T-LEVELS | Institute for Apprenticeships & Technical Education

T Level Technical Qualification in Engineering, Manufacturing, Processing and Control (8713-34)

Fabrication and Welding Technologies (334)

Guide standard exemplification material

Distinction – Sample 2022

First teaching from September 2022
Version 1.0

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Contents

Introduction

The sample assessment materials within this document refer to the Fabrication and Welding Technologies sample occupational specialism assignment. The aim of these materials is to provide centres with examples of knowledge, skills and understanding that attest to a **distinction** grade. The examples provided do not reflect all evidence from the sample assignment as the focus of this material is the quality and standards that need to be achieved rather than the volume of exemplar evidence provided. However, the examples provided are representative of all tasks in the sample assignment. The evidence presented here has been developed to reflect **distinction** grade within each task but is not necessarily intended to reflect the work of a single candidate. It is important to note that in live assessments a candidate's performance is very likely to exhibit a spikey profile and standard of performance will vary across tasks. A **distinction** grade will be based on a synoptic mark across all tasks.

The materials in this Guide Standard Exemplification Material (GSEM) are separated into the sections as described below. Materials are presented against a number of tasks from the assignment.

Task

This section details the tasks that the candidate has been asked to carry out, what needs to be submitted for marking and any additional evidence required including any photographic evidence. Also referenced in this section are the assessment themes the candidates will be marked against when completing the tasks within it. In addition, candidate evidence that has been included or not been included in this GSEM has been identified within this section.

In this GSEM there is candidate evidence from:

Task 1 – Planning

Task 2 – Production

Task 3 – Quality review and testing.

Candidate evidence

This section includes exemplars of candidate work, photographs of the work in production (or completed) and practical observation records of the assessment completed by centre assessors. This will be exemplar evidence that was captured as part of the assessment and then internally marked by the centre assessor.

Photographs in this GSEM demonstrate the full process that the candidate has undertaken to complete the anchor. Commentary sections detail where performance is considered to be at a level reflective of a distinction grade. Note, due to the nature of this process, not all individual work activities would provide opportunity to demonstrate a defined level of differentiation beyond a pass – but these images are shown in order to show the cohesiveness of the process being undertaken, and to draw out where differentiation is possible.

Commentary

This section includes detailed comments to demonstrate how the candidate evidence attests to the standard of **distinction** by directly correlating to the grade descriptors for this occupational area. Centres can compare the evidence against the performance indicators in the marking grid descriptors within the assessor packs, to provide guidance on the standard of knowledge, skills and understanding that need to be met for **distinction**.

It is important to note that the commentary section is not part of the evidence or assessment but are evaluative statements on how and why that piece of evidence meets a particular standard.

Grade descriptors

To achieve a distinction, a candidate will typically be able to:

Competently and thoroughly interpret technical information, applying technical skills to plan, assess risk and follow safe working methods to practical tasks and procedures to an exemplary standard in response to the requirements of the brief, producing an excellent quality of work that meets regulations and standards.

Thoroughly prepare working area, mitigating potential risks prior to commencing tasks and consistently apply exemplary housekeeping techniques during tasks.

Demonstrate exemplary technical practical skills in marking out, cutting, forging, fabricating and welding that is in line with industry standards and meet the requirements of the brief.

Demonstrate exemplary knowledge and understanding of the principles and processes required for fabrication and welding technologies.

Work safely and make informed and appropriate use of tools, materials and equipment within the working environments for marking out, cutting, forging, fabricating and welding activities.

Identify causes and diagnose problems or common issues related to fabrication and welding and have a thorough understanding and the skills to be able resolve and rectify them.

Consistently and accurately use industry and technical terminology across different communication methods with full consideration of technical and non-technical audiences.

Task 1 – Planning

(Assessment themes: Health and safety, Planning and preparation)

For task 1, candidates need to produce the following pieces of evidence:

- a resources list with measuring equipment calibration check recorded
- a risk assessment
- a method statement with justifications
- a hot works permit
- a cutting list
- a quality check sheet.

The following task 1 supporting evidence has not been included for this version of the GSEM.

- a hot works permit

For task 1 candidates will be expected to complete a hot works permit template as part of their preparation. This is supporting evidence for assessors to gauge the candidate's planning skills and safety awareness and will not be marked. *See assessor pack for additional guidance.*

For task 1 candidates will be expected to produce a quality check sheet to use in task 3a during the quality inspection task. This is supporting evidence for assessors to gauge the candidate's planning skills and will not be marked.

No photographic or video evidence is required for task 1.

Candidate evidence

1. Resources list with justifications for the selections and measuring equipment calibration check recorded

Requirements and resources	Task	Quantity	Justification
Tools/equipment/materials/consumables			
Writing materials (paper, ruler, pen pencil, eraser)	1	N/A	So that I can plan my work and add any notes needed for the job. To create the cut list and quality check sheet.
8mm1mx2m mild steel plate, 6mm x 1m mild steel round bar	2	2	To fabricate each component to the required dimensions.
Scribe	2	1	Needed for marking out, in conjunction with steel rule/engineers square. This will be used to mark out each component.
Engineer's square	2 and 3	1	Used to check for squareness when establishing the datums on the workpiece, and to mark out lines square to the workpiece if required. Also used when marking out areas for the weld testing.
Steel rule	2 and 3	1	Used to mark out the components dimensions for cutting and creating the holes and notches. Also, for checking the dimensions in the testing phase.
Centre punch	2	1	Used to create clear cut lines for the oxy fuel cutting, and for marking the location of the holes before cutting.
Forging hammer	2	1	Used for hammering the heated stock end.
Oxy fuel cutting equipment including gas bottle regulators	2	1	Used to cut each component of the anchor out, also to cut the hole and notches out as well as to heat up the stock end for forging.
Ball pein hammer	2	1	Used for hammering the punch marks with the centre punch to allow accurate cuts.
Anvil	2	1	This will be used in the forging process when hammering the stock end.
Angle grinder with grinding wheel	2	1	Used to clean up all the cut edges and remove sharp edges.
MIG Welding plant with 1.2mm mild steel wire copper coated	2	1	To fully weld the crown pieces together following the correct settings.
MMA Welding plant with 3mm mild steel electrodes	2	1	To fully weld the remainder of the anchor components following the correct welding positions.

Chipping hammer	2	1	Used to remove the welding slag after the MMA welding process.
Wire brush	2	1	To clean the welds after removing the slag.
Oxygen gas bottle	2	1	Used for the cutting of the components.
Acetylene gas bottle	2	1	Used for the cutting of the components.
Tongs	2	1	Used to hold the stock end during the forging process.
Pillar drill	2	1	Needed to drill the hole for the round bar
Drill bits 3.2mm and 8mm	2	1	Needed to drill the hole for the round bar
110v electromagnetic yoke magnet	3	1	For using during the NDT testing stage to identify any defects using MPI testing.
MPI liquid (magnetic ink)	3	1	For using during the NDT testing stage to identify any defects using MPI testing.
Brush	3	1	To apply evenly the MPI liquid to the selected weld to be tested.
Rags and cleaning supplies	3	1	To clean all weld testing areas.
Computer access	3	N/A	Needed to write up the report and to note all of the measurements once I have quality checked the anchor to ensure it is in line with the drawing specification.
Personal Protective Equipment (PPE)			
Gloves	2 and 3	1 pair	Needed to protect hands from any cuts or scrapes when marking out the materials. Disposable gloves to be worn when handling liquids but not to be worn when using the pillar drill due to risk of entanglement. Welding gauntlets to be worn during hot work.
Safety boots or safety shoes	All	1 pair	Needed to be worn in the workshop to prevent injury to feet if any objects are dropped and to ensure that you can change footwear to prevent dirt being tracked outside of the work area.
Overalls or coat	All	1 pair	Needed to protect yourself and clothing form dirt and debris from the work carried out. Ensure no loose clothing is worn around the drill due to risk of entanglement.
Safety glasses	2	1 pair	Needed to protect eyes from swarf and grinding dust.
Welding helmet	2	1	To protect eyes during welding.
Welding gauntlets	2	1 pair	To protect hands during welding, cutting and forging.
Welding screen	2	1	To protect from the bright welding light.
Dark cutting screen	2	1	To protect from the bright light and sparks during the cutting and forging process.
Technical Information/documentation			
Assignment brief	All	Needed for technical drawings, tolerances and assessment information.	

Calibration record	2 and 3	Needed to check that the equipment used is within calibration and up to date.
Risk assessment	All	This is a document that I will prepare to record the risks and hazards that may occur during the creation of the fabrication and welding of the anchor. I will mitigate against the risks to reduce the likelihood of injury.
User manuals	2	Needed for the pillar drill, MIG and MMA welding plant. Manual or instructions for the Yoke magnet.
COSHH data sheet	2	Needed for the hazardous substances which need to be used to ensure correct safety precautions could be followed, e.g. magnetic ink.
Method statement	2 and 3	This will be used during the tasks to ensure the correct sequence of operations is followed to ensure the quality requirements can be met.
Cutting list	1 and 2	I will create this to plan the individual components to be cut from the raw material to be assembled into the anchor. List will show the required sizes and how many to cut and from which material. Additional notes will be added to aid the fabrication process.
Hot works permit	2	To complete the hot works permit prior to starting any hot works (cutting or welding). Permission to start hot works will only be given by the supervisor if the risk assessment is completed and the work area is correctly set up for hot works.
Quality check sheet	3	Needed to record measurements of finished anchor to check it is within drawing specification and to record the NDT results.
Copies of official guidance	All	Copies of Welding and NDT Standards for reference: BS EN ISO 5817 – Welding – Fusion-welded joints ISO 17638 Non-destructive testing of welds (MPI) ISO 9934-1 Non-destructive testing - Magnetic particle testing - Part 1. (General principles).
General Workshop resources		
Extraction system	2	Workshop extraction system to be used to extract fumes and excess heat from welding and cutting station.
Waste disposal bins	All	Waste to be segregated to ensure all waste is disposed of correctly and to ensure materials can be recycled and hazardous substances are disposed of with registered waste carriers.
First aid kit	2 and 3	Needed in the case of any minor injury when carrying out the task.
Eye wash station	2 and 3	In case of emergencies, access to an eye wash station to treat any eye incidents to minimise injury before seeking medical treatment.
Warning signs and notices	2 and 3	To inform people of required PPE requirements, fire exits, first aid information and any hazards in the workshop such as wet floors spillages etc.
Dust pan and brushes and spill kits	2 and 3	Needed to clean work area and to clear up any spillages that may occur.

Mop and bucket	2 and 3	To clean up any spillages and clean the work area once job has been completed.
Calibration of measuring equipment		
All measuring equipment has been checked for calibration against the workshop record. Last calibration date was November 2021.		

1. Cutting list

Component	Material	Requirements	Quantity	Fabrication notes
Shank	Mild steel flat bar	650mm x 50mm x 8mm with 8mm hole in the middle of the width side but in required position for the stock.	1	Holes need adding to allow the stock to slide through and keep the pieces together.
Flukes	Mild steel plate	340mm x 150mm x 8mm	2	n/a
Flukes support	Mild steel plate	340mm x 30mm x 8mm	2	This is the size to connect to the flukes
Stock	Mild steel round bar	6mm x 530mm	1	n/a
Crown	Mild steel plate	100mm x 100mm x 8mm	2	Each piece to be cut to allow the stock and shank through.
Crown (middle)	Mild steel plate	84mm x 100mm x 8mm	1	Need to take off the 2 thicknesses of the crown which is 8mm on each side.
Other:	n/a	8mm hole drilled in the crown middle, in the centre.	1	Hole to be cut slightly bigger than size of the stock to allow it to slide through.
	n/a	Notches cut to suit the stock piece	2	This is to be determined by the shank size.

Commentary

Note: This commentary covers the resources list and cutting list.

The candidate has interpreted the requirements of the brief and applied their understanding to produce a comprehensive list of resources required, demonstrating technical knowledge of the requirements required for producing the anchor, carrying out the quality inspection and testing the anchor using non-destructive testing equipment.

The candidate has produced a standard cutting list with some additional information to aid them with the measuring and marking out of the components.

The candidate has listed the correct amount of each resource that they have planned to use and has provided a detailed justification. The candidate has correctly indicated the task in which the listed resources will be used. The candidate has also included consideration for other resources that should be available in the workshop, for example, access to a first aid kit and eye wash station.

The candidate has listed a range of supporting technical documentation in order to complete the task and has provided reference to some technical guidance and industry standards.

The candidate has demonstrated planning for safe working by identifying the correct PPE and stating why each piece should be used, for example, the type of gloves to be worn and why they are the preferred type.

1. Risk assessment

Work area

Hazard	Risk	Control	Likelihood	Severity
Slips, trips, and falls	Trips over trailing cables or hoses. Slips from build-up of debris on floor, spillages or items left on floor, personal injury.	Workshop thoroughfare identified by green floor paint always to be kept clear. Floor marking at entrance remind of PPE. Mandatory safety footwear to be worn in the workshop. Ensure no equipment, tools, hoses or cables are left unattended in the work area or encroach the thoroughfare at any time. Ensure area is kept clean and tidy at all times, following good housekeeping.	2	1
Falling or moving objects	Items falling from workbench or equipment causing crushing or impact.	Benches are not cluttered with tools and equipment. Ensure good housekeeping during and on completion of activities. Safety footwear to be worn.	2	1
Hot sparks	Sparks causing burns to feet, chest, or neck. Fire.	Safety footwear and overalls to be worn leaving no gaps between leg and shoes or boots. Fire extinguishers available if hot sparks ignite any combustible materials.	3	2
Electrical energy	Contact with electrical energy, 415v, 240v, and 110v usage. Electrocution.	No jewellery permitted when working in workshop. All electrical connections to be checked prior to and after use. Follow safe isolation procedures.	2	2
Manual handling	Movement or lifting of items without operation being adequately assessed, incorrect manner. Personal injury.	When obtaining equipment and tools ensure awareness of maximum lifting weight. Manual handling training and procedures followed. Use mechanical means of lifting or team lifting for heavy weights.	2	1
Faulty equipment or machinery.	Equipment failure causing new hazards, electrical or mechanical.	Carry out pre-use checks prior to using any equipment to check for any issues or hazards. Any faulty equipment to be locked off and quarantined until a repair is completed. Report any faulty tools or equipment to workshop supervisor to quarantine. Comply with PUWER regulations.	2	1
Liquids, chemicals and substances	Injuries (eyes, skin, lungs), spillages.	Check COSHH data sheet for handling, storage information, usage instructions, storage instructions, disposal instructions prior to use. Wear appropriate PPE when handling and using. Use spill kit to clean	2	1

		up any spillages. Dry floors and surfaces to prevent slips.		
Noise	Hearing damage	If workshop if busy and noise levels are elevated, use ear protection.	2	1

Completing fabrication and welding tasks

Hazard	Risk	Control	Likelihood	Severity
Welding and burning fumes	Inhalation of fumes and gases which cause respiratory illness with continued exposure.	Fume extraction is active when welding, burning, or grinding activities are carried out.	3	1
Ultra-violet and infra-red radiation	Can cause burns to the skin or damage eyes. Arc-eye.	Use of welding bay curtains and screens, mandatory safety glasses worn all times. Wear anti-reflective welding mask or hood when welding. Overalls worn correctly.	2	2
Flammable Gas	Leakage of oxygen or acetylene from joints or hoses.	Pre-user checks made of regulator, hoses and joints to ensure no damage or looseness.	2	1
Hot equipment and parts	Hot material causing burns if touched.	Hot material to be left to cool before removal from burning area and is labelled with chalk to warn others. Equipment isolated from others to prevent accident contact.	3	2
Hot sparks, slag, and chippings	Can cause severe burns when ejected from cutting and welding process.	Materials cleaned prior to burning and materials with a surface coating not permitted. Correct PPE to be worn.	3	2
Manual Handling	Movement or lifting of items without operation being adequately assessed, incorrect manner. Personal injury.	When obtaining equipment and tools ensure awareness of maximum lifting weight. Manual handling training and procedures followed. Use mechanical means of lifting or team lifting for heavy weights.	2	1

Likelihood		Severity	
1	Very unlikely to happen	1	Minor injury
2	Unlikely to happen	2	Major injury
3	Possible to happen	3	Loss of limb
4	Likely to happen	4	Death of an individual
5	Very likely to happen	5	Multiple death

Commentary

The candidate has demonstrated a thorough knowledge and understanding of the different types of risks and hazards associated with fabrication and welding activities. The candidate has considered and identified all the major hazards and associated risks for each of the tasks. The candidate has identified where the workshop set up has a role to play in managing risk, for example, citing the painting of the workshop floor for thoroughfares which is typical in an industrial workshop and the use of a local ventilation or extraction system to extract any harmful fumes or gases which are given off as part of the fabrication process.

The candidate has demonstrated an excellent understanding of the mitigations required that can minimise the risks and hazards and has identified thorough detail for the controls necessary.

The likelihood and severity has also been identified in respect of the hazards and risks occurring based on the welding systems the candidate will be using for the fabrication task.

1. Method statement

Production of the anchor

Firstly, I will obtain the PPE required which includes steel toe capped boots, flame retardant overalls, safety glasses, gloves, and ear protection. I will check each item for any damage and that the PPE is fit for purpose. Should the PPE not be fit for purpose or is damaged, this will be reported to the appropriate person and obtain a replacement. Once checked and wearing the required workshop PPE I can enter the fabrication and welding workshop.

All of the above will be in compliance with both the PPE regulations (Personal Protective Equipment at work Regulations 1992) and the HASWA (Health and Safety at work act 1974).

I will then visually inspect the work area to ensure that it is safe and remove anything that is unwanted out of the vicinity of the work area to mitigate risks and maintain good housekeeping, for example a tool left over from a previous user. I will set up my workstation and hand my completed hot works permit to the supervisor for authority to begin work.

Using the technical drawing I will produce a cut list. I will select and check the materials, in a safe manner using the correct lifting techniques and placing them on a safe, stable surface ready for marking out, being careful not to damage the raw material by dropping it. I will visually check the materials to ensure they are suitable for use. I will remove any corrosion, oil, grease, or paint if present, to prepare them for fabrication.

Only on receipt of my countersigned hot works permit can I start the hot work.

Carefully and accurately, I will produce the markings required for cutting the materials to size, remembering to allow for cut thickness when (oxy-fuel) cutting. This will be completed using the correct marking out techniques including the use of datums, marking from tools such as squares correctly, to help avoid parallax error.

I will then produce the scribe markings required for the plates used for the crown and flukes of the anchor. I will check markings and use a centre-pop to highlight the markings ready for cutting. I will cut the plates using a thermal cutting process (oxy-fuel) applying safe working practices throughout. I will check the accuracy of the cut plates and clean using hand tools and an angle grinder.

I will then produce and check the markings for the notches and correct diameter hole in the crown and, using the correct equipment, produce the notches and hole in the crown side plates, and check for accuracy. I will clean all components using an angle grinder. I will measure the angles for the flukes at 30° to join the shortest side to the highest point (340mm) and cut the flukes to the correct angles using a thermal method.

Once all materials are cut to size, I will check all measurements are accurate and in-line with the cutting list. I will collect the prefabricated components (pin, shackle, and chain) and inspect to make sure they are to desired dimensions. Before fabricating components, I will ensure that the welding equipment for the two processes are safe and set-up correctly. To do this I will check all connections including electrical and gas. I will ensure the welding-bay has adequate lighting and that the extraction is enabled. I will check that I have the correct filter lens in my welding screen and that it is appropriate for the process.

I will begin to fabricate the anchor using the correct fabrication techniques. I will make sure to restrain or pre-set angles to remedy any distortion when using welding processes. I will carefully and accurately assemble the components starting with the three plates used for the stock, producing tack welds that sufficiently hold the plates together using the MIG welding process. I will check for accuracy then produce the welds. I will then repeat the process for the fluke and fluke support.

I will then position the stock, through the crown and use tack welds to secure the flukes with the support, and the shank into position. I will check the fabricated anchor is accurate and position ready for welding the flukes and shank to the stock using the MMA process.

Once all welds are completed, I will visually inspect for surface breaking flaws and visual quality. I will remove any spatter with hammer and chisel and use a wire brush to clean the welds for further inspection. I will prepare the material for the NDT process (MPI) by removing any oil and grease from the surface and position the material ready for applying the iron-filing solvent.

Following the correct COSHH and safe working practice procedures, I will carry out non-destructive testing of the welded sections of the anchor and record quality of welds on the quality check sheet.

On completion of all activities, I will reinstate my workstation, check all tools and equipment are undamaged and return all equipment and tools to correct areas. I will clean my workstation, dispose of any scrap using segregated disposal and complete associated paperwork.

Commentary

The candidate has demonstrated that they can analyse and interpret fabrication and welding requirements by comprehensively and thoroughly analysing the brief and interpreting the technical drawings in order to plan the work and to identify procedures to be followed.

The candidate has demonstrated a thorough understanding of the order the activities should take place. This is sequenced accurate with detail given in each stage in terms of the safety checks, material collection, marking-out of components, checking for dimensions, fabricating, joining, and testing the component.

The comprehensive method statement produced gives a logical and methodical sequence to follow to fabricate the component to the required tolerances, prior to, during and after assembling and welding the product.

The method statement is accurate throughout, detailed, and justified using the correct methods expected at this level for example, ‘use of datums, marking from tools such as squares correctly, this will help avoid parallax error’.

The candidate has correctly included reference to the hot works permit and to only start work on receipt of a countersigned permit. This shows a good understanding of the health and safety considerations prior to starting any hot work.

1. Quality check sheet

Check	Criteria			Comments
Material:				
Stock, crown, shank, flukes, fluke supports				
Component sizing:	**Required dimensions to be met:**	**Finished size (Pre-fabrication):**	**Met**	
Stock	530 mm x 6 mm			
Crown	100 mm high x 100 mm wide at widest point			
Shank	650 mm x base width 50 mm to 25 mm at top			
Flukes	340 mm overall height x 150 mm wide x 240 mm at shortest height side x 30-degree angle to meet top			
Fluke supports	340mm x base width 30 mm			
Hole and notches	8 mm			
Finished anchor height:	730 mm			

Equipment and processes:		
Cutting equipment:		
Abrasive equipment:		

Welding processes:		
Welding process 1	MMA	
Welding process 2	MIG	
Welding positions:		
Position 1		
Position 2		
Welding standard	BS EN ISO 5817	

Non-destructive testing – Magnetic Particle Inspection (MPI)		
Test result:	PASS	FAIL
Weld 1:		
Weld 2:		
Weld 3:		
Result comments or observations:		

Task 2 – Production

(Assessment themes: Health and safety, Production and assembly (Measuring and marking out, Cutting components, Assembly techniques and methods, Tools and equipment).

For task 2, candidates need to produce the following pieces of evidence:

- Fully fabricated and welded anchor consisting of:
    - stock
    - crown
    - shank
    - flukes and support
    - pre-fabricated shackle and chain attached.

For task 2, assessors will need to produce the following pieces of supporting evidence from completing the fabrication activities:

- assessor observation to include:
    - the work area, prior to, during and on completion of fabrication activities
    - preparation of tools and equipment
    - welding and tool skills
    - use of cutting list (noting any changes made)
    - production stages of anchor (marking out, cutting, welding preparation, welding, finishing and final assembly)
    - the application and use of tools and equipment
        - the use of two different welding processes
        - the use of two different welding techniques.

Photographic evidence required:

- Photographic evidence showing the prepared working area – *Illustrated in task 2 photographic evidence section below (photograph 1)*

- Photographic evidence showing marking out and use of measuring equipment - *Illustrated in task 2 photographic evidence section below (photographs 2 - 5)*

- Photographic evidence showing cutting and preparation of cut components - *Illustrated in task 2 photographic evidence section below (photographs 6 - 10)*

- Photographic evidence showing application of welding techniques, showing two different welding processes and two different welding positions - *Illustrated in task 2 photographic evidence section below (photographs 11 - 16)*

- Photographic evidence of the completed anchor (with the pre-fabricated shackle and chain attached) – *Illustrated in task 2 photographic evidence section below (photographs 17 - 18). Note: the shackle and chain have not been attached in this version of the GSEM. Due to material availability and extended procurement process it was not possible to procure these pre-fabricated materials prior to the photographic evidence being created due to time constraints and material availability. For formal*

assessments it will be expected that the complete anchor has the shackle and chain attached

Note: For the purpose of this GSEM additional photographs have been included, however it is not expected that Providers will capture this level of evidence for each candidate. A sample is recommended to show the key points within a process and to highlight any defects or issues encountered etc.

Photographs in this GSEM demonstrate the full process that the candidate has undertaken to complete the anchor. Commentary sections detail where performance is considered to be at a level reflective of a distinction grade.

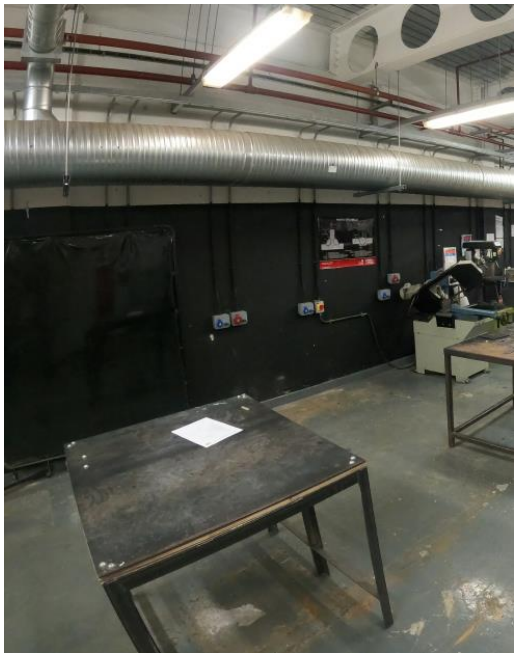
Note, due to the nature of this process, not all individual work activities would provide opportunity to demonstrate a defined level of differentiation beyond a pass – but these images are shown in order to show the cohesiveness of the process being undertaken, and to draw out where differentiation is possible.

*Due to safety considerations it was not possible to fully capture the welding processes being used. Assessors should apply direct observation at the time of the assessment to ensure the welding processes are correctly applied.

2. Photographic evidence – Production of the anchor

Preparing the work area (Photograph 1)

Photograph 1 – showing the work area prior to activities being started. Photograph shows clear area around the work bench, no excess materials or equipment, floor is clean and clear of any debris.



Marking out and use of measuring equipment (Photographs 2 – 5)

Photographs 2 and 3 - showing the candidate marking out using their selected measuring equipment. The candidate selected an engineer's rule and a scribe.

Photograph 4 – showing the candidate has planned the marking out of the components and has made the best use of the material, no excessive wastage.

Photograph 5 – showing the candidate using steel rule, scriber, square, correct hammer and centre-pop to mark the steelwork accurately. Photograph shows a clean, ordered work space, materials are sufficiently supported when marking out. Materials cleaned prepared for the marking process.

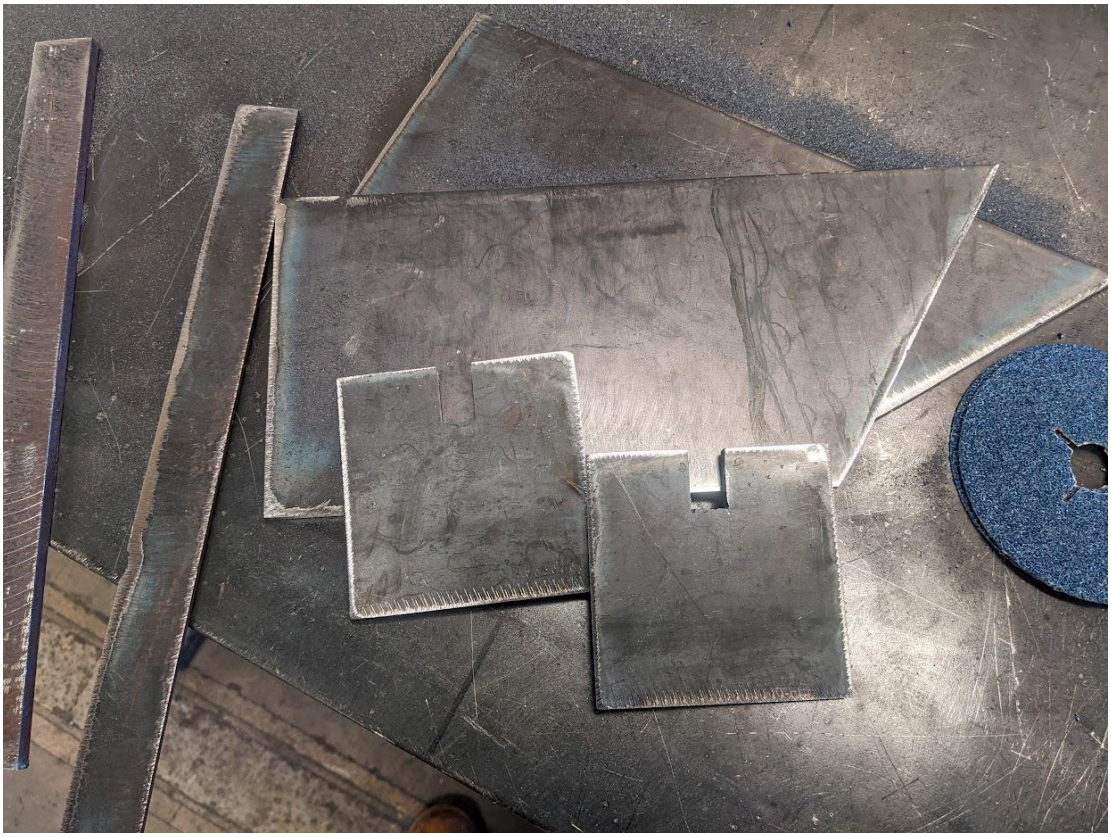
No pieces of equipment present that are not required at this stage. Correct use of equipment.

Cutting and preparation of cut components (Photographs 6 – 10)

Photograph 6 and 7 – showing the candidate using oxy-fuel (acetylene) cutting process safely. Full PPE always worn and completed cuts accurately.

Photograph 8 – showing the candidate cutting the components, using the scribe marks to guide the cutting torch.

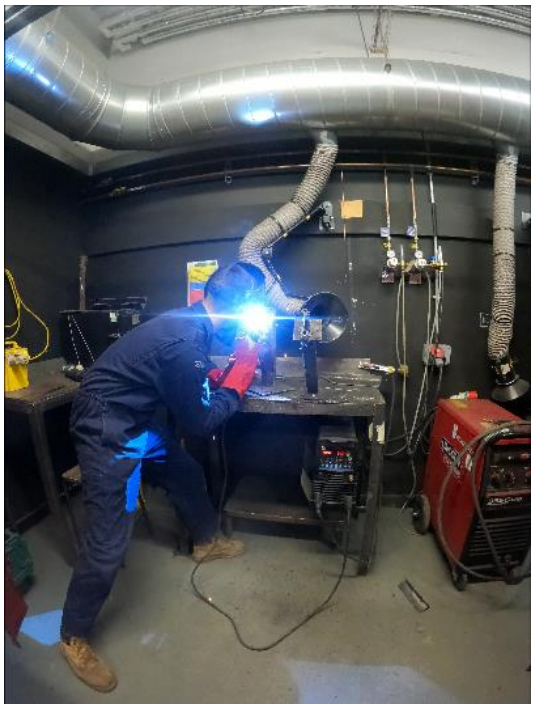
Photograph 9 – showing the result of the cutting process. The correct cutting method was adopted for the material. The material was supported correctly throughout to ensure safety and accuracy. Materials were marked to reduce scrap (nested) and minimal off-cuts.



Photograph 10 – showing the result of the preparation process. The edges of the cut material were correctly dressed well using appropriate tools including a hammer, chisel, wire brush, and angle grinder, to prepare the components for welding.

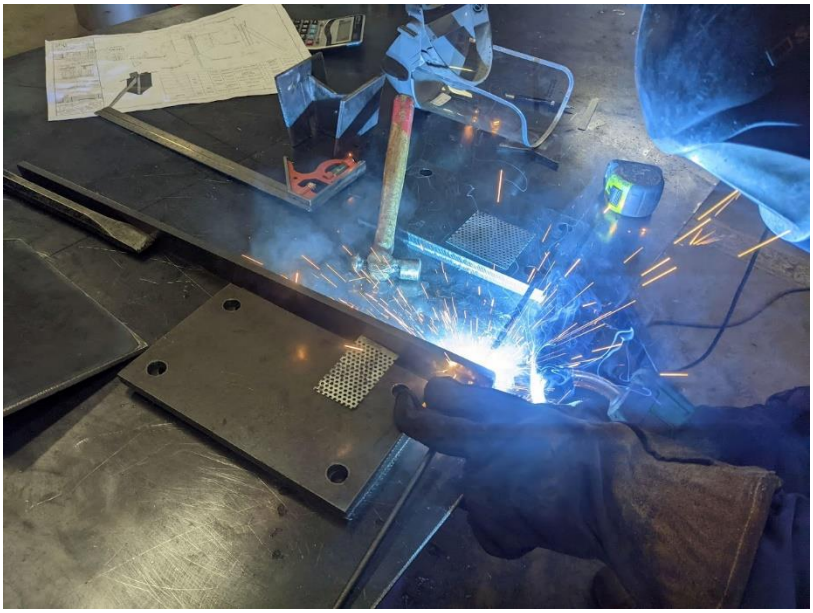
Application of welding techniques and demonstrating two different welding processes and two different welding positions (Photographs 11 – 16)*

Photograph 11 – showing application of the MMA welding process, using PF position (vertical).



Photographs 12 and 13 – showing application of welding process 2 (MIG) in PA position (flat). Candidate is wearing full protective equipment and the work area is organised. Safety protocols are being followed; welding curtain is closed.

Photograph 14 - showing the welding application, workpiece is secured on the welding table. Full protective equipment is worn.



Photographs 15 and 16 – showing the candidate carrying out in-production checks to ensure the components have been welded square and are at the correct size.

Fabricated anchor (Photographs 17 – 18)

Photographs 17 and 18 – showing the fabricated anchor.

2. Practical observation form – Preparation and reinstatement of the work area

Assessment ID	Qualification number
8713-334	8713-334
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Health and safety Planning and preparation

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Preparation	The candidate collected their PPE, completing checks for condition and functionality. Using their risk assessment, they completed checks on their immediate workstation, cleaning the surface from debris, waste disposed of in designated bin. Welding table checked for stability and function, deemed fit for purpose. Lighting checked. Hot works permit filled out and handed it to the workshop supervisor for countersigning. Candidate checked the local exhaust ventilation system was enabled and ready for use. Resources list and method statement used to set up workstation with resources. Resources collected for first task only, visual and condition checks completed on each. Logical and efficient set up. No excess equipment on the workstation. The work area was prepared promptly.
During and reinstatement	During tasks excess equipment was returned to storage when no longer needed. All tools and equipment cleaned and checked. No buildup of materials in the work area. All hoses and cables kept within the workstation area. All welding equipment and tools returned to storage after units and parts were at room temperature. Immediate work area and surrounding floor area swept clean of debris. All used materials, offcuts and debris disposed of in the correct waste bins. Surfaces cleaned. All ancillary equipment checked for damage before returning to stores. All cables and hoses stored correctly.

Assessor signature	Date
Assessor A	**17.11.21**

Commentary

The evidence shows the candidate has demonstrated a thorough understanding of how to safely prepare the work area and to reinstate the work area on completion of the fabrication and welding activities.

The candidate demonstrated comprehensive understanding of the need to follow processes and procedures, for example, ensuring a hot works permit was completed and submitted prior to any hot works being carried out and to ensure that the ventilation system was working to remove any fumes created by the welding process.

The candidate referred to their risk assessment and method statement to ensure all set up and safety requirements had been covered. This allowed the candidate to plan each task accurately and allow for the correct selection of equipment at each stage. The demonstrated a logical approach to selecting their equipment, for example, only selecting the tools and equipment needed for the first task to avoid crowding the workstation and then returning them to storage when they were no longer needed. This enabled the candidate to work efficiently.

The work area was returned to original condition with all tools and equipment returned to correct storage facilities, disposal of waste was carried out taking into account all of the disposal requirements and waste regulations.

2. Practical observation form – Preparation of tools and equipment

Assessment ID	Qualification number
8713-334	8713-334
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Health and safety Planning and preparation Production

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Preparation of tools and equipment	The candidate checked their resources list and method statement, sourcing resources required from the stores; in the order they were needed. Candidate methodically completed thorough visual and serviceability checks, one at a time for of all the tools and equipment. All tools and equipment checked for cleanliness, any previous debris or dirt removed and disposed of correctly. One hose was found to be faulty, this was reported to the supervisor, marked accordingly and taken out of use following the workshop procedure. The candidate completed a thorough inspection of the welding equipment, visually checking the condition of the cables and completed condition checks for any breaks or blockages or twists which may affect the flow. No issues found. Completed visual and serviceability checks on all electrical and gas connections. Performed a gas leak test on the oxy-fuel equipment. An isolation procedure was applied throughout. Functionality check made on the workshop extraction system in the welding bay. Visual and serviceability checks completed on all specialist welding PPE including welding hood and the correct screen filters were in place. Welding curtain checked for serviceability. Hoses and cables kept within welding bay. All equipment set up according to the user manual. All consumables checked for suitability for the raw material.

Assessor signature	**Date**
Assessor A	**17.11.21**

Commentary

The observation evidence shows the candidate has demonstrated an excellent understanding of the planning, preparation, and correct use of tools and equipment.

With the work area already prepared, the candidate has safely prepared a comprehensive range of materials, components and resources selected with detailed evaluation of preparatory checks for working condition, serviceability and feasibility. The candidate has given consideration for safe isolation and calibration checks on all listed tools and equipment.

The candidate carried out appropriate checks on the equipment, ensuring the tools and equipment were safe for use, making assured judgement at each stage and inspecting each prior to use. The candidate made checks on the consumables to ensure they were suitable for the raw material, showing a comprehensive knowledge of both the material properties and the consumables used within the welding processes. The candidate demonstrated a comprehensive understanding of procedures, for example, by taking steps to remove a split hose from use, marking it up and taking it out of use.

The candidate demonstrated a comprehensive knowledge and understanding of the need for health and safety, for example, gas leak checks were applied when using the oxy-fuel process and they ensured that appropriate extraction was employed prior to cutting materials and electrical connections to the welding machines were carried out and all hand-tools were checked for damages prior to use.

2. Practical observation form – Marking out process

Assessment ID	Qualification number
8713-334	8713-334
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Health and safety Production

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Marking out materials	The candidate first referred to their method statement and cutting plan to check the order for marking out the required materials. Marked out each component accurately on the raw material, using an engineer's steel rule, engineer's square and a scribe. Used correct measurement and marking techniques. Positioning good, avoided excess waste material by nesting the plates. All measurements were checked for accuracy. The candidate checked that the plates were square, making minor adjustments. Datum edge used throughout and used centerlines to check accuracy. Centre pop marks used to highlight the scribed lines to make the cutting marks more visible which is good practice, aided accuracy when cutting. Preciseness of marks regularly checked prior to cutting materials using corner to corner method.
Use of measuring equipment	Appropriate tools and equipment for marking out were selected. Each tool inspected prior to use for serviceability and condition. All measuring equipment was free of any residual dirt prior to use.

Assessor signature	**Date**
Assessor A	**17.11.21**

Commentary

The candidate has demonstrated a comprehensive understanding of the application and use of relevant technical information to measure and mark out each of the components, for example, referring back to their method statement and cutting plan.

The evidence shows the candidate has a comprehensive knowledge and understanding of measuring and marking out processes. The candidate has used correct marking out techniques and attention to detail was applied when marking materials, using the correct equipment and checking measurements twice, using datums and squared edges to achieve this. Measurements are accurate and consideration was given to material waste, for example, positioning the individual components on the raw material to ensure no excess waste was created during the marking out process.

The candidate demonstrated a knowledge of tool selection, for example, the candidate chose the tools that were appropriate to achieve closer accuracy. For instance, for marking the components the candidate chose a scribe over a piece of chalk, though both are fine, the scribe scores the material resulting in more accuracy. The candidate also chose to use an engineer's steel rule for measurements over a tape measure as the steel rule is manufactured to a higher accuracy.

2. Practical observation form – Cutting out and preparing components for fabrication and welding

Assessment ID	Qualification number
8713-334	8713-334
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Health and safety Production

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Task	**Notes** – *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Cutting out	The candidate set up their work area and referred to their risk assessment and method statement before selecting the equipment required for oxy-acetylene cutting. The candidate correctly prepared the equipment and performed safety checks prior to lighting the cutting torch. The candidate correctly selected a neutral flame. The candidate used the cutting torch to heat the metal to its kindling temperature, before applying the oxygen. The candidate proceeded to cut the components from the steel, following closely the scribed lines, keeping the cutting torch at the correct angle and distance from the surface of steel. The candidate worked methodically when cutting the material to produce good quality cuts. The candidate adopted a good stance when holding the torch, keeping the torch away from the body and their hands away from the hot tip at all times. The candidate completed regular in-production checks, checking the accuracy of the cuts and dimensions of the cut pieces prior to starting the preparation.
Preparing cut components for welding	The candidate referred to their risk assessment before selecting an angle grinder and wheels to clean and abrade the cut edges. The candidate checked the grinder and the condition of the selected wheel before use. All cut edges were prepared to the required standard with all burrs removed. No corrections were needed. The candidate clamped the cut pieces to the table, checking the cut piece was secure before starting the grinding. The candidate used the appropriate angle, speeds and pressure for the wheel when applying the grinder to the surface, resulting in an even finish. All cut edges were

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Health and safety	prepared to the required standard. The candidate checked the abraded edges and checked the final dimensions of the components. The candidate performed serviceability and condition checks before using the cutting and grinding equipment. The candidate wore the correct PPE (welding jacket, no exposed skin, ear plugs, dry gloves, eye protection) for the task. Fume extraction was used during the activity. The grinder was held correctly using two hands at all times.

Assessor signature	**Date**
Assessor A	**17.11.21**

Commentary

The candidate has demonstrated a comprehensive understanding and application of the process to cut each of the components from the raw material and then prepare the cut components for fabrication and welding.

The candidate followed health and safety procedures at all times and correctly checked the equipment prior to use showing a good understanding of health and safety and the importance of working safely, for example, checking their risk assessment before starting both cutting and grinding activities and adopting a good stance when using the cutting torch, keeping the torch away from the body and hands clear of the hot tip.

The candidate demonstrated very good cutting skills and techniques which resulted in all components being completed on the first attempt with no additional work required to prepare the cut pieces for fabrication. The candidate demonstrated very good accuracy with their cutting and grinding skills resulting in no size discrepancies of the cut pieces.

In-production checks were carried out throughout and all dimensions and tolerances were met.

2. Practical observation form – Welding and tool skills

Assessment ID	Qualification number
8713-334	8713-334
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Health and safety Production

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Application of welding processes and welding positions	All welding equipment had been prepared according to manufacturer's recommendations. Correct PPE was worn throughout. The welding process using Metal Inert Gas (MIG) was carried out using good technique. The candidate correctly identified and selected the gas to be used for the material, flowrates and set the correct amperage for the welded position. Appropriate filler wire size chosen. Welded in the PA Position (flat) using the correct travel speed and gun angle throughout. Creating a straight bead. Welds appeared to be free from any surface flaws or defects. No areas of excessive welding were observed. The candidate allowed for distortion of plates by pre-setting the angle and using the heat to pull the material exactly where it was required to be. This shows really good understanding and skill. The welding process using Manual Metal Arc (MMA) equipment was carried out to a very high standard. All electrical connections checked, and the welding bay curtain kept closed. The candidate referred to the correct gas pressures to protect the arc from weld defects. The candidate demonstrated the PF position (vertical). Correct electrode angles and travel speed. Appropriate electrode flux and size for the appropriate amperage. The welding technique adopted was accurate in terms of travel speed and electrode angle to the parent plates.
Finishing the welds	The candidate cleaned the welds using a chipping hammer and a wire brush. Good clean welds observed. Welds appeared to be free from any surface flaws or defects. No areas of excessive welding observed.

Assessor signature	**Date**
Assessor A	**17.11.21**

Commentary

The evidence shows the candidate has demonstrated effective joining and bonding techniques and methods to produce the fabrication. The candidate has demonstrated exemplary technical practical skills using two different welding processes and two different welding positions, for example using MIG and MMA welding processes and demonstrating both PA (flat) and PF (vertical) positioning.

The candidate has demonstrated safe working practices and has made informed and appropriate choices for tools and equipment, for example, ensuring the welding curtain was kept closed to prevent a hazard to others in the workshop.

The candidate has demonstrated a comprehensive understanding of welding processes and techniques and positioning to achieve a quality weld, for example, ensuring the correct equipment parameters had been set to avoid any over welding and by pre-setting the angle and using the heat to pull the material where needed.

Welding techniques and methods used resulted in a fabrication with no areas of excessive welding. The candidate removed any welding residue from the welds and anchor to achieve a good quality finish with no areas of visible surface defects.

Task 3a – Quality review and testing

(Assessment themes: Health and safety, Quality testing, review and evaluation (quality testing, quality review, reporting, recording and handover)

For task 3a, candidates need to produce the following pieces of evidence:

- completed check sheet with NDT results recorded.
- assessor observation to include:
    - use of measuring equipment
    - application of non-destructive testing method
    - quality checks
    - review of work area.

Photographic evidence required:

- Photographic evidence of the quality review being undertaken – *Illustrated in task 3 photographic evidence section below (photographs 15 - 19).*

- Photographic evidence of the non-destructive testing process used - *Illustrated in task 3 photographic evidence section below (photographs 20 - 21).*

Photographs in this GSEM demonstrate the full process that the candidate has undertaken to complete the anchor. Commentary sections detail where performance is considered to be at a level reflective of a distinction grade.

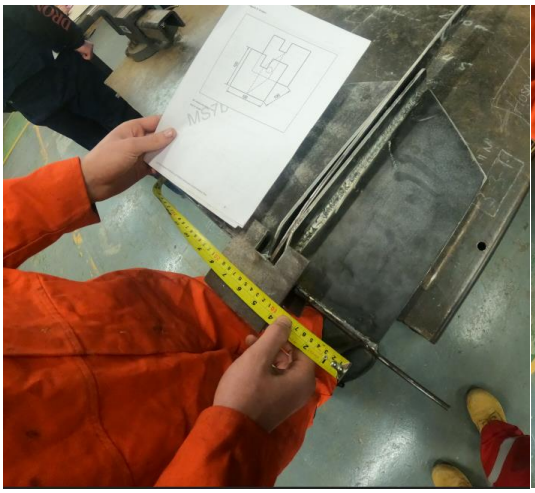
Note, due to the nature of this process, not all individual work activities would provide opportunity to demonstrate a defined level of differentiation beyond a pass – but these images are shown in order to show the cohesiveness of the process being undertaken, and to draw out where differentiation is possible.

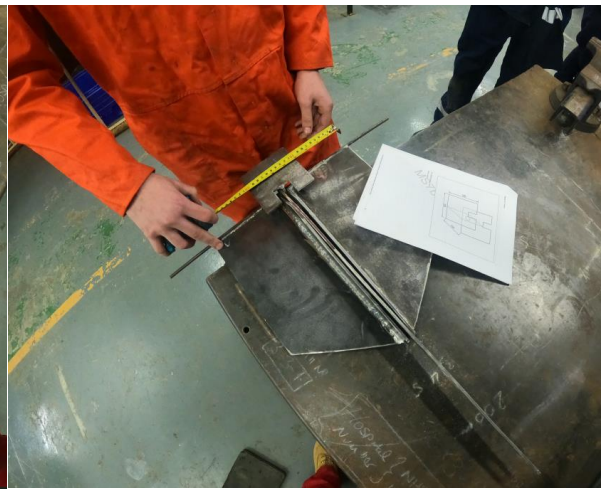
**It was not possible to fully capture the MPI process being used. Assessors should apply direct observation at the time of the assessment to ensure the MPI process is correctly carried out.

3a. Photographic evidence - Quality review and testing

Photographs 19 – 21 show the quality review being undertaken.

Photographs 19 and 20 – showing the quality review process being undertaken. The correct method of measuring and checking tolerance, using a metal tape measure from 100mm and checking against the drawing and quality criteria.





Photograph 21 – showing a close up of the finished welds, good straight welds, welds cleaned and finished with no excess material.

Photographs 22 – 23 show the application and result of using the magnetic particle inspection (MPI) non-destructive testing method.**

Photographs 22 and 23 - showing magnetic particle testing method process used. Note: MPI test showed zero defects and with a high-quality weld. The white spray has been applied evenly and the magnet applied to the areas selected for weld testing.

3a. Completed quality check sheet

Check	Criteria			Comments
Material:				
Stock, crown, shank, flukes, fluke supports	6mm mild steel plate 6mm mild steel round bar 10mm mild steel flat bar			Pin, shackle and chain all pre-fabricated
Component sizing:	**Required dimensions to be met:**	**Finished size (Pre-fabrication):**	**Met**	
Stock	530 mm x 6 mm	530 mm x 6 mm	✓	Item measures accurately and within tolerances required
Crown	100 mm high x 100 mm wide at widest point	100 mm x 100 mm	✓	
Shank	650 mm x base width 50 mm to 25 mm at top	650 mm x 50 mm base, top 25 mm	✓	
Flukes	340 mm overall height x 150 mm wide x 240 mm at shortest height side x 30-degree angle to meet top	340 mm x 240 mm 30 degree angle to top	✓	
Fluke supports	340mm x base width 30 mm	340 mm x 30 mm	✓	
Hole and notches	8 mm	8 mm	✓	Hole drilled to 8 mm to enable clearance for the stock.
Finished anchor height:	730 mm	730 mm	✓	
Equipment and processes:				
Cutting equipment:	Oxy-acetylene ~~Shears~~			Shears not required.
Abrasive equipment:	Angle grinder Grinding disc Wire brush			Also used a ball pein hammer to forge the ends of the stock.
Welding processes:				

Welding process 1	MMA	NA
Welding process 2	MIG	NA
Welding positions:		
Position 1	PF (Vertical) – using MMA process	Correct techniques adopted to ensure fusion into parent plates
Position 2	PA (Flat) – using MIG process	Correct set-up of machinery, variables accurately selected
Welding standard	BS EN ISO 5817	

Non-destructive testing – Magnetic Particle Inspection (MPI)		
Test result:	PASS	FAIL
Weld 1: Crown 1	✓	
Weld 2: Crown 2	✓	
Weld 3: Fluke	✓	
Result comments or observations: The MPI test was carried out on the 3 welds listed. Correct PPE was worn throughout. COSHH regulation procedures were followed when handling the MPI equipment and solution. The results identified that there were no surface, or subsurface defects or flaws present in the welds that were tested - and therefore the welds have passed the quality inspection. Overall condition of anchor is good quality finish, some minor defects to surface but does not detract from the finished appearance. Some scratches to the steel and one area with scorch mark which could be improved.		

3a. Practical observation form – Quality inspection and testing

Assessment ID	Qualification number
8713-332	8713-332
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Quality testing, review and testing

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Task	Notes – *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Quality inspection and application of measuring equipment	The candidate selected appropriate measuring equipment, checking the calibration record. They completed a thorough visual inspection of the anchor. All dimensional checks completed. Appropriate methods used to measure the anchor. All dimensions and findings recorded on their quality check sheet. All tolerances met. Measuring tools used with good accuracy; candidate completed a brief calibration check before use. Some minor surface defects identified and recorded on the quality check sheet.
Non-destructive testing (NDT)	The candidate correctly set up the MPI testing equipment, referring to the manufacturer's information and their risk assessment. Three welds were selected for testing (Crown 1, Crown 2 and Fluke). Tests completed for each selected weld according to NDT procedures. Good use of testing equipment, successful tests. Crown 1 and Crown 2 showed no sub-surface defects. The test on the Fluke weld showed a small sub-surface defect. Appropriate PPE was worn throughout. COSHH data sheet was checked before handling the MPI solution. Work area was reinstated, all waste disposed of in accordance with workshop procedures. NDT equipment was thoroughly cleaned and returned to storage.

Assessor signature	Date
Assessor A	18.12.2021

Commentary

This commentary also covers the completion of the quality check sheet.

The observation evidence has captured that the candidate undertook a comprehensive quality inspection of the completed anchor.

They utilised measuring equipment to complete the checks on each of the components to record the final dimensions and to check for compliance with tolerances against the brief. All dimensional checks and a surface check for defects, recording their findings on their check sheet. The candidate has utilised the quality check sheet template from task 1 and has made no changes to the form showing a good understanding of planning and what is required for a quality check. The check sheet contains a comprehensive level of information, is set out clearly and shows the candidate has recorded the findings and provided additional comments from their quality inspection and testing.

All dimensions and components were checked for accuracy against the dimensions and tolerances in the given specification and recorded. All dimensions were within the given tolerances.

All detectable surface defects were identified, recorded and attributed to a process or procedural deficiency. For example, some scratches within the raw material and a scorch mark from the torch.

The candidate demonstrated Magnetic Particle Inspection (MPI), a Non-Destructive Testing (NDT) method on three welds to check for sub-surface defects or flaws. No sub-surface defects were found showing a high-quality weld had been produced.

Health and safety was good for this task, PPE was worn and all health and safety procedures followed and good reference to the risk assessment.

Task 3b – Evaluation and recording

(Assessment themes: Quality testing, review and evaluation (quality testing, quality review, reporting, recording and handover)

For task 3b, candidates need to produce the following piece of evidence:

- quality inspection report.

Candidate evidence

3b - Quality inspection report

Introduction

The assignment brief was to produce an anchor for a small boat. On completion of the production, the anchor would be quality inspected and the integrity of the welds would be tested using a non-destructive testing (NDT) method, as specified in the brief, to check the welds conformed to industrial welding standard BS EN ISO 5817.

Fabrication and welding processes

To produce the anchor, I followed a series of standard fabrication and welding processes which included measuring and marking out, cutting and grinding the components for welding and the welding of the components to form the anchor.

The anchor was fabricated out of mild steel. The anchor consisted of a number of individual components including a stock, crown (in two parts), shank, flukes and fluke supports. These components needed to be fabricated and then welded together to form the anchor.

Each component was fabricated following the same process. The process was to first mark out the mild steel with the required dimensions using the cutting list and technical drawings for reference. To do this I used a scribe, steel rule and engineer's square to make the initial marks on the raw material which were then confirmed using a ball pein hammer and centre punch to create clear lines for the oxy fuel cutting. Each component was cut out from the steel using oxy-acetylene torch. Each cut piece was abraded using an angle grinder, ensuring the edges to receive a weld were prepared thoroughly to enable a good weld to be established. Notches were cut into the crown pieces and the shank was drilled using the pillar drill to enable the stock to be fitted.

The components were then assembled to form the anchor using both MMA and MIG welding processes and a series of vertical and flat welding techniques. The ends of the stock were heated using oxy-acetylene equipment and a forging hammer was used to create a rounded edge using and a hammer to prevent the stock from sliding out. On completion of the welding, the anchor was cleaned of any welding residue using a chipping hammer and wire brush.

Quality inspection

A full quality inspection was carried out on the fabricated anchor. This included a visual check; dimensional accuracy check and non-destructive testing (NDT).

I prepared my work area and collected my measurement tools and my quality check sheet to record my findings on. Firstly, I completed a visual check of the completed assembly to identify any visible surface defects. There were no obvious breaks visible in the welds and there was no excess weld material left from the welding process. The overall finish was good, no obvious signs of warping. One area had a small scorch mark. There was some minor marks and light scratches on the steel, but this did not detract from the overall finish or performance of the anchor.

I performed a dimensional accuracy to check that the finished dimensions of the anchor. I selected a steel tape to measure which had been calibrated. Each component was measured. All measurements were checked twice to confirm the final dimensions and these were recorded on the quality check sheet, along with my observations. All dimensions were within the given tolerances.

A copy of my quality check sheet is included below:

Check	Criteria			Comments
Material:				
Stock, crown, shank, flukes, fluke supports	6mm mild steel plate 6mm mild steel round bar 10mm mild steel flat bar			Pin, shackle and chain all pre-fabricated
Component sizing:	**Required dimensions to be met:**	**Finished size (Pre-fabrication):**	**Met**	
Stock	530 mm x 6 mm	530 mm x 6 mm	✓	Item measures accurately and within tolerances required
Crown	100 mm high x 100 mm wide at widest point	100 mm x 100 mm	✓	
Shank	650 mm x base width 50 mm to 25 mm at top	650 mm x 50 mm base, top 25 mm	✓	
Flukes	340 mm overall height x 150 mm wide x 240 mm at shortest height side x 30-degree angle to meet top	340 mm x 240 mm 30 degree angle to top	✓	
Fluke supports	340mm x base width 30 mm	340 mm x 30 mm	✓	
Hole and notches	8 mm	8 mm	✓	Hole drilled to 8 mm to enable clearance for the stock.
Finished anchor height:	730 mm	730 mm	✓	

Equipment and processes:		
Cutting equipment:	Oxy-acetylene ~~Shears~~	Shears not required.
Abrasive equipment:	Angle grinder Grinding disc Wire brush	Also used a ball pein hammer to forge the ends of the stock.
Welding processes:		
Welding process 1	MMA	NA
Welding process 2	MIG	NA
Welding positions:		
Position 1	PF (Vertical) – using MMA process	Correct techniques adopted to ensure fusion into parent plates
Position 2	PA (Flat) – using MIG process	Correct set-up of machinery, variables accurately selected
Welding standard	BS EN ISO 5817	

Non-destructive testing – Magnetic Particle Inspection (MPI)		
Test result:	PASS	FAIL
Weld 1: Crown 1	✓	
Weld 2: Crown 2	✓	
Weld 3: Fluke	✓	
Result comments or observations: The MPI test was carried out on the 3 welds listed. Correct PPE was worn throughout. COSHH regulation procedures were followed when handling the MPI equipment and solution. The results identified that there were no surface, or subsurface defects or flaws present in the welds that were tested - and therefore the welds have passed the quality inspection. Overall condition of anchor is good quality finish, some minor defects to surface but does not detract from the finished appearance. Some scratches to the steel and one area with scorch mark which could be improved.		

I confirm the above is a true reflection of my work.

Signature:	Date:
Candidate A	18.12.2021

Non-destructive testing (NDT)

To test the integrity of the welds and to confirm the welds met quality standard BS EN ISO 5817, I used the Magnetic Particle Inspection (MPI) NDT method. MPI is a very effective method for locating surface breaks and shallow sub-surface defects in welds. MPI works by magnetising the area to be tested with a 110v AC handheld yoke magnet. Magnetic ink (iron powder particles in a liquid carrier base) is brushed over the chosen weld, the iron particles within the ink will group where a defective weld is detected and give a visible indication. Using a removable paint can help contrast the results against the bare metal.

I referred to ISO 9934-3, the industry standard for MPI equipment, before selecting the MPI equipment from the stores. I set up the equipment according to the user instructions and checked the COSHH data sheet for the MPI fluid (magnetic ink). I selected three welds to test using this process. These include two on the crown as it was a complex assembly and one on the flukes.

The MPI test result showed that all the selected welds had no surface or sub-surface defect and had passed and were to BS EN ISO 5817 standard. The results were recorded on the quality check sheet. The anchor was then demagnetised and cleaned of all MPI fluid and residue.

Evaluation

The production and fabrication of the anchor went well. I did not experience any difficulties with the fabrication or welding.

If I were to repeat this assessment I would want be more thorough when using the oxy-acetylene and welding guns to avoid causing any surface defects from occuring during the fabrication. For example, the scortch mark on the anchor could have been avoided if I had taken more time. I would also pay more attention to the selection of the raw material, being careful to avoid any pieces that have visible scratches that could not be easily rectified. For example, marking out the components on a clean area, but this would impact on the waste created and may not be cost effective.

Conclusion

The design for the anchor is good and would be suitable for the purpose it was intended.

The processes are standard procedures for this sector and are fit for purpose. However, I would suggest an improvement to the design team which would be to supply all the required dimensions for the anchor, for instance, the size of the notches on the crown as this was not stated and took extra time to set out to the correct size. If they provided all the dimensions the process could be more time efficient and if the design was to be mass manufactured, the notches would be standardised.

The MPI NDT method was easy to set up and being portable helped with the iregular shape of the anchor. Other NDT methods could be used to test the welds, for example, dye pentrant testing but due to the complex design of the crown this might not work well to get the dye pentrant to the areas to be tested which could result in an inaccurate result.

Commentary

The candidate has given a comprehensive description of the processes and techniques undertaken to produce the anchor and the process of performing the quality testing and non-destructive testing method.

The candidate did not experience any difficulties with either the production of the anchor or the quality testing process. The candidate has shown a comprehensive understanding of the testing process and has referred to relevant legislation within their report relating to the use of Magnetic Particle Inspection (MPI) equipment showing a knowledge of industry standards.

All results and information was recorded on their quality check sheet. Evaluation is comprehensive and the candidate has identified some improvements to their own performance including taking more time to ensure their cutting and welding techniques were accurate and did not cause any surface faults or defects, citing the scorching of the metal.

The candidate has suggested an improvement for the design which is to include all the dimensions for the anchor, specifically standardising the notches on the crown. The candidate has suggested that if all the measurements were provided by the designer in the brief, the production efficiency could be improved. This demonstrates a comprehensive understanding of additional factors which could affect the implementation of the design on a larger scale.

The report is well structured with an introduction, overviews for the processes followed to fabricate the anchor, quality inspection and non-destructive testing, evaluation and conclusion.

The report contains the appropriate information and uses the correct technical terminology throughout. The report contains reference to the two industrial standards which includes BS EN ISO 5817 and ISO 0034-3 showing a good understanding of the standards which must be met when using non-destructive testing (NDT).

Task 3c – Handover meeting

(Assessment themes: Quality testing, review and evaluation (quality review, reporting, recording and handover).

For task 3c, candidates must provide the following materials:

- completed anchor assembly (from task 2)
- quality inspection report (from task 3b).

For task 3c, assessors will need to produce the following pieces of supporting evidence:

- assessor observation:
    - handover meeting.

Video evidence

- video evidence showing the handover meeting.

The following task 3c supporting evidence has not been included for this version of the GSEM:

Video evidence

- video evidence showing the handover meeting.

3c. Practical observation form – Handover meeting

Assessment ID	Qualification number
8713-334	8713-334
Candidate name	**Candidate number**
Candidate A	CG12345
Centre name	**Assessment theme**
City & Guilds	Quality testing, review and evaluation

Complete the table below referring to the relevant marking grid, found in the assessment pack. Do not allocate marks at this stage.

Task	**Notes –** *detailed, accurate and differentiating notes which identify areas of strength and weakness are necessary to distinguish between different qualities of performance and to facilitate accurate allocation of marks once all evidence has been submitted.*
Handover meeting	The candidate explained their given brief and comprehensively justified the methods of marking-out procedures adopted, and cutting methods used to produce the components. They explained the benefits of both welding processes used to join the components. They explained the MPI results and how the process works to identify defects or flaws for surface and sub-surface discontinuities. They shared their results, pointing to the welds on the anchor that were selected and tested. The candidate demonstrated a good understanding of the MPI process and its use in NDT testing. They referred to the technical drawings, the given tolerances, and quality procedures throughout discussion to confirm or reiterate points made. They used correct terminology throughout and referred to the adherence and meeting of industry standard BS EN ISO 5817. They explained what they had done through each stage of the process and justified the reasons behind the methods adopted. They provided detail about what they felt they could improve if they were to complete the task again and suggested an improvement to be made if the company was to consider mass producing this anchor, explaining why all dimensions should be specified by the designer in the brief They displayed professionalism throughout the meeting, using good communication skills throughout the meeting. They presented the completed anchor and the quality inspection report. They also supplied their completed quality check sheet.

Assessor signature	**Date**
Assessor A	**19.11.2021**

Commentary

The observation report details that the candidate conducted a comprehensive handover meeting and supplied all the required evidence for the supervisor to review.

The candidate gave comprehensive descriptions of the processes and techniques undertaken to produce the anchor, detailing any inconsistencies and suggesting preventative measures for future production. The candidate has considered an improvement that could be made to future production to improve the overall efficiency of the production process by standardising the notch dimensions.

The observation report comments on the candidate's ability to communicate using good communication skills and that the candidate is able to approach and speak with supervisor using correct terminology throughout and made reference to industry standards.

The T Level is a qualification approved and managed by the Institute for Apprenticeships and Technical Education.