. follow safety precautions during welding work as per SOP and organizational guidelines

PC12. start the MMAW machine for welding operations

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

PC14. perform MMAW welding process as per SOP and tack weld the joint at appropriate intervals to produce joints of the specified quality, dimensions and profile

PC15. produce fillet and grove joints in 1F/1G, 2F/2G and 3F/ 3G welding positions as specified in WPS by using single or multi-run welds

PC16. ensure correct angle of torch, travel speed, direction of weld and feed during the welding operation

PC17. maintain proper bead sequence with respect to groove/fillet configurations and positions

PC18. monitor 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

PC19. measure the final welded piece and compare with the dimensional and geometrical aspects of the weld as prescribed in the WPS and engineering drawing

PC20. remove extra material, slag etc. by using brush, chipping hammers, grinders etc., from the welded piece

PC21. hammer the work piece to get the desired shape, if there are any welding bulges/distortions

PC22. shut down the welding equipment and remove the workpiece after completion of welding activities

Perform post-welding operations

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

PC23. check the work pieces as per the work instructions for product quality

PC24. identify various weld defects by conducting visual inspection, destructive and non-destructive tests on the work pieces

PC25. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair

PC26. clean and store all the tools, machine and equipment after completion of work

PC27. dispose scrap or waste material in accordance with the company policies and environmental regulations

PC28. 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 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 color 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 & alignment)

KU12. impact 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

KU13. welding techniques i.e. drag, weave, whip

KU14. various materials used for MMAW welding and their properties

KU15. SOP recommended by the organisation for operating MMAW welding machine and its accessories

KU16. purpose and importance of pre-heating requirements for base metals

KU17. • 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)

KU18. • types of beads, characteristics and uses (stringer, weave, weave patterns)
• Bead characteristics: spatter deposits, roughness, evenness, fill, crater, overlap

KU19. SOP recommended by the organisation for checking irregularities in the product/work piece

KU20. • 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).

KU21. • 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

KU22. how to control distortion (such as welding sequence deposition technique)

KU23. magnetic arc blow or arc deflection, causes and methods to avoid or compensate

KU24. various testing techniques like visual, destructive and non-destructive

KU25. common welder testing codes i.e. ASME section IX, EN 287, ISO 9606, IS 7310 and their purpose

KU26. 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	**13**	**20**	**-**	**7**
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. identify the tools, welding machines, measuring instruments, accessories, consumables and input materials (i.e. carbon, low alloy steel etc.) 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. electrode, filler wire, shielding gas etc. as per the SOP and job requirements	2	3	-	1
PC4. check the input material, tools and equipment for any defects and that they are as per the required quality standards	2	3	-	1
PC5. prepare the work area for the welding activities	1	2	-	-
PC6. prepare the materials (i.e. plate(1.5 - 24mm)/ sheet (1.5mm)) and joint for welding process	1	2	-	1
PC7. set the MMAW machine and its parameters as per the WPS and SOP	1	2	-	1
PC8. re-dry electrodes as per electrode classification requirement	1	1	-	-
PC9. install the work pieces and fixture on the apparatus and align them with the electrodes as per the job requirements	1	2	-	-
PC10. verify set up by running test weld specimen (scrap plate)	-	1	-	-
Perform MMAW/SMAW operations	**11**	**20**	**-**	**8**
PC11. follow safety precautions during welding work as per SOP and organizational guidelines	-	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. start the MMAW machine for welding operations	1	2	-	-
PC13. strike and maintain a stable arc by applying correct technique (i.e. scratch start, tapping techniques) and to avoid welding defects	1	2	-	1
PC14. perform MMAW welding process as per SOP and tack weld the joint at appropriate intervals to produce joints of the specified quality, dimensions and profile	2	4	-	2
PC15. produce fillet and grove joints in 1F/1G, 2F/2G and 3F/ 3G welding positions as specified in WPS by using single or multi-run welds	2	4	-	2
PC16. ensure correct angle of torch, travel speed, direction of weld and feed during the welding operation	1	1	-	1
PC17. maintain proper bead sequence with respect to groove/fillet configurations and positions	-	1	-	-
PC18. monitor 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
PC19. measure the final welded piece and compare with the dimensional and geometrical aspects of the weld as prescribed in the WPS and engineering drawing	1	1	-	1
PC20. remove extra material, slag etc. by using brush, chipping hammers, grinders etc., from the welded piece	1	1	-	-
PC21. hammer the work piece to get the desired shape, if there are any welding bulges/distortions	1	1	-	-
PC22. shut down the welding equipment and remove the workpiece after completion of welding activities	-	1	-	-
Perform post-welding operations	**6**	**10**	**-**	**5**
PC23. check the work pieces as per the work instructions for product quality	1	2	-	1

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC24. identify various weld defects by conducting visual inspection, destructive and non-destructive tests on the work pieces	2	3	-	2
PC25. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair	1	1	-	1
PC26. clean and store all the tools, machine and equipment after completion of work	1	2	-	1
PC27. dispose scrap or waste material in accordance with the company policies and environmental regulations	1	1	-	-
PC28. 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	ISC/N0943
NOS Name	Perform Arc welding and post-welding operations
Sector	Iron and Steel
Sub-Sector	Iron Making, Sponge Iron, Re-Rollers
Occupation	Mechanical Maintenance
NSQF Level	4
Credits	2
Version	1.0
Next Review Date	NA

ISC/N0911: Perform GTAW welding and post-welding operations

Description

This NOS unit is about performing all GTAW welding and post-welding operations as per the given work order and the standards specified by the organization.

Scope

The scope covers the following :

- Preparing for welding operations
- Perform GTAW welding operations
- Perform post-welding operations

Elements and Performance Criteria

Preparing 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 engineering drawing, Welding Procedure Specification (WPS) and job orders

PC2. identify the tools, welding machines, measuring instruments, accessories, consumables and input materials as per the requirements mentioned in WPS or drawing

PC3. select and arrange the right material, equipment, fixtures, accessories such as welding torch and consumables such as electrode, filler wire, shielding gas etc. as per the SOP and job requirements

PC4. check the input material, tools and equipment for any defects and that they are as per the required quality standards

PC5. plan the welding activities before starting the actual process as per WPS

PC6. set the GTAW welding machine and its parameters as per the WPS and SOP

PC7. prepare the materials and joint for welding process

PC8. install the work pieces and fixture on the apparatus and align them with the electrodes as per the job requirements

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

PC10. set pre-purge with shielding gas as required

PC11. prepare tungsten electrode by sharpening or balling to desired tip shape

Perform GTAW welding operations

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

PC12. start the GTAW welding machine for welding operations

PC13. use correct technique for starting the arc

PC14. perform GTAW welding process as per SOP and tack weld the joint at appropriate intervals

PC15. ensure correct angle of torch and filler wire, direction of weld and feed and travel speed during the welding operation

PC16. monitor 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

PC17. produce joints of the specified dimensional accuracy and required weld quality which is equivalent to level B of ISO 5817

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

PC19. remove extra material by using chipping hammers, grinders etc., from the welded piece

PC20. hammer the work piece to get the desired shape, if there are any welding bulges/distortions

Perform post-welding operations

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

PC21. check the work pieces as per the work instructions for product quality

PC22. conduct destructive and non-destructive tests on the work pieces

PC23. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair and maintain records of each category

PC24. tag and store the right quality pieces by following organisational policies and procedures

PC25. clean and store all the tools, machine and equipment after completion of work

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

PC27. remove chips from different machine areas and dispose scrap or waste material in accordance with the company policies and environmental regulations

PC28. 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 standards and procedures followed in the company

KU2. the basic principle of welding process

KU3. TIG 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, single j (for higher thickness), double j)

KU5. different 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, Pipe to Pipe 5G, Pipe welding at inclined position 6G)

KU6. how to read and interpret WPS, welding drawings and symbols

KU7. welding specific equipment requirements for TIG welding i.e. transformers, rectifiers, generators, invertors, tungsten electrodes, filler wire, shielding gas, holders, cables, welding torch and accessories, power saw, angle, pedestal and straight grinders, tong tester, etc.

KU8. SOP recommended by the manufacturer for using tools, measuring instruments, accessories, TIG welding machine etc. during the welding process

KU9. main components and controls of welding equipment

KU10. type of current used and implication

KU11. ISO colour codes for welding apparatus such as gas cylinder, hoses, electric cables, etc.

KU12. impact 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

KU13. various materials used for TIG welding and their properties

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. pre- and post-flow purge and its importance

KU16. importance and application of back purging

KU17. reasons for using shielding gases, and the types and application of the various gases

KU18. impact of shielding gas composition and purity on welding quality

KU19. SOP recommended by the organisation for checking irregularities in the product/work piece

KU20. factors that affect weld quality standards

KU21. various defects associated with the TIG welding process

KU22. various testing techniques like visual, destructive and non-destructive

KU23. how to control distortion (such as welding sequence, deposition technique)

KU24. safety requirements during the welding work

Generic Skills (GS)

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

GS1. read work instructions, equipment manuals and process documents

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

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

GS4. write 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 organise work according to the work requirements

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
Preparing for welding operations	**12**	**17**	**-**	**11**
PC1. identify the work to be done and product specifications by interpreting the engineering drawing, Welding Procedure Specification (WPS) and job orders	1	2	-	1
PC2. identify the tools, welding machines, measuring instruments, accessories, consumables and input 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 welding torch and consumables such as electrode, filler wire, shielding gas etc. as per the SOP and job requirements	1	2	-	2
PC4. check the input material, tools and equipment for any defects and that they are as per the required quality standards	1	2	-	1
PC5. plan the welding activities before starting the actual process as per WPS	-	1	-	-
PC6. set the GTAW welding machine and its parameters as per the WPS and SOP	1	2	-	1
PC7. prepare the materials and joint for welding process	1	1	-	1
PC8. install the work pieces and fixture on the apparatus and align them with the electrodes as per the job requirements	1	1	-	1
PC9. ensure that electrodes distance, contact area, pressure, application etc. are maintained as specified in Work Instructions (WI)	1	1	-	-
PC10. set pre-purge with shielding gas as required	1	1	-	1
PC11. prepare tungsten electrode by sharpening or balling to desired tip shape	1	2	-	1
Perform GTAW welding operations	**9**	**16**	**-**	**5**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. start the GTAW welding machine for welding operations	1	1	-	-
PC13. use correct technique for starting the arc	1	1	-	1
PC14. perform GTAW welding process as per SOP and tack weld the joint at appropriate intervals	2	4	-	1
PC15. ensure correct angle of torch and filler wire, direction of weld and feed and travel speed during the welding operation	1	1	-	1
PC16. monitor 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	2	-	-
PC17. produce joints of the specified dimensional accuracy and required weld quality which is equivalent to level B of ISO 5817	1	1	-	1
PC18. measure the final welded piece and compare with the dimensions as prescribed in the WPS and engineering drawing	1	2	-	1
PC19. remove extra material by using chipping hammers, grinders etc., from the welded piece	1	2	-	-
PC20. hammer the work piece to get the desired shape, if there are any welding bulges/distortions	-	2	-	-
Perform post-welding operations	**9**	**17**	**-**	**4**
PC21. check the work pieces as per the work instructions for product quality	2	3	-	1
PC22. conduct destructive and non-destructive tests on the work pieces	2	4	-	2
PC23. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair and maintain records of each category	1	2	-	-
PC24. tag and store the right quality pieces by following organisational policies and procedures	1	2	-	1
PC25. clean and store all the tools, machine and equipment after completion of work	1	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC26. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction	1	2	-	-
PC27. remove chips from different machine areas and dispose scrap or waste material in accordance with the company policies and environmental regulations	1	1	-	-
PC28. 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	ISC/N0911
NOS Name	Perform GTAW welding and post-welding operations
Sector	Iron and Steel
Sub-Sector	Steel, Sponge Iron, Ferro Alloys, Re-Rollers, Refractory, Mechanical Maintenance, Iron Making
Occupation	Mechanical Maintenance
NSQF Level	4
Credits	TBD
Version	2.0
Last Reviewed Date	NA
Next Review Date	31/03/2025
NSQC Clearance Date	31/03/2022

ISC/N0944: Perform MIG welding and post-welding operations

Description

This unit is about performing MIG/MAG welding for producing various types of joints on metal and metal alloys as per the given specifications and standards specified by the organisation.

Scope

The scope covers the following :

- Prepare for welding operations
- Perform MIG/MAG welding operations
- Perform 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. identify the tools, MIG welding machines, measuring instruments, accessories, consumables and input materials (i.e. ferrous metals/materials: carbon steel, stainless steel etc.) 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. electrode, filler wire, shielding gas etc. as per the SOP and job requirements

PC4. check the input material, tools and equipment for any defects and that they are as per the required quality standards

PC5. prepare the work area for welding activities

PC6. prepare the materials (i.e. sheet (less than 1.5 mm), plate, structural section, pipe/tube, other forms) and joint for welding process

PC7. clean wire feeder and torch tip

PC8. set the MIG welding machine and its parameters i.e. wire feed rate, amperage, gas flow rate etc. as per the WPS and SOP

PC9. connect and adjust regulators and flow meters to cylinders

PC10. choose appropriate mode of metal transfer

PC11. set pre-purge with shielding gas as required

PC12. install the work pieces and fixture on the apparatus and align them with the electrodes as per the job requirements

PC13. verify set up by running test weld on the specimen (scrap plate)

Perform MIG/MAG welding operations

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

PC14. follow safety precautions during welding work as per SOP and organizational guidelines

PC15. start the MIG welding machine for welding operations

PC16. perform MIG welding process in all welding positions as per SOP and tack weld the joint at appropriate intervals to produce joints of the specified quality, dimensions and profile

PC17. adjust wire stick-out as per requirement

PC18. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to Level C of ISO 5817

PC19. ensure correct angle of torch, travel speed, direction of weld and feed during the welding operation

PC20. monitor 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. measure the final welded piece and compare with the dimensions as prescribed in the WPS and engineering drawing

PC22. remove extra material, slag etc. by using brush, chipping hammers, grinders etc., from the welded piece

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

Perform post-welding operations

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

PC24. check the work pieces as per the work instructions for product quality

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

PC26. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair

PC27. clean and store all the tools, machine and equipment after completion of work

PC28. dispose scrap or waste material in accordance with the company policies and environmental regulations

PC29. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction

PC30. 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. MIG welding and its process flow

KU3. various types of welding joints i.e. fillet lap joints, tee fillet joints, corner joints, butt joints (square, single, vee, double vee)

KU4. various welding positions

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

KU6. welding specific equipment requirements for MIG/MAG welding

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

KU10. joint preparation process

KU11. impact 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. relationship between wire feed, speed control and welding current

KU13. MIG/MAG welding technique: e.g. fine adjustment of parameters, correct manipulation of the torch, blending in stops/starts, tack welds, angle of the torch, setting of individual parameters like wire feed speed, voltage, gas flow rate, stick-out, etc. various materials used for MMAW welding and their properties

KU14. • SOP recommended by the organisation for operating MIG welding machine and its
• accessories

KU15. current and polarity required for GMAW

KU16. types, selection and application of filler wires and welding electrodes

KU17. reasons for using shielding gases, and the types and application of the various gases

KU18. • use, impact and importance of gas pressures and flow rates (in relationship to the type of material being welded)
• Types of ferrous metals/materials: carbon steel, stainless steel

KU19. • methods/modes of metal transfer and their uses
• Methods: globular, short circuit transfer, spray arc, pulse, surface tension transfer (STT)

KU20. purpose and correct use of anti-spatter compound

KU21. importance and procedure to clean torch tip and liner

KU22. • factors that determine weld bead shape
• Factors: gun angles and weld bead profiles (push, perpendicular, drag); electrode extensions stick out (short, normal, long); fillet weld electrode extension stick out (short, normal, long); gun travel speed (slow, normal, fast); current and voltage

KU23. • types of beads, characteristics and uses (stringer, weave, weave patterns)
• Bead characteristics: spatter deposits, roughness, evenness, fill, crater, overlap

KU24. • weld bead quality characteristics
• Bead characteristics spatter deposits, roughness, evenness, fill, crater, overlap, contour - convex, concave, mitre

KU25. SOP recommended by the organisation for checking irregularities in the product/work piece

KU26. factors that affect weld quality standards

KU27. various defects associated with the MIG welding process

KU28. how to control distortion (such as welding sequence, deposition technique)

KU29. various testing techniques like visual, destructive and non-destructive KU30. 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	**15**	**21**	**-**	**7**
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. identify the tools, MIG welding machines, measuring instruments, accessories, consumables and input materials (i.e. ferrous metals/materials: carbon steel, stainless steel etc.) as per the requirements mentioned in WPS or drawing	3	2	-	1
PC3. select and arrange the right material, equipment, fixtures, accessories, welding torch and consumables i.e. electrode, filler wire, shielding gas etc. as per the SOP and job requirements	2	3	-	1
PC4. check the input material, tools and equipment for any defects and that they are as per the required quality standards	2	3	-	1
PC5. prepare the work area for welding activities	1	1	-	-
PC6. prepare the materials (i.e. sheet (less than 1.5 mm), plate, structural section, pipe/tube, other forms) and joint for welding process	1	1	-	1
PC7. clean wire feeder and torch tip	-	1	-	-
PC8. set the MIG welding machine and its parameters i.e. wire feed rate, amperage, gas flow rate etc. as per the WPS and SOP	1	2	-	1
PC9. connect and adjust regulators and flow meters to cylinders	1	1	-	-
PC10. choose appropriate mode of metal transfer	1	1	-	-
PC11. set pre-purge with shielding gas as required	1	1	-	1
PC12. install the work pieces and fixture on the apparatus and align them with the electrodes as per the job requirements	1	2	-	-
PC13. verify set up by running test weld on the specimen (scrap plate)	-	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Perform MIG/MAG welding operations	**8**	**17**	**-**	**8**
PC14. follow safety precautions during welding work as per SOP and organizational guidelines	-	1	-	-
PC15. start the MIG welding machine for welding operations	1	2	-	-
PC16. perform MIG welding process in all welding positions as per SOP and tack weld the joint at appropriate intervals to produce joints of the specified quality, dimensions and profile	2	4	-	2
PC17. adjust wire stick-out as per requirement	1	1	-	1
PC18. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to Level C of ISO 5817	1	4	-	2
PC19. ensure correct angle of torch, travel speed, direction of weld and feed during the welding operation	1	1	-	1
PC20. monitor 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. measure the final welded piece and compare with the dimensions as prescribed in the WPS and engineering drawing	1	1	-	1
PC22. remove extra material, slag etc. by using brush, chipping hammers, grinders etc., from the welded piece	-	1	-	-
PC23. shut down the welding equipment and remove the workpiece after completion of welding activities	-	1	-	-
Perform post-welding operations	**7**	**12**	**-**	**5**
PC24. check the work pieces as per the work instructions for product quality	1	2	-	1
PC25. identify various weld defects by conducting visual inspection, destructive and non-destructive tests on the work pieces	2	3	-	2

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC26. separate the defective pieces which can be repaired/ reworked and pieces which are beyond repair	1	1	-	1
PC27. clean and store all the tools, machine and equipment after completion of work	1	2	-	1
PC28. dispose scrap or waste material in accordance with the company policies and environmental regulations	1	1	-	-
PC29. check the machine operations for any malfunctions/defects in the component and immediately inform the supervisor/maintenance team for correction	1	2	-	-
PC30. 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	ISC/N0944
NOS Name	Perform MIG welding and post-welding operations
Sector	Iron and Steel
Sub-Sector	Iron Making, Sponge Iron, Re-Rollers
Occupation	Mechanical Maintenance
NSQF Level	4
Credits	3
Version	1.0
Next Review Date	NA

DGT/VSQ/N0102: Employability Skills (60 Hours)

Description

This unit is about employability skills, Constitutional values, becoming a professional in the 21st Century, digital, financial, and legal literacy, diversity and Inclusion, English and communication skills, customer service, entrepreneurship, and apprenticeship, getting ready for jobs and career development.

Scope

The scope covers the following :

- Introduction to Employability Skills
- Constitutional values - Citizenship
- Becoming a Professional in the 21st Century
- Basic English Skills
- Career Development & Goal Setting
- Communication Skills
- Diversity & Inclusion
- Financial and Legal Literacy
- Essential Digital Skills
- Entrepreneurship
- Customer Service
- Getting ready for Apprenticeship & Jobs

Elements and Performance Criteria

Introduction to Employability Skills

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

PC1. identify employability skills required for jobs in various industries

PC2. identify and explore learning and employability portals

Constitutional values – Citizenship

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

PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.

PC4. follow environmentally sustainable practices

Becoming a Professional in the 21st Century

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

PC5. recognize the significance of 21st Century Skills for employment

PC6. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life

Basic English Skills

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

PC7. use basic English for everyday conversation in different contexts, in person and over the telephone

PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English

PC9. write short messages, notes, letters, e-mails etc. in English

Career Development & Goal Setting

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

PC10. understand the difference between job and career

PC11. prepare a career development plan with short- and long-term goals, based on aptitude

Communication Skills

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

PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings

PC13. work collaboratively with others in a team

Diversity & Inclusion

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

PC14. communicate and behave appropriately with all genders and PwD

PC15. escalate any issues related to sexual harassment at workplace according to POSH Act

Financial and Legal Literacy

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

PC16. select financial institutions, products and services as per requirement

PC17. carry out offline and online financial transactions, safely and securely

PC18. identify common components of salary and compute income, expenses, taxes, investments etc

PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation

Essential Digital Skills

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

PC20. operate digital devices and carry out basic internet operations securely and safely

PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively

PC22. use basic features of word processor, spreadsheets, and presentations

Entrepreneurship

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

PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research

PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion

PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity

Customer Service

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

PC26. identify different types of customers

PC27. identify and respond to customer requests and needs in a professional manner.

PC28. follow appropriate hygiene and grooming standards

Getting ready for apprenticeship & Jobs

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

PC29. create a professional Curriculum vitae (Résumé)

PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively

PC31. apply to identified job openings using offline /online methods as per requirement

PC32. answer questions politely, with clarity and confidence, during recruitment and selection

PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. need for employability skills and different learning and employability related portals

KU2. various constitutional and personal values

KU3. different environmentally sustainable practices and their importance

KU4. Twenty first (21st) century skills and their importance

KU5. how to use English language for effective verbal (face to face and telephonic) and written communication in formal and informal set up

KU6. importance of career development and setting long- and short-term goals

KU7. about effective communication

KU8. POSH Act

KU9. Gender sensitivity and inclusivity

KU10. different types of financial institutes, products, and services

KU11. how to compute income and expenditure

KU12. importance of maintaining safety and security in offline and online financial transactions

KU13. different legal rights and laws

KU14. different types of digital devices and the procedure to operate them safely and securely

KU15. how to create and operate an e- mail account and use applications such as word processors, spreadsheets etc.

KU16. how to identify business opportunities

KU17. types and needs of customers

KU18. how to apply for a job and prepare for an interview

KU19. apprenticeship scheme and the process of registering on apprenticeship portal

Generic Skills (GS)

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

GS1. read and write different types of documents/instructions/correspondence

GS2. communicate effectively using appropriate language in formal and informal settings

GS3. behave politely and appropriately with all

GS4. how to work in a virtual mode

GS5. perform calculations efficiently
GS6. solve problems effectively
GS7. pay attention to details
GS8. manage time efficiently
GS9. maintain hygiene and sanitization to avoid infection

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Introduction to Employability Skills	**1**	**1**	**-**	**-**
PC1. identify employability skills required for jobs in various industries	-	-	-	-
PC2. identify and explore learning and employability portals	-	-	-	-
Constitutional values – Citizenship	**1**	**1**	**-**	**-**
PC3. recognize the significance of constitutional values, including civic rights and duties, citizenship, responsibility towards society etc. and personal values and ethics such as honesty, integrity, caring and respecting others, etc.	-	-	-	-
PC4. follow environmentally sustainable practices	-	-	-	-
Becoming a Professional in the 21st Century	**2**	**4**	**-**	**-**
PC5. recognize the significance of 21st Century Skills for employment	-	-	-	-
PC6. practice the 21st Century Skills such as Self-Awareness, Behaviour Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn for continuous learning etc. in personal and professional life	-	-	-	-
Basic English Skills	**2**	**3**	**-**	**-**
PC7. use basic English for everyday conversation in different contexts, in person and over the telephone	-	-	-	-
PC8. read and understand routine information, notes, instructions, mails, letters etc. written in English	-	-	-	-
PC9. write short messages, notes, letters, e-mails etc. in English	-	-	-	-
Career Development & Goal Setting	**1**	**2**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC10. understand the difference between job and career	-	-	-	-
PC11. prepare a career development plan with short- and long-term goals, based on aptitude	-	-	-	-
Communication Skills	**2**	**2**	**-**	**-**
PC12. follow verbal and non-verbal communication etiquette and active listening techniques in various settings	-	-	-	-
PC13. work collaboratively with others in a team	-	-	-	-
Diversity & Inclusion	**1**	**2**	**-**	**-**
PC14. communicate and behave appropriately with all genders and PwD	-	-	-	-
PC15. escalate any issues related to sexual harassment at workplace according to POSH Act	-	-	-	-
Financial and Legal Literacy	**2**	**3**	**-**	**-**
PC16. select financial institutions, products and services as per requirement	-	-	-	-
PC17. carry out offline and online financial transactions, safely and securely	-	-	-	-
PC18. identify common components of salary and compute income, expenses, taxes, investments etc	-	-	-	-
PC19. identify relevant rights and laws and use legal aids to fight against legal exploitation	-	-	-	-
Essential Digital Skills	**3**	**4**	**-**	**-**
PC20. operate digital devices and carry out basic internet operations securely and safely	-	-	-	-
PC21. use e- mail and social media platforms and virtual collaboration tools to work effectively	-	-	-	-
PC22. use basic features of word processor, spreadsheets, and presentations	-	-	-	-
Entrepreneurship	**2**	**3**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC23. identify different types of Entrepreneurship and Enterprises and assess opportunities for potential business through research	-	-	-	-
PC24. develop a business plan and a work model, considering the 4Ps of Marketing Product, Price, Place and Promotion	-	-	-	-
PC25. identify sources of funding, anticipate, and mitigate any financial/ legal hurdles for the potential business opportunity	-	-	-	-
Customer Service	**1**	**2**	**-**	**-**
PC26. identify different types of customers	-	-	-	-
PC27. identify and respond to customer requests and needs in a professional manner.	-	-	-	-
PC28. follow appropriate hygiene and grooming standards	-	-	-	-
Getting ready for apprenticeship & Jobs	**2**	**3**	**-**	**-**
PC29. create a professional Curriculum vitae (Résumé)	-	-	-	-
PC30. search for suitable jobs using reliable offline and online sources such as Employment exchange, recruitment agencies, newspapers etc. and job portals, respectively	-	-	-	-
PC31. apply to identified job openings using offline /online methods as per requirement	-	-	-	-
PC32. answer questions politely, with clarity and confidence, during recruitment and selection	-	-	-	-
PC33. identify apprenticeship opportunities and register for it as per guidelines and requirements	-	-	-	-
NOS Total	**20**	**30**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	DGT/VSQ/N0102
NOS Name	Employability Skills (60 Hours)
Sector	Cross Sectoral
Sub-Sector	Professional Skills
Occupation	Employability
NSQF Level	4
Credits	2
Version	1.0
Last Reviewed Date	NA
Next Review Date	17/06/2023
NSQC Clearance Date	17/12/2022

Assessment Guidelines and Assessment Weightage

Assessment Guidelines

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

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 IISSSC.

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 IISSSC 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 50% 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
ISC/N0008.Use basic health and safety practices at the workplace	30	50	-	20	100	10
ISC/N0009.Work effectively with others	30	50	-	20	100	5
ISC/N0910.Perform oxy-gas cutting and post-cutting operations	30	50	-	20	100	20
ISC/N0943.Perform Arc welding and post-welding operations	30	50	0	20	100	20
ISC/N0911.Perform GTAW welding and post-welding operations	30	50	-	20	100	20
ISC/N0944.Perform MIG welding and post-welding operations	30	50	0	20	100	20
DGT/VSQ/N0102.Employability Skills (60 Hours)	20	30	-	-	50	5
Total	**200**	**330**	**0**	**120**	**650**	**100**

Acronyms

NOS	National Occupational Standard(s)
NSQF	National Skills Qualifications Framework
QP	Qualifications Pack
TVET	Technical and Vocational Education and Training
CO2	Carbon Dioxide
CPR	Cardiac Pulmonary Resuscitation
PPE	Personal Protective Equipment

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.