HYDROCARBON SECTOR SKILL COUNCIL

सत्यमेव जयते
GOVERNMENT OF INDIA
MINISTRY OF SKILL DEVELOPMENT
& ENTREPRENEURSHIP

Qualification Pack

N·S·D·C National Skill Development Corporation
Transforming the skill landscape

Industrial Welder (Oil & Gas)

QP Code: HYC/Q9101

Version: 1.0

NSQF Level: 4

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Contents

HYC/Q9101: Industrial Welder (Oil & Gas)

Brief Job Description

Industrial welders (Oil & Gas) perform welding using manual and semi-automatic welding equipment to weld different types of metals together (ferrous/non-ferrous), following drawing and welding process specifications. They are specialised in certain types of welding, such as welding in refinery, aerospace precision welding, manufacturing welding, pipeline, automotive and construction welding.

Personal Attributes

The individual should have a good sense of responsibility, must be alert at all times, ability to work Independently, concentrate on work, all to work as a team and Stress Management Skills.

Applicable National Occupational Standards (NOS)

Compulsory NOS:

1. HYC/N9301: Working effectively in a team
2. HYC/N9302: Maintain health, safety and security procedures
3. HYC/N9101: General work shop practice followed in the shop floor
4. HYC/N9102: Welding using Manual Metal Arc welding/Shielded metal arc welding
5. HYC/N9103: Manually (semi-automatic) welding joints using the MIG/MAG
6. HYC/N9104: Perform Manually welding joints using the TIG (GTAW) Process

Qualification Pack (QP) Parameters

Sector	Hydrocarbon
Sub-Sector	Construction & Services
Occupation	Welding
Country	India
NSQF Level	4
Aligned to NCO/ISCO/ISIC Code	NCO-2015/7212.0303

Minimum Educational Qualification & Experience	10th with 2 year of exp. / or Class 12th ITI (two years after class 10th in engineering trade)
Minimum Level of Education for Training in School	
Pre-Requisite License or Training	Some training on basic machining skill Some training in stress management like yoga is recommended.
Minimum Job Entry Age	18 Years
Last Reviewed On	27/01/2022
Next Review Date	26/01/2025
Deactivation Date	
NSQC Approval Date	27/01/2022
Version	2.0
Reference code on NQR	2017/HYC/HSSCI/01965
NQR Version	2.0

HYC/N9101: General work shop practice followed in the shop floor

Description

The welder can prepare various Fillet and Groove joints and prepare for operations by interpreting the right information. He will be able to understand basic drawing, workshop operation including inspection.

Scope

The unit/ task covers the following:

- Understand the basic Engineering practice
- Mathematical skills with respect to welding
- Knowledge on different types of materials and Heat Treatment
- Fundamentals of Electricity
- Knowledge on basic workshop practice and tools used

Elements and Performance Criteria

Understand the basic Engineering practice

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

PC1. consistently apply and promote health and safety legislation and best practice and work in a safe manner on a worksite

PC2. health and safety legislation and best practice

PC3. the range and uses of trade related equipments

PC4. how to use and operate tools safely

PC5. specific safety issues relating to work involving cutting tools

PC6. the importance of working logically and in a well-organized manner.

PC7. operate trade machinery effectively, safely and in accordance with manufacturers instructions

PC8. select and use appropriate machine tools safely and effectively

Mathematical skills with respect to welding

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

PC9. basic mathematical manipulation and unit conversion

PC10. geometrical principles, techniques and calculations

PC11. understand basic mathematical calculation. units of metric, iso and fps addition subtraction multiplication and division

PC12. select and apply basic calculation of area and volume area of a square, rectangle, triangle and circle volume of a cube, cuboid, cylinder, sphere and hemisphere

PC13. use appropriate mathematical concepts and skills to solve problems in fractions, decimals, percentage and ratio conversion of fraction to decimals conversion of decimals to fractions problems in percentage and ratio and averages

PC14. develop ability to perform basics of algebra and understand simple algebraic equations and problems

PC15. acquire the techniques of solving simple trigonometric problems introduction to sine, cosine and tan functions pythagoras theorem identifies and simple problems.

Knowledge on different types of materials and Heat Treatment

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

PC16. ability to apply knowledge of metals and non-metals

PC17. able to understand the types and characteristics of materials used in the manufacturing industry

PC18. ability to identify ferrous and non-ferrous metals

PC19. ability to integrate steel - properties and applications of the following carbon steels and alloy steels (with reference to welding)

PC20. apply the basic principles of material selection to specific applications stainless steel, non ferrous metal -properties and applications

PC21. highlight the property of different material and their workability.

PC22. explain the differences in properties of different materials, including metals, alloys, ceramics, polymers and composites

PC23. describe the basics of heat treatment principles

PC24. highlight different heat treatment operations, their purpose

PC25. apply and explain the application of stress relieving with reference to welding

Fundamentals of Electricity

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

PC26. understanding written sentences and paragraphs in work related documents.

PC27. primary electrical supply circuit terminology and its operation

PC28. secondary electrical / welding circuit terminology and operation

PC29. knowledge of the practical application of electricity and technology.

PC30. this includes applying principles, techniques, procedures like ac and dc current, single phase circuit and three phase circuit etc

PC31. perform routine maintenance on equipment and determining when and what kind of maintenance is needed. will require you to manage systems and ensure they work smoothly.

PC32. testing existing wiring for safety and quality control. earth connections circuit protective devices

PC33. understanding of work shop safety and welding safety

Knowledge on basic workshop practice and tools used

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

PC34. able to work independently or as part of a team in the following areas

PC35. understand the task required and plan ahead what steps must be taken to achieve the outcome.

PC36. cary out marking on the materials as per the drawing using

PC37. able to do the drilling as per standard specification and methods

PC38. set up and adjust metalworking tools and do threading

PC39. ability to set up and/or operate hand tools

PC40. correctly use and maintain the tools, hammers, spnners and fasteners

PC41. measure and mark materials as per the drawing and check accuracy and quality of finished partsmeasuring / checking instruments steel rule and tape- application, specification and care inside and outside caliper- application, specification and care vernier calliper- application, specification and care micro meter- application, specification and care radius and fillet gauges, use and care weld gauges to verify size of weld. bevel protractor - application, specification and care

PC42. safe operation of equipment and apply occupational health and safety policy and procedures to minimise risk.

PC43. knowledge and ability to use different hand tools and power tools

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. companys policies on: personnel management, duty reporting procedure and associated mis compliance

KU2. legislation, standards, policies, and procedures followed in the company relevant to own employment and performance conditions

KU3. own job role and responsibilities and sources for information pertaining to employment terms, entitlements, job role and responsibilities

KU4. reporting structure within organization and relevant people and their responsibilities within the work area

KU5. problem escalation procedure and escalation matrix for reporting work and employment related issues

KU6. standard operating procedure while working

KU7. relevant health and safety requirements applicable in the work place

KU8. importance of working in clean and safe environment

KU9. documentation and related procedures applicable in the context of employment and work

KU10. importance and purpose of documentation in context of employment and work

KU11. interpretation of drawing as per standard and knowledge of geometric dimensioning and tolerance (gd&t).

KU12. knowledge of making isometric drawing and orthographic projection.

KU13. selection of datum plain and its importance.

KU14. knowledge to establish a proper datum

KU15. to determine limits, fits and tolerance.

KU16. plan sequence of operation applying the knowledge of geometry.

KU17. know the different protective coatings used in pipe and how it protects the pipe and also the care to be taken while handling.

KU18. understand the different thread geometry, types and its application.

KU19. knowledge on different materials and the performance of this material in different application.

KU20. basic knowledge of the property and behaviour of fluids, liquids and gases,

KU21. awareness on basic hydraulic and pneumatic elements and the working

KU22. making of drawing using standard symbols, proper representation and layout.

KU23. application of different cutting fluids used while working on ferrous metals: e.g. carbon steels, stainless steels, cast iron, tool steel, hard metals; non-ferrous metals: e.g. bronze, aluminium, copper and copper alloys

KU24. identify correct orientation of pipe fitting in regard to the flow.

KU25. use of different fasteners for both temporary and permanent fastening.

Generic Skills (GS)

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

GS1. fill in the attendance sheet and the requisite details

GS2. keep abreast by reading about new policies at an organization level

GS3. read and interpret information correctly from various job specification documents, manuals, health and safety instructions, memos, etc. applicable to the job in English and/or local language

GS4. fill up appropriate technical forms, process charts, activity logs as per organizational format in English and/or local language

GS5. execute task, schedules, and work-loads with co-workers and supervisors

GS6. convey and share technical information clearly using appropriate language

GS7. check and clarify task-related information

GS8. liaise with appropriate authorities using correct protocol

GS9. communicate with people in respectful form and manner in line with organizational protocol

GS10. share work load as required

GS11. assist others who require help

GS12. share knowledge with co-workers/assistant.

GS13. Undertake numerical operations, and calculations using calculators

GS14. demonstrate measurement and calculation of Angle, Perimeter, Area of a common geometrical shape and can co-relate with job area requirements

GS15. use appropriate measuring techniques and units of measurement

GS16. use British and metric system of measurement and make conversions between them

GS17. describe the difference between Celsius & Fahrenheit Scale and relationship between them

GS18. use appropriate units and number systems to express degree of accuracy Units and number systems representing degree of accuracy: decimals places, significant figures, fractions as a decimal quantity interpret and express tolerance in terms of limits on dimensions perform

GS19. basic operations in a computer like switching it on/off, using the mouse and keyboard, accessing files, opening, closing, creating and deleting folders, etc.

GS20. use basic office applications like spread sheet, word processor, presentations

GS21. use organizational software specific to quality function

GS22. use email to communicate within the organization as per organization guidelines

GS23. retrieve and enter data using standard system forms and templates take printouts of documents

GS24. participate in on-the-job and other learning, training and development interventions and assessments

GS25. clarify task related information with appropriate personnel or technical adviser
GS26. seek to improve and modify own work practices
GS27. maintain current knowledge of application standards, legislation, codes of practice and product/process developments
GS28. identify problems with work planning, procedures, output and behaviour and their implications
GS29. prioritize and plan for problem solving
GS30. communicate problems appropriately to others
GS31. identify sources of information and support for problem solving
GS32. seek assistance and support from other sources to solve problems
GS33. identify effective resolution techniques
GS34. select and apply resolution techniques
GS35. seek evidence for problem resolution
GS36. plan, prioritize and sequence work operations as per job requirements
GS37. organize and analyse information relevant to work
GS38. basic concepts of shop-floor work productivity including waste reduction, efficient material usage and optimization of time
GS39. undertake and express new ideas and initiatives to others
GS40. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses
GS41. ones competencies in new and different situations and contexts to achieve more
GS42. exercise restraint while expressing dissent and during conflict situations
GS43. avoid and manage distractions to be disciplined at work
GS44. manage own time for achieving better results
GS45. work in a team in order to achieve better results
GS46. identify and clarify work roles within a team
GS47. communicate and cooperate with others in the team for better results
GS48. seek assistance from fellow team members

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Understand the basic Engineering practice	**6**	**14**	**-**	**-**
PC1. consistently apply and promote health and safety legislation and best practice and work in a safe manner on a worksite	1	2	-	-
PC2. health and safety legislation and best practice	-	2	-	-
PC3. the range and uses of trade related equipments	1	2	-	-
PC4. how to use and operate tools safely	-	2	-	-
PC5. specific safety issues relating to work involving cutting tools	1	1	-	-
PC6. the importance of working logically and in a well-organized manner.	1	1	-	-
PC7. operate trade machinery effectively, safely and in accordance with manufacturers instructions	1	2	-	-
PC8. select and use appropriate machine tools safely and effectively	1	2	-	-
Mathematical skills with respect to welding	**7**	**8**	**-**	**-**
PC9. basic mathematical manipulation and unit conversion	1	2	-	-
PC10. geometrical principles, techniques and calculations	1	1	-	-
PC11. understand basic mathematical calculation. units of metric, iso and fps addition subtraction multiplication and division	1	1	-	-
PC12. select and apply basic calculation of area and volume area of a square, rectangle, triangle and circle volume of a cube, cuboid, cylinder, sphere and hemisphere	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC13. use appropriate mathematical concepts and skills to solve problems in fractions, decimals, percentage and ratio conversion of fraction to decimals conversion of decimals to fractions problems in percentage and ratio and averages	1	1	-	-
PC14. develop ability to perform basics of algebra and understand simple algebraic equations and problems	1	1	-	-
PC15. acquire the techniques of solving simple trigonometric problems introduction to sine, cosine and tan functions pythagoras theorem identifies and simple problems.	1	1	-	-
Knowledge on different types of materials and Heat Treatment	**9**	**15**	**-**	**-**
PC16. ability to apply knowledge of metals and non-metals	1	2	-	-
PC17. able to understand the types and characteristics of materials used in the manufacturing industry	1	1	-	-
PC18. ability to identify ferrous and non-ferrous metals	1	2	-	-
PC19. ability to integrate steel - properties and applications of the following carbon steels and alloy steels (with reference to welding)	1	1	-	-
PC20. apply the basic principles of material selection to specific applications stainless steel, non ferrous metal -properties and applications	1	1	-	-
PC21. highlight the property of different material and their workability.	1	2	-	-
PC22. explain the differences in properties of different materials, including metals, alloys, ceramics, polymers and composites	1	1	-	-
PC23. describe the basics of heat treatment principles	1	1	-	-
PC24. highlight different heat treatment operations, their purpose	1	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC25. apply and explain the application of stress relieving with reference to welding	-	2	-	-
Fundamentals of Electricity	**6**	**11**	**-**	**-**
PC26. understanding written sentences and paragraphs in work related documents.	-	2	-	-
PC27. primary electrical supply circuit terminology and its operation	-	2	-	-
PC28. secondary electrical / welding circuit terminology and operation	1	1	-	-
PC29. knowledge of the practical application of electricity and technology.	1	1	-	-
PC30. this includes applying principles, techniques, procedures like ac and dc current, single phase circuit and three phase circuit etc	1	2	-	-
PC31. perform routine maintenance on equipment and determining when and what kind of maintenance is needed. will require you to manage systems and ensure they work smoothly.	1	1	-	-
PC32. testing existing wiring for safety and quality control. earth connections circuit protective devices	1	1	-	-
PC33. understanding of work shop safety and welding safety	1	1	-	-
Knowledge on basic workshop practice and tools used	**6**	**18**	**-**	**-**
PC34. able to work independently or as part of a team in the following areas	1	2	-	-
PC35. understand the task required and plan ahead what steps must be taken to achieve the outcome.	1	2	-	-
PC36. cary out marking on the materials as per the drawing using	1	2	-	-
PC37. able to do the drilling as per standard specification and methods	-	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC38. set up and adjust metalworking tools and do threading	1	2	-	-
PC39. ability to set up and/or operate hand tools	-	2	-	-
PC40. correctly use and maintain the tools, hammers, spnners and fasteners	1	2	-	-
PC41. measure and mark materials as per the drawing and check accuracy and quality of finished partsmeasuring / checking instruments steel rule and tape- application, specification and care inside and outside caliper- application, specification and care vernier calliper- application, specification and care micro meter- application, specification and care radius and fillet gauges, use and care weld gauges to verify size of weld. bevel protractor - application, specification and care	-	1	-	-
PC42. safe operation of equipment and apply occupational health and safety policy and procedures to minimise risk.	1	1	-	-
PC43. knowledge and ability to use different hand tools and power tools	-	2	-	-
NOS Total	**34**	**66**	**-**	**-**

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National Occupational Standards (NOS) Parameters

NOS Code	HYC/N9101
NOS Name	General work shop practice followed in the shop floor
Sector	Hydrocarbon
Sub-Sector	Construction & Services
Occupation	Welding
NSQF Level	4
Credits	TBD
Version	1.0
Last Reviewed Date	31/03/2017
Next Review Date	31/03/2019
Deactivation Date	NA
NSQC Clearance Date	22/06/2017

HYC/N9102: Welding using Manual Metal Arc welding/Shielded metal arc welding

Description

Perform manual metal arc welding (MMAW) also known as shielded metal arc welding (SMAW) for producing a fillet and groove joints on carbon and low alloy steels in a range of welding positions as per detailed instructions received Metal Arc Welding / Shielded Metal Arc Welding

Scope

The unit/ task covers the following:

- Understand the basic Engineering practice
- Mathematical skills with respect to welding
- Knowledge on different types of materials and Heat Treatment
- Fundamentals of Electricity
- Knowledge on basic workshop practice and tools used

Elements and Performance Criteria

Welding Process

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

PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines

PC2. adhere to procedures or systems in place for health and safety, persona protective equipment (ppe) and other relevant safety regulations

PC3. check the condition of, welding leads, earthling arrangements and electrode holder

PC4. report any faults or potential hazards to appropriate authority

PC5. follow fume extraction safety procedures

PC6. explain different types of welding

PC7. use specific terminology used in the welding industry

PC8. the selection, use and techniques of the various welding process

PC9. the most common welding processes

PC10. knowledge of the different welding terminology

Welding Equipments

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

PC11. able to differentiate ac/dc machines

PC12. narrate and justify the advantages of dc machines

PC13. know how the specification of dc machines are done

PC14. ability to select the machine as per job specification practical setup the machine for welding

PC15. understand all care and maintenance of machine

PC16. arc welding accessories -electrode holder, earth lamp welding cables

PC17. selection and use of safety equipment related to specific or dangerous tasks

PC18. knowledge on components of the essential equipment required for welding

PC19. make essential connections for specific welding procedures being undertaken and identify welding machines eg. transformers, rectifiers, inverters and generators, according to the task

Welding preparation

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

PC20. ability to interpretation of welding / engineering drawings and weld symbols welding procedure specifications and standard operating procedures

PC21. correct alignment of process with material being used

PC22. knowledge of surface contamination can influence the finished weld characteristics

PC23. able to correct machine and settings to be aligned as per the standard procedure

PC24. able to identify and use the correct welding electrodes types of electrodes specification of electrodes aws coding of electrodes selection of electrodes storage of electrodes drying of electrodes

PC25. the characteristics and properties of filler materials

PC26. the methods of edge preparation to align with joint profile, strength, material and drawing specification

PC27. perform measurements for joint preparation and routine mmaw. prepare the materials and joint in readiness for welding ,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

PC28. use manual metal-arc welding and related equipment to include alternating current (ac) equipment direct current (dc) equipment

PC29. report any faults or problem to appropriate authority

Carrying out weldingoperations

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

PC30. strike and maintain a stable arc

PC31. stop and properly re-start arc to avoid welding defects (scratch start, tapping techniques)

PC32. maintain constant puddle by using appropriate travel speed

PC33. maintain proper bead sequence with respect to groove/fillet configurations and positions

PC34. remove slag in an appropriate manner (eg. wire brush, hammer, etc.)

PC35. produce welded joints to the specified quality, dimensions and profile applicable to carbon and low alloy steel sheets and plates from 1.5 24 mm

PC36. produce fillet and grove joints in 1f/1g, 2f/2g and 3f/ 3g welding positions as per the wps specified using single or multi-run welds positions: flat (pa) ig/1f, horizontal vertical (pb)2f, horizontal (pc)2g, vertical upwards (pf) 3f / 3g, vertical downwards (pg) 3f / 3g, plate to pipe (fixed) 5f

PC37. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve

PC38. produce joints on carbon and low alloy steel materials using various methods methods: drag, weave, whip

PC39. shut down and make safe the welding equipment on completion of the welding activities

Testing for quality

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

PC40. measure and check that all dimensional and geometrical aspects of the weld are as per instructions

PC41. check that the welded joint conforms to the instructions given, by checking various quality parameters by visual inspection

PC42. identify various weld defects using visual inspection

PC43. detect and report surface imperfections to appropriate authority

PC44. deal with defects in welding as per instructions given

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the importance of listening as part of effective communications

KU2. consistently apply and promote health and safety legislation and best practice and work in a safe manner on a worksite

KU3. reviews and intent the requisition of materials/equipment by assigned employees; may tag and store material as necessary

KU4. maintains records and prepares reports on repairs completed or on units requiring future special service

KU5. works closely with project coordinates, administration, and/or other related staff to determine and coordinate projects, estimating and controlling craft-related project costs, operational needs, troubleshooting, etc.

KU6. ability to understand and carry out work direction in a safe manner

KU7. plan and prioritize own work and work of others to maximize efficiency and to meet prescribed timescalesplan and prioritize own work and work of others to maximize efficiency and to meet prescribed timescales

KU8. demonstrate strong listening and questioning skills to deepen understanding of complex situations

KU9. they may specialize in certain types of welding, such as mobile welding, aerospace precision welding, manufacturing welding and pipeline construction welding.

KU10. ability to plan and think in steps and three-dimensionally

KU11. ability to keep up to date with changing technology

KU12. range of destructive and non-destructive weld testing

KU13. methods of distortion control in steels, alloys and aluminium effects of exposure to the electric arc

KU14. types of fire extinguishers and their suitable uses

KU15. methods of managing welding fume hazards

KU16. effects of exposure to welding fume

KU17. personal protective equipment (ppe) and clothing to be worn during

KU18. awareness and importance of cable size and length

KU19. types of polarity such as dc electrode negative and dc electrode positive for welding purposes

KU20. various types of base metals used in welding and their implications
KU21. distortion and how to control distortion
KU22. magnetic arc blow or arc deflection, causes and methods to avoid or compensate
KU23. significance of diffusible hydrogen for welds
KU24. storage requirements for consumable electrodes
KU25. welding process specification sheet, process qualification record (pqr) and related essential variables
KU26. travel speed and heat inputs
KU27. amperage requirements for different classification of electrodes and positions
KU28. importance and implications of various diameters of electrodes
KU29. gouging and back gouging principles, methods and procedures
KU30. purpose and importance of pre-heating requirements for base metals
KU31. tools and methods to measure temperature for pre-heat and post-heat requirements such as thermal chalk, thermocouple, etc.
KU32. purpose and importance of post-heating in welding
KU33. types of visual inspection indicators and methods

Generic Skills (GS)

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

GS1. follow verbal and written instructions as per sop
GS2. communicate orally and in writing with other team members, leaders and operations personnel
GS3. determining personnel matters (such as job progress, schedule changes, time sheet review, and work performance)
GS4. knowledge of human resource and supervisory activities, including the coordination and management of people and resources
GS5. work within company policy as outlined
GS6. read, write and communicate using english language sufficient to perform job functions
GS7. ability to understand and carry out work direction in a safe manner
GS8. identifying complex problems and reviewing related information to develop and evaluate options and implement solutions
GS9. ability to listen to and understand information and ideas presented through spoken words and sentences
GS10. performs other related duties as assigned
GS11. ability to apply general rules to specific problems to produce answers that make sense
GS12. participates in the management of personnel matters/activities
GS13. feeds and speeds to operate machinery
GS14. basic mathematical manipulation and unit conversion
GS15. calculate areas and volumes using geometric formulae
GS16. calculate material requirements, consumables and costs of welding

GS17. ability to measure material and calculate the weight
GS18. use autocad and draw simple working sketch and do the calculation.
GS19. preperation of bill of materials and calculate the material requirement
GS20. mathematics knowledge of arithmetic, algebra, geometry, , and their applications.
GS21. welds components in flat, vertical, or overhead positions
GS22. parts to ensure accuracy against drawings
GS23. work on special projects
GS24. operating other necessary equipment and performing tasks necessary to complete parts to specifications
GS25. identify problems with work planning, procedures, output and behaviour and their implications
GS26. prioritize and plan for problem solving
GS27. communicate problems appropriately to others
GS28. identify sources of information and support for problem solving
GS29. seek assistance and support from other sources to solve problems
GS30. identify effective resolution techniques
GS31. select and apply resolution techniques
GS32. seek evidence for problem resolution
GS33. plan, prioritize and sequence work operations as per job requirements
GS34. organize and analyse information relevant to work
GS35. basic concepts of shop-floor work productivity including waste reduction, efficient material usage and optimization of time
GS36. undertake and express new ideas and initiatives to others
GS37. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses
GS38. ones competencies in new and different situations and contexts to achieve more
GS39. exercise restraint while expressing dissent and during conflict situations
GS40. avoid and manage distractions to be disciplined at work
GS41. manage own time for achieving better results
GS42. work in a team in order to achieve better results
GS43. identify and clarify work roles within a team
GS44. communicate and cooperate with others in the team for better results
GS45. seek assistance from fellow team members

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Welding Process	**9**	**12**	**-**	**-**
PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines	1	2	-	-
PC2. adhere to procedures or systems in place for health and safety, persona protective equipment (ppe) and other relevant safety regulations	1	1	-	-
PC3. check the condition of, welding leads, earthling arrangements and electrode holder	-	2	-	-
PC4. report any faults or potential hazards to appropriate authority	-	2	-	-
PC5. follow fume extraction safety procedures	-	2	-	-
PC6. explain different types of welding	1	1	-	-
PC7. use specific terminology used in the welding industry	1	1	-	-
PC8. the selection, use and techniques of the various welding process	1	1	-	-
PC9. the most common welding processes	2	-	-	-
PC10. knowledge of the different welding terminology	2	-	-	-
Welding Equipments	**7**	**11**	**-**	**-**
PC11. able to differentiate ac/dc machines	-	2	-	-
PC12. narrate and justify the advantages of dc machines	1	1	-	-
PC13. know how the specification of dc machines are done	2	-	-	-
PC14. ability to select the machine as per job specification practical setup the machine for welding	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC15. understand all care and maintenance of machine	1	1	-	-
PC16. arc welding accessories -electrode holder, earth lamp welding cables	-	2	-	-
PC17. selection and use of safety equipment related to specific or dangerous tasks	1	2	-	-
PC18. knowledge on components of the essential equipment required for welding	1	1	-	-
PC19. make essential connections for specific welding procedures being undertaken and identify welding machines eg. transformers, rectifiers, inverters and generators, according to the task	-	1	-	-
Welding preparation	**10**	**11**	**-**	**-**
PC20. ability to interpretation of welding / engineering drawings and weld symbols welding procedure specifications and standard operating procedures	1	2	-	-
PC21. correct alignment of process with material being used	1	1	-	-
PC22. knowledge of surface contamination can influence the finished weld characteristics	1	1	-	-
PC23. able to correct machine and settings to be aligned as per the standard procedure	1	1	-	-
PC24. able to identify and use the correct welding electrodes types of electrodes specification of electrodes aws coding of electrodes selection of electrodes storage of electrodes drying of electrodes	1	1	-	-
PC25. the characteristics and properties of filler materials	1	1	-	-
PC26. the methods of edge preparation to align with joint profile, strength, material and drawing specification	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC27. perform measurements for joint preparation and routine mmaw. prepare the materials and joint in readiness for welding ,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	1	1	-	-
PC28. use manual metal-arc welding and related equipment to include alternating current (ac) equipment direct current (dc) equipment	1	1	-	-
PC29. report any faults or problem to appropriate authority	1	1	-	-
Carrying out weldingoperations	**10**	**10**	**-**	**-**
PC30. strike and maintain a stable arc	1	1	-	-
PC31. stop and properly re-start arc to avoid welding defects (scratch start, tapping techniques)	1	1	-	-
PC32. maintain constant puddle by using appropriate travel speed	1	1	-	-
PC33. maintain proper bead sequence with respect to groove/fillet configurations and positions	1	1	-	-
PC34. remove slag in an appropriate manner (eg. wire brush, hammer, etc.)	1	1	-	-
PC35. produce welded joints to the specified quality, dimensions and profile applicable to carbon and low alloy steel sheets and plates from 1.5 24 mm	1	1	-	-
PC36. produce fillet and grove joints in 1f/1g, 2f/2g and 3f/ 3g welding positions as per the wps specified using single or multi-run welds positions: flat (pa) ig/1f, horizontal vertical (pb)2f, horizontal (pc)2g, vertical upwards (pf) 3f / 3g, vertical downwards (pg) 3f / 3g, plate to pipe (fixed) 5f	1	1	-	-
PC37. deal promptly and effectively with problems within their control, and seek help and guidance from the relevant people if they have problems that they cannot resolve	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC38. produce joints on carbon and low alloy steel materials using various methods methods: drag, weave, whip	1	1	-	-
PC39. shut down and make safe the welding equipment on completion of the welding activities	1	1	-	-
Testing for quality	**5**	**15**	**-**	**-**
PC40. measure and check that all dimensional and geometrical aspects of the weld are as per instructions	1	3	-	-
PC41. check that the welded joint conforms to the instructions given, by checking various quality parameters by visual inspection	1	3	-	-
PC42. identify various weld defects using visual inspection	1	3	-	-
PC43. detect and report surface imperfections to appropriate authority	1	3	-	-
PC44. deal with defects in welding as per instructions given	1	3	-	-
NOS Total	**41**	**59**	**-**	**-**

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Qualification Pack

N·S·D·C National Skill Development Corporation
Transforming the skill landscape

National Occupational Standards (NOS) Parameters

NOS Code	HYC/N9102
NOS Name	Welding using Manual Metal Arc welding/Shielded metal arc welding
Sector	Hydrocarbon
Sub-Sector	Construction & Services
Occupation	Welding
NSQF Level	4
Credits	TBD
Version	1.0
Last Reviewed Date	31/03/2017
Next Review Date	31/03/2019
Deactivation Date	NA
NSQC Clearance Date	22/06/2017

HYC/N9103: Manually (semi-automatic) welding joints using the MIG/MAG

Description

Perform Tungsten Inert Gas (TIG) Welding also known as Gas Tungsten Arc Welding (GTAW) Welding) welding (MIG) / metal active gas welding (MAG) also known as gas metal arc welding (GMAW) for welding joints in all positions as per welding procedure specification.

Scope

The unit/ task covers the following:

- Do MIG welding to attain higher productivity.
- Highlight and use MIG welding because of the low cost.
- Use advantage of high deposit of MIG welding and low hydrogen deposit
- Able to weld stainless steel, carbon steel, nickel alloys, aluminum.
- Easily used on thin materials and there is no limitation for thickness.
- Advantage of MIG operation - easy to learn and it is a clean operation

Elements and Performance Criteria

Work Safely

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

PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines

PC2. adhere to procedures or systems in place for health and safety, personal protective equipment (ppe) and other relevant safety regulations for mig/mag welding operations

PC3. check the condition of welding leads, gas connection arrangements, earthing arrangements and electrode holder

PC4. report any faults or potential hazards to appropriate authority

Welding Equipments

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

PC5. understand the different elements of the equipment dc output power source wire feed unit torch work return welding lead shielding gas supply, (normally from cylinder)

Prepare for weldingoperations

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

PC6. interpret weld procedure data sheets specifications, pqr and wps

PC7. select welding machines such as inverters, rectifiers and generators, according to the task

PC8. select electrodes according to classification and specifications

PC9. prepare the materials and joint in readiness for welding

PC10. check the condition of, and correctly connect, welding leads/cables, hoses, shielding gas supply and wire feed mechanisms

PC11. prepare the welding equipment for a range of given applications welding

PC12. select the welding shielding gases and equipment for a range of given applications

PC13. plan the welding activities before they start them effectively and efficiently for achieving specifications as per wps

PC14. clean wire feeder and torch tip

PC15. connect torches and components

PC16. connect and adjust regulators and flow meters to cylinders pc16. adjust wire feed rate and read and set current as required

PC17. set other welding parameters (eg. voltage, slope of current versus voltage curve where required)

PC18. choose appropriate mode of metal transfer

PC19. set pre-purge with shielding gas as required

PC20. set and verify gas flow rates

PC21. prepare and support the joint, using the appropriate methods

PC22. tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding

Carry out welding operations

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

PC23. use manual welding and related equipment, to carry out mig/mag welding processes

PC24. perform mig/mag welding operations using various welding techniques to meet welding procedure specification requirementswelding techniques: 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.

PC25. adjust wire stick-out as per requirement

PC26. use welding consumables appropriate to the material and application to dc current typeswelding consumables: wire electrodes, wires and rods for arc welding; shielding gases; welding spools and drum packs; anti-spatter compound

PC27. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to level c of iso 5817

PC28. produce joints from various materials in different forms, ferrous metals/materials: carbon steel, stainless steel and types of forms: sheet (less than 1.5 mm), plate, structural section, pipe/tube, other forms

PC29. weld joints in good access situations, in select positions

PC30. make sure that the work area is maintained and left in a safe and tidy condition

Test for quality

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

PC31. identify various weld defects use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specificationweld defects: lack of continuity of the weld ; uneven and irregular

PC32. check that the welded joint conforms to the specification, by checking various quality parameters by visual inspection

PC33. detect surface imperfections and deal with them appropriately

PC34. carry out dpt tests to assess fine defect open to the surface not detected by visual inspection (vt)

Post weldingactivities

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

PC35. assist in preparation for non-destructive testing of the welds, for a range of tests non-destructive tests (ndt): dye penetrant (dpt), fluorescent penetrant (fpt), magnetic particle (mpt)

PC36. prepare for destructive tests on weld specimens for fillet, butt and corner destructive tests (dt): macro examination, nick break test, bend tests (such as face, root or side, as appropriate), mechanical (peel, tensile and shear, fatigue, impact tests), chemical

PC37. shut down and make safe the welding equipment on completion of the welding activities

PC38. follow the established organisational process for dealing with the welded pieces including handover, storage, safety and security, record keeping, etc.

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

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

KU2. key purpose of the organization

KU3. department structure and hierarchy protocols

KU4. work flow and own role in the workflow

KU5. dependencies and interdependencies in the workflow

KU6. support functions and types of support available for incumbents in this role

KU7. types of fire extinguishers and their suitable uses in case of welding related fires

KU8. effects of exposure to welding fume and related safety practices

KU9. range of welding equipment available for GMAW welding

KU10. functions of welding equipment

KU11. principles and techniques of MIG/MAG welding

KU12. relationship between wire feed, speed control and welding current

KU13. how to compare welding consumables for suitability for a range of given applications

KU14. welding consumables classification as applicable to GMAW

KU15. safe working practices and procedures to be followed when preparing and using MIG/MAG welding equipment

KU16. hazards associated with MIG/MAG welding and safety precautions to minimize risk

KU17. correct handling and storage of gas cylinders for welding purposes

KU18. type and thickness of base metals for welding purposes

KU19. types (availability, typical sizes), storage (storage, identification, segregation (classification, size) of ferrous metals

KU20. current and polarity required for GMAW

KU21. types, selection and application of filler wires and welding electrodes

KU22. reasons for using shielding gases, and the types and application of the various gases

KU23. 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

KU24. methods/modes of metal transfer and their uses Methods: globular, short circuit transfer, spray arc, pulse, surface tension transfer (STT)

KU25. Understanding of types of welded joints to be produced

KU26. type, components and features of a manual gas shielded arc welding torch
KU27. how to prepare the materials in readiness for the welding activity
KU28. purpose and correct use of anti-spatter compound
KU29. importance and procedure to clean torch tip and liner
KU30. how to set up and restrain the joint, and the tools and techniques to be used
KU31. checks to be made prior to welding
KU32. factors that determine weld bead shape Factors: gun angles and weld bead profiles (push, perpendicular, drag); electrode extensions stickout (short, normal, long); fillet weld electrode extension stickout (short, normal, long); gun travel speed (slow, normal, fast); current and voltage
KU33. types of weld beads and uses (stringer, weave, weave patterns)
KU34. weld bead quality characteristics
KU35. techniques of operating the welding equipment to produce a range of joints in the various joint positions
KU36. effects of the electrical characteristics of the MIG/MAG welding arc
KU37. problems that can occur with the welding activities and how to address them
KU38. own responsibility to assist in preparation of the welds and weld pieces for examination
KU39. how to check the welded joints for uniformity, alignment, position, weld size and profile
KU40. gouging and back gouging, its importance, principles, methods and procedures in welding
KU41. purpose and importance of pre-heating requirements for base metals in preparation for welding
KU42. purpose and importance of post-heating in welding
KU43. methods to achieve pre-heat and post heat requirements for welding purposes
KU44. tools and methods to measure temperature for pre-heat and post-heat requirements such as thermal chalk, thermocouple, etc.
KU45. significance of diffusible hydrogen for welds and how it is measured
KU46. procedure to conduct dye penetrant test to assess weld quality
KU47. various procedures for visual examination of the welds for cracks
KU48. types of non-destructive and destructive tests for assessing weld quality Non-destructive tests (NDT): dye penetrant (DPT), fluorescent penetrant (FPT), magnetic particle (MPT) Destructive tests (DT): macro examination, nick break test, bend tests (such as face, root or side, as appropriate), mechanical (peel, tensile and shear, fatigue, impact tests), chemical
KU49. safe working practices, handling and procedures to be adopted when preparing the welds for examination
KU50. importance of leaving the work area and equipment in a safe condition on completion of the welding activities

Generic Skills (GS)

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

GS1. follow the instructions
GS2. ability to write the instruction to the fellow worker.

GS3. should be able to communicate job progress, schedule changes, time sheet review, and work performance

GS4. knowledge of human resource and supervisory activities, including the coordination and management of people and resources

GS5. understanding the purpose of a communication

GS6. analyzing the audience and communicate

GS7. communicating with words as well as with body language

GS8. giving each communication greater impact

GS9. you must have a clear purpose and state that purpose as quickly as possible.

GS10. what is a team and why are teams important

GS11. how do you and others interact in a team

GS12. how can a team operate effectively and strategies help teams achieve their goals

GS13. undertake numerical operations, geometry and calculations/ formulae (including addition, subtraction, multiplication, division, fractions and decimals, percentages and proportions, simple ratios and averages)

GS14. ability to calculate volume, area and weight of material.

GS15. use appropriate measuring techniques

GS16. use and convert imperial and metric systems of measurements

GS17. apply appropriate degree of accuracy to express numbers units and number systems representing degree of accuracy: decimals places, significant figures, fractions as a decimal quantity

GS18. use and understand tolerance in terms of limits of size

GS19. check measurements, angles, orientation and slope

GS20. types of reference lines such as tangent lines, datam lines, centre lines and work points

GS21. use basic communication and cooperation skills when interacting with familiar people.

GS22. ability n to share feelings and meet basic needs when interacting with other people.

GS23. able to contribute for interpersonal and group interactions.

GS24. demonstrate skills required to reconcile conflict and changes in relationships and groups.

GS25. identify problems with work planning, procedures, output and behaviour and their implications

GS26. prioritize and plan for problem solving

GS27. communicate problems appropriately to others

GS28. identify sources of information and support for problem solving

GS29. seek assistance and support from other sources to solve problems

GS30. identify effective resolution techniques

GS31. select and apply resolution techniques

GS32. seek evidence for problem resolution

GS33. plan, prioritize and sequence work operations as per job requirements

GS34. organize and analyse information relevant to work

GS35. basic concepts of shop-floor work productivity including waste reduction, efficient material usage and optimization of time

GS36. undertake and express new ideas and initiatives to others

GS37. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses

GS38. ones competencies in new and different situations and contexts to achieve more

GS39. exercise restraint while expressing dissent and during conflict situations

GS40. avoid and manage distractions to be disciplined at work

GS41. manage own time for achieving better results

GS42. work in a team in order to achieve better results

GS43. identify and clarify work roles within a team

GS44. communicate and cooperate with others in the team for better results

GS45. seek assistance from fellow team members

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Work Safely	**4**	**7**	**-**	**-**
PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines	1	2	-	-
PC2. adhere to procedures or systems in place for health and safety, personal protective equipment (ppe) and other relevant safety regulations for mig/mag welding operations	1	2	-	-
PC3. check the condition of welding leads, gas connection arrangements, earthing arrangements and electrode holder	1	2	-	-
PC4. report any faults or potential hazards to appropriate authority	1	1	-	-
Welding Equipments	**1**	**1**	**-**	**-**
PC5. understand the different elements of the equipment dc output power source wire feed unit torch work return welding lead shielding gas supply, (normally from cylinder)	1	1	-	-
Prepare for weldingoperations	**17**	**26**	**-**	**-**
PC6. interpret weld procedure data sheets specifications, pqr and wps	1	2	-	-
PC7. select welding machines such as inverters, rectifiers and generators, according to the task	1	1	-	-
PC8. select electrodes according to classification and specifications	1	1	-	-
PC9. prepare the materials and joint in readiness for welding	1	2	-	-
PC10. check the condition of, and correctly connect, welding leads/cables, hoses, shielding gas supply and wire feed mechanisms	1	2	-	-
PC11. prepare the welding equipment for a range of given applications welding	1	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. select the welding shielding gases and equipment for a range of given applications	1	1	-	-
PC13. plan the welding activities before they start them effectively and efficiently for achieving specifications as per wps	1	1	-	-
PC14. clean wire feeder and torch tip	1	2	-	-
PC15. connect torches and components	1	1	-	-
PC16. connect and adjust regulators and flow meters to cylinders pc16. adjust wire feed rate and read and set current as required	1	1	-	-
PC17. set other welding parameters (eg. voltage, slope of current versus voltage curve where required)	1	1	-	-
PC18. choose appropriate mode of metal transfer	1	1	-	-
PC19. set pre-purge with shielding gas as required	1	2	-	-
PC20. set and verify gas flow rates	1	2	-	-
PC21. prepare and support the joint, using the appropriate methods	1	2	-	-
PC22. tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding	1	2	-	-
Carry out welding operations	**9**	**13**	**-**	**-**
PC23. use manual welding and related equipment, to carry out mig/mag welding processes	1	2	-	-
PC24. perform mig/mag welding operations using various welding techniques to meet welding procedure specification requirementswelding techniques: 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.	1	2	-	-
PC25. adjust wire stick-out as per requirement	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC26. use welding consumables appropriate to the material and application to dc current typeswelding consumables: wire electrodes, wires and rods for arc welding; shielding gases; welding spools and drum packs; anti-spatter compound	2	2	-	-
PC27. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to level c of iso 5817	1	1	-	-
PC28. produce joints from various materials in different forms, ferrous metals/materials: carbon steel, stainless steel and types of forms: sheet (less than 1.5 mm), plate, structural section, pipe/tube, other forms	1	1	-	-
PC29. weld joints in good access situations, in select positions	1	2	-	-
PC30. make sure that the work area is maintained and left in a safe and tidy condition	1	2	-	-
Test for quality	**5**	**5**	**-**	**-**
PC31. identify various weld defects use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specificationweld defects: lack of continuity of the weld ; uneven and irregular	1	1	-	-
PC32. check that the welded joint conforms to the specification, by checking various quality parameters by visual inspection	2	-	-	-
PC33. detect surface imperfections and deal with them appropriately	1	2	-	-
PC34. carry out dpt tests to assess fine defect open to the surface not detected by visual inspection (vt)	1	2	-	-
Post weldingactivities	**4**	**8**	**-**	**-**
PC35. assist in preparation for non-destructive testing of the welds, for a range of tests non-destructive tests (ndt): dye penetrant (dpt), fluorescent penetrant (fpt), magnetic particle (mpt)	1	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC36. prepare for destructive tests on weld specimens for fillet, butt and corner destructive tests (dt): macro examination, nick break test, bend tests (such as face, root or side, as appropriate), mechanical (peel, tensile and shear, fatigue, impact tests), chemical	1	2	-	-
PC37. shut down and make safe the welding equipment on completion of the welding activities	1	2	-	-
PC38. follow the established organisational process for dealing with the welded pieces including handover, storage, safety and security, record keeping, etc.	1	2	-	-
NOS Total	**40**	**60**	**-**	**-**

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National Occupational Standards (NOS) Parameters

NOS Code	HYC/N9103
NOS Name	Manually (semi-automatic) welding joints using the MIG/MAG
Sector	Hydrocarbon
Sub-Sector	Construction & Services
Occupation	Welding
NSQF Level	4
Credits	TBD
Version	1.0
Last Reviewed Date	31/03/2017
Next Review Date	31/03/2019
Deactivation Date	NA
NSQC Clearance Date	22/06/2017

HYC/N9104: Perform Manually welding joints using the TIG (GTAW) Process

Description

This unit covers the performing of manual TIG (GTAW) welding for a range of standard welding job requirements. This involves welding different materials (carbon steel, aluminum and stainless steel) in various positions.

Scope

The unit/ task covers the following:

- Maintain Safe working
- Welding Equipment's
- Prepare for welding
- operations
- Carry out welding operations
- Test for quality
- Post welding
- activities
- Other related operation

Elements and Performance Criteria

Maintain Safe working

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

PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines

PC2. adhere to procedures or systems in place for health and safety, personal protective equipment (ppe) and other relevant safety regulations for tig welding operations

PC3. check the condition of welding leads, gas connection arrangements, earthing arrangements and electrode holder

PC4. report any faults or potential hazards to appropriate authority

Welding Equipments

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

PC5. understand the different elements of the equipment dc output power source wire feed unit torch work return welding lead shielding gas supply, (normally from cylinder)

Prepare for weldingoperations

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

PC6. interpret weld procedure data sheets specifications interpreting the wps: welding process (iso codes);

PC7. select welding machines eg. transformer, inverters (ac/dc), rectifiers and generators, according to the materials and task

PC8. select proper welding torch and tungsten electrode that meet the job requirement and specification

PC9. obtain filler wire according to specifications

PC10. prepare for the tig welding process

PC11. prepare the materials and joint in readiness for welding

PC12. select tungsten electrode by the colour of the tip according to base metal, and correct diameter

PC13. select and fit the welding shielding gases for a range of given applications pc13. plan the welding activities before they start them effectively and efficiently for achieving specifications as per wps

PC14. connect torches and the components

PC15. connect and adjust regulators and flow meters to cylinders

PC16. read, set and adjust current (amperage) as required

PC17. set pre-purge with shielding gas as required

PC18. prepare tungsten by sharpening or balling it to desired tip shape

PC19. set and verify gas flow rates

PC20. prepare and support the joint, using the appropriate methods

PC21. tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding

PC22. obtain clearance from quality control for weld joint before welding

PC23. match feed and travel speed as required

Carry out welding operations

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

PC24. perform tig welding operations using appropriate welding techniques to meet welding procedure specification requirements

PC25. use correct technique for starting the arc (using hf (high frequency) unit, scratching the electrode on the job material, lifting the electrode immediately after touching the job material)

PC26. use correct angle of torch and filler wire

PC27. weld the joint to the specified quality, dimensions and profile

PC28. use manual welding and related equipment, to carry out tig welding processes

PC29. use welding consumables appropriate to the material and application, to include ac current types and dc current types

PC30. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to level b of iso 5817

PC31. use both methods to produce the various joints a) with filler wire b) without filler wire (autogenously)

PC32. produce joints from various materials in different forms materials: ferrous : carbon steel, stainless steel (all grades); non-ferrous: aluminum and aluminum alloys; nickel and nickel alloys; titanium; copper and copper alloys forms: sheet (less than 1.5 mm), plate (8 mm), section, pipe/tube, other forms

PC33. weld joints in good access situations, in select positions

PC34. shut down and make safe the welding equipment on completion of the welding activities

PC35. make sure that the work area is maintained and left in a safe and tidy condition

Test for quality

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

PC36. use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specification

PC37. check that the welded joint conforms to the specification, by checking various quality parameters using visual inspection quality parameters: dimensional accuracy; alignment/squareness; size and profile of weld; visual defects; ndt/dt tested defects; types of visual inspections: use of visual techniques, lighting, low powered magnification, fillet weld gauges

PC38. identify various weld defects; types of weld defects: lack of continuity of the weld; uneven and irregular ripple formation, incorrect weld size or profile, undercutting, overlap, inclusions, porosity, internal cracks, surface cracks, lack of fusion, lack of penetration, welding spatter, gouges, stray arc strikes, sharp edges

PC39. detect surface imperfections and deal with them appropriately

PC40. carry out lpt tests to assess fine defect open to the surface not detected by visual inspection (vt)

Post weldingactivities

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

PC41. assist in preparation for non-destructive testing of the welds for a range of tests non-destructive tests (ndt): visual inspection, leak test: dye penetrant (dpt), fluorescent penetrant (fpt); magnetic particle (mpt); radiographic (rt); ultrasonic (ut)

PC42. prepare for destructive tests on weld specimens for select tests; destructive tests (dt): nick break test; bend tests (such as face, root or side, as appropriate); metallographic; mechanical (peel, tensile and shear, fatigue, impact tests); chemical

PC43. follow the established organisational process for dealing with the welded pieces including handover, storage, safety and security, record keeping, etc.

Other related operation

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

PC44. ability do the following related operation oxy fuel cutting manual cutting machine cutting plasma cutting

PC45. ability to do pipe welding following the standard practices

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

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

KU2. key purpose of the organization

KU3. department structure and hierarchy protocols

KU4. work flow and own role in the workflow

KU5. dependencies and interdependencies in the workflow

KU6. support functions and types of support available for incumbents in this role

KU7. types of fire extinguishers and their suitable uses in case of welding related fires

KU8. the effects of exposure to welding fume
KU9. range of welding equipment available
KU10. basic principles of tig welding and the functions of welding equipment
KU11. concepts and mechanisms of welding
KU12. different types of power source
KU13. how to compare welding consumables for suitability for a range of given applications
KU14. welding consumables classification chemical composition of the weld metal; protection of bare wires
KU15. safe working practices, precautions and procedures to be followed when preparing and using tig welding equipment
KU16. different variants of the tig welding (eg. orbital welding, internal bore welding, ng-tig etc.)
KU17. personal protective equipment to be worn for the welding activities
KU18. correct handling and storage of gas cylinders
KU19. manual tig welding process
KU20. type and thickness of base metals
KU21. current types and polarity
KU22. types of tungsten
KU23. types, selection and application of filler wires and welding electrodes
KU24. reasons for using shielding gases, and the types and application of the various gases
KU25. impact of shielding gas composition and purity on welding quality
KU26. use, impact and importance of gas pressures and flow rates in relationship to the type of material being welded
KU27. pre- and post-flow purge and its importance
KU28. importance and application of back purging
KU29. types of welded joints to be produced
KU30. terminology used for the appropriate welding positions
KU31. types of torches such as air cooled and liquid cooled
KU32. how to prepare the materials in readiness for the welding activity
KU33. how to set up and restrain the joint, and the tools and techniques to be used
KU34. appropriate tack welding size and spacing (in relationship to material thickness)
KU35. checks to be made prior to welding checking activities: correct set-up of the joint; proper condition of electrical connections; welding return and earthing arrangements; operating parameters
KU36. operating the welding equipment to produce a range of joints in the various joint positions
KU37. effects of the electrical characteristics of the tig welding arc
KU38. gouging and back gouging principles, methods and procedures
KU39. purpose and importance of pre-heating requirements for base metals
KU40. purpose and importance of post-heating in welding
KU41. methods to achieve pre-heat and post heat requirements
KU42. tools and methods to measure temperature for pre-heat and post-heat requirements such as thermal chalk, thermocouple, etc.

KU43. how to control distortion (such as welding sequence; deposition technique)
KU44. problems that can occur with the welding activities
KU45. how to close down the welding equipment safely and correctly
KU46. how to prepare the welds for examination
KU47. how to check the welded joints for uniformity, alignment, position, weld size and profile
KU48. various procedures for visual examination of the welds for cracks
KU49. types of non-destructive and destructive tests
KU50. correct procedure for carrying out the dye penetrant test
KU51. handling of weld specimens for tests and methods of removing a test piece of weld from a suitable position in the joint
KU52. safe working practices and procedures to be adopted when preparing the welds for examination
KU53. importance of leaving the work area and equipment in a safe condition on completion of the welding activities

Generic Skills (GS)

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

GS1. follow verbal and written instructions
GS2. communicate orally and in writing with other team members, leaders and operations personnel
GS3. determining personnel matters (such as job progress, schedule changes, time sheet review, and work performance)
GS4. knowledge of human resource and supervisory activities, including the coordination and management of people and resources
GS5. work within company policy as outlined
GS6. read, write and communicate using english language sufficient to perform job functions
GS7. ability to understand and carry out work direction in a safe manner
GS8. identifying complex problems and reviewing related information to develop and evaluate options and implement solutions
GS9. Ability to listen to and understand information and ideas presented through spoken words and sentences
GS10. performs other related duties as assigned
GS11. ability to apply general rules to specific problems to produce answers that make sense
GS12. participates in the management of personnel matters/activities
GS13. identify pipe fittings by size, type, material, and service type
GS14. read and interpret hanger and support drawings
GS15. identify pipe by size, type, and wall thickness
GS16. calculate how threaded is measured
GS17. install pipe hangers, supports, anchors, and guides
GS18. read and interpret pipe and hanger drawings

GS19. calculate pressure and heat in piping systems
GS20. mathematics knowledge of arithmetic, algebra, geometry, , and their applications
GS21. participate in on-the-job and other learning, training and development interventions and assessments
GS22. clarify task related information with appropriate personnel or technical adviser
GS23. seek to improve and modify own work practices
GS24. maintain current knowledge of application standards, legislation, codes of practice and product/process developments
GS25. identify problems with work planning, procedures, output and behaviour and their implications
GS26. prioritize and plan for problem solving
GS27. communicate problems appropriately to others
GS28. identify sources of information and support for problem solving
GS29. seek assistance and support from other sources to solve problems
GS30. identify effective resolution techniques
GS31. select and apply resolution techniques
GS32. seek evidence for problem resolution
GS33. plan, prioritize and sequence work operations as per job requirements
GS34. organize and analyse information relevant to work
GS35. basic concepts of shop-floor work productivity including waste reduction, efficient material usage and optimization of time
GS36. undertake and express new ideas and initiatives to others
GS37. modify work plan to overcome unforeseen difficulties or developments that occur as work progresses
GS38. ones competencies in new and different situations and contexts to achieve more
GS39. exercise restraint while expressing dissent and during conflict situations
GS40. avoid and manage distractions to be disciplined at work
GS41. manage own time for achieving better results
GS42. work in a team in order to achieve better results
GS43. identify and clarify work roles within a team
GS44. communicate and cooperate with others in the team for better results
GS45. seek assistance from fellow team members

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Maintain Safe working	**3**	**5**	**-**	**-**
PC1. work safely at all times, complying with health and safety legislation, regulations and other relevant guidelines	1	1	-	-
PC2. adhere to procedures or systems in place for health and safety, personal protective equipment (ppe) and other relevant safety regulations for tig welding operations	1	1	-	-
PC3. check the condition of welding leads, gas connection arrangements, earthing arrangements and electrode holder	1	1	-	-
PC4. report any faults or potential hazards to appropriate authority	-	2	-	-
Welding Equipments	**1**	**2**	**-**	**-**
PC5. understand the different elements of the equipment dc output power source wire feed unit torch work return welding lead shielding gas supply, (normally from cylinder)	1	2	-	-
Prepare for weldingoperations	**18**	**21**	**-**	**-**
PC6. interpret weld procedure data sheets specifications interpreting the wps: welding process (iso codes);	1	1	-	-
PC7. select welding machines eg. transformer, inverters (ac/dc), rectifiers and generators, according to the materials and task	1	1	-	-
PC8. select proper welding torch and tungsten electrode that meet the job requirement and specification	1	1	-	-
PC9. obtain filler wire according to specifications	1	1	-	-
PC10. prepare for the tig welding process	1	2	-	-
PC11. prepare the materials and joint in readiness for welding	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC12. select tungsten electrode by the colour of the tip according to base metal, and correct diameter	1	1	-	-
PC13. select and fit the welding shielding gases for a range of given applications pc13. plan the welding activities before they start them effectively and efficiently for achieving specifications as per wps	1	1	-	-
PC14. connect torches and the components	1	1	-	-
PC15. connect and adjust regulators and flow meters to cylinders	1	2	-	-
PC16. read, set and adjust current (amperage) as required	1	1	-	-
PC17. set pre-purge with shielding gas as required	1	1	-	-
PC18. prepare tungsten by sharpening or balling it to desired tip shape	1	1	-	-
PC19. set and verify gas flow rates	1	1	-	-
PC20. prepare and support the joint, using the appropriate methods	1	2	-	-
PC21. tack weld the joint at appropriate intervals, and check the joint for accuracy before final welding	1	1	-	-
PC22. obtain clearance from quality control for weld joint before welding	1	1	-	-
PC23. match feed and travel speed as required	1	1	-	-
Carry out welding operations	**12**	**12**	**-**	**-**
PC24. perform tig welding operations using appropriate welding techniques to meet welding procedure specification requirements	1	1	-	-
PC25. use correct technique for starting the arc (using hf (high frequency) unit, scratching the electrode on the job material, lifting the electrode immediately after touching the job material)	1	1	-	-
PC26. use correct angle of torch and filler wire	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC27. weld the joint to the specified quality, dimensions and profile	1	1	-	-
PC28. use manual welding and related equipment, to carry out tig welding processes	1	1	-	-
PC29. use welding consumables appropriate to the material and application, to include ac current types and dc current types	1	1	-	-
PC30. produce joints of the required quality and of specified dimensional accuracy which achieve a weld quality equivalent to level b of iso 5817	1	1	-	-
PC31. use both methods to produce the various joints a) with filler wire b) without filler wire (autogenously)	1	1	-	-
PC32. produce joints from various materials in different forms materials: ferrous : carbon steel, stainless steel (all grades); non-ferrous: aluminum and aluminum alloys; nickel and nickel alloys; titanium; copper and copper alloys forms: sheet (less than 1.5 mm), plate (8 mm), section, pipe/tube, other forms	1	1	-	-
PC33. weld joints in good access situations, in select positions	1	1	-	-
PC34. shut down and make safe the welding equipment on completion of the welding activities	1	1	-	-
PC35. make sure that the work area is maintained and left in a safe and tidy condition	1	1	-	-
Test for quality	**5**	**6**	**-**	**-**
PC36. use appropriate methods and equipment to check the quality, and that all dimensional and geometrical aspects of the weld are to the specification	1	1	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC37. check that the welded joint conforms to the specification, by checking various quality parameters using visual inspection quality parameters: dimensional accuracy; alignment/squareness; size and profile of weld; visual defects; ndt/dt tested defects; types of visual inspections: use of visual techniques, lighting, low powered magnification, fillet weld gauges	1	2	-	-
PC38. identify various weld defects; types of weld defects: lack of continuity of the weld; uneven and irregular ripple formation, incorrect weld size or profile, undercutting, overlap, inclusions, porosity, internal cracks, surface cracks, lack of fusion, lack of penetration, welding spatter, gouges, stray arc strikes, sharp edges	1	1	-	-
PC39. detect surface imperfections and deal with them appropriately	1	1	-	-
PC40. carry out lpt tests to assess fine defect open to the surface not detected by visual inspection (vt)	1	1	-	-
Post weldingactivities	**3**	**4**	**-**	**-**
PC41. assist in preparation for non-destructive testing of the welds for a range of tests non-destructive tests (ndt): visual inspection, leak test: dye penetrant (dpt), fluorescent penetrant (fpt); magnetic particle (mpt); radiographic (rt); ultrasonic (ut)	1	1	-	-
PC42. prepare for destructive tests on weld specimens for select tests; destructive tests (dt): nick break test; bend tests (such as face, root or side, as appropriate); metallographic; mechanical (peel, tensile and shear, fatigue, impact tests); chemical	1	2	-	-
PC43. follow the established organisational process for dealing with the welded pieces including handover, storage, safety and security, record keeping, etc.	1	1	-	-
Other related operation	**2**	**6**	**-**	**-**

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC44. ability do the following related operation oxy fuel cutting manual cutting machine cutting plasma cutting	1	3	-	-
PC45. ability to do pipe welding following the standard practices	1	3	-	-
NOS Total	**44**	**56**	**-**	**-**

HYC/N9301: Working effectively in a team

Description

This unit is about working effectively within a team.

Scope

The scope covers the following :

- Effective team work

Elements and Performance Criteria

Effective team work

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

PC1. maintain clear communication with colleagues
PC2. pass on information to colleagues in line with organisational requirements
PC3. provide support to the team members
PC4. respect the colleagues
PC5. fulfil commitments made to colleagues
PC6. inform team members timely, if timelines can't be met
PC7. take the necessary initiatives to resolve the issues while working in team
PC8. adopt gender neutral behaviour while interacting with colleagues
PC9. offer assistance to a person with disability (PWD), only if required

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. the organization policies and procedures related to team performance
KU2. the importance of effective communication and establishing good working relationships with colleagues
KU3. the importance of creating an environment of trust and mutual respect
KU4. the implications of own work on the work and schedule of others
KU5. the standard practices in organisation w.r.t communication at various levels
KU6. the personal responsibility for completing the task in time
KU7. importance of gender equality
KU8. importance of showing empathy while interacting with a PwD

Generic Skills (GS)

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

GS1. communicate effectively in writing

GS2. read instructions, guidelines/procedures
GS3. work in a disciplined manner for meeting commitments and deadline
GS4. how to plan and prioritise the work
GS5. the importance of consistent and reliable services
GS6. apply problem solving approaches in different situations
GS7. apply balanced judgments to different situations

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Effective team work	**20**	**30**	**-**	**-**
PC1. maintain clear communication with colleagues	2	3	-	-
PC2. pass on information to colleagues in line with organisational requirements	2	3	-	-
PC3. provide support to the team members	2	4	-	-
PC4. respect the colleagues	3	4	-	-
PC5. fulfil commitments made to colleagues	2	3	-	-
PC6. inform team members timely, if timelines can't be met	2	4	-	-
PC7. take the necessary initiatives to resolve the issues while working in team	3	4	-	-
PC8. adopt gender neutral behaviour while interacting with colleagues	2	2	-	-
PC9. offer assistance to a person with disability (PWD), only if required	2	3	-	-
NOS Total	**20**	**30**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	HYC/N9301
NOS Name	Working effectively in a team
Sector	Hydrocarbon
Sub-Sector	Generic
Occupation	Generic
NSQF Level	4
Credits	TBD
Version	2.0
Last Reviewed Date	NA
Next Review Date	NA
NSQC Clearance Date	

HYC/N9302: Maintain health, safety and security procedures

Description

This unit is about maintaining health, safety and security procedure at workplace. It covers responsibilities towards self, others, assets and the environment.

Scope

The scope covers the following :

- Follow health and safety measures
- Follow safety procedures during emergency

Elements and Performance Criteria

Follow health and safety measures

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

PC1. use protective clothing/equipment such as face mask, hand gloves, goggle etc for specific tasks and work conditions

PC2. identify the people responsible for maintaining health and safety in the workplace

PC3. identify possible causes of risk or accident in the workplace

PC4. follow safe working practices while dealing with hazards to ensure the safety of self and others

PC5. lift heavy objects safely using correct procedures

PC6. follow safety signages

PC7. maintain hands hygiene by washing hand frequently and thoroughly with soap and water or alcohol-based hand rub

PC8. inform the concerned person of any illness related to self and others

PC9. maintain workplace hygiene by disinfecting the equipment and tools regularly

Follow safety procedures during emergency

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

PC10. respond promptly and appropriately to an accident or in an emergency situation

PC11. use appropriate fire extinguishers for different types of fires correctly

PC12. follow appropriate rescue techniques during fire hazard

PC13. follow good housekeeping practice in order to prevent fire hazards

PC14. inform fire safety department about any near-miss incidents in the work place

PC15. provide appropriate first aid to victims in an emergency situation

PC16. follow the applicable regulations and codes as per safety standard

PC17. prepare written accident/incident report and share with the concerned officer/department

Knowledge and Understanding (KU)

The individual on the job needs to know and understand:

KU1. company's policies on personnel management and duty reporting procedure
KU2. reporting structure within organization
KU3. health and safety hazards commonly affecting the work environment and related precautions
KU4. importance of maintaining personal hygiene using PPE kit, sanitizer and soap
KU5. importance of maintaining workplace hygiene
KU6. preventative and remedial actions to be taken in the case of exposure to toxic materials
KU7. importance of using protective clothing/equipment while working
KU8. various causes of fire
KU9. techniques of using different types of fire extinguishers
KU10. different materials used for extinguishing fire
KU11. various types of safety signs and their significance

Generic Skills (GS)

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

GS1. communicate effectively by writing
GS2. read instructions, guidelines/procedures and reports
GS3. identify and report potential sources of danger
GS4. how to plan the work to meet the deadline
GS5. the importance of on time services
GS6. apply problem solving approaches in different situations
GS7. apply balanced judgments in different situations

Assessment Criteria

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
Follow health and safety measures	**9**	**15**	**-**	**-**
PC1. use protective clothing/equipment such as face mask, hand gloves, goggle etc for specific tasks and work conditions	1	2	-	-
PC2. identify the people responsible for maintaining health and safety in the workplace	1	-	-	-
PC3. identify possible causes of risk or accident in the workplace	1	2	-	-
PC4. follow safe working practices while dealing with hazards to ensure the safety of self and others	1	2	-	-
PC5. lift heavy objects safely using correct procedures	1	2	-	-
PC6. follow safety signages	1	2	-	-
PC7. maintain hands hygiene by washing hand frequently and thoroughly with soap and water or alcohol-based hand rub	1	2	-	-
PC8. inform the concerned person of any illness related to self and others	1	1	-	-
PC9. maintain workplace hygiene by disinfecting the equipment and tools regularly	1	2	-	-
Follow safety procedures during emergency	**11**	**15**	**-**	**-**
PC10. respond promptly and appropriately to an accident or in an emergency situation	1	2	-	-
PC11. use appropriate fire extinguishers for different types of fires correctly	2	2	-	-
PC12. follow appropriate rescue techniques during fire hazard	1	2	-	-
PC13. follow good housekeeping practice in order to prevent fire hazards	1	1	-	-
PC14. inform fire safety department about any near-miss incidents in the work place	2	2	-	-

Assessment Criteria for Outcomes	Theory Marks	Practical Marks	Project Marks	Viva Marks
PC15. provide appropriate first aid to victims in an emergency situation	1	2	-	-
PC16. follow the applicable regulations and codes as per safety standard	1	2	-	-
PC17. prepare written accident/incident report and share with the concerned officer/department	2	2	-	-
NOS Total	**20**	**30**	**-**	**-**

National Occupational Standards (NOS) Parameters

NOS Code	HYC/N9302
NOS Name	Maintain health, safety and security procedures
Sector	Hydrocarbon
Sub-Sector	Generic
Occupation	Generic
NSQF Level	4
Credits	TBD
Version	2.0
Last Reviewed Date	NA
Next Review Date	NA
NSQC Clearance Date	