Skills Proficiency awards in Basic Fabrication, Welding and Pipework

City & Guilds

www.cityandguilds.com

Skills Foundation Certificate (Basic Engineering Skills) 3528
Skills Proficiency Certificate (Basic Fabrication, Welding and Pipework) 3529
Syllabus
Assessments
Programme guidance notes

General information about City & Guilds is available on our website
www.cityandguilds.com

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Contents

Contents
continued

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About City & Guilds

We provide assessment and certification services for schools and colleges, business and industry, trade associations and government agencies in nearly 100 countries. We have over 125 years of experience in identifying training needs, developing assessment materials, carrying out assessments and training assessment staff. We award certificates to people who have shown they have mastered skills that are based on world-class standards set by industry. City & Guilds International provides a service to customers around the world who need quality assessments and certification.

Introduction to this programme

We have designed the Skills Proficiency awards to provide a broad introduction to essential practical skills for those undergoing training or employed in these areas of work.

There are two related levels:
Skills Foundation Certificate Skills
Proficiency Certificate

We do not say the amount of time a candidate would need to carry out the programme. We award certificates and diplomas for gaining and showing skills by whatever mode of study, and not for periods of time spent in study.

We recommend that candidates achieve the Skills Foundation Certificate before attempting the Skills Proficiency Certificate.

About this booklet

This booklet is designed to be used by:

- Candidates
- Instructors
- Assessors
- Verifiers
- Centre co-ordinators
- Employers

It provides all the information required to understand and take part in the Skills Proficiency awards, and conduct suitable training and assessment in accordance with City & Guilds' regulations, policy and practice.

How to offer this programme

To offer these awards you must get approval from us.

There are two categories of approval.

Qualification approval
We give approval to offer a training and assessment course based on this syllabus.

Examination centre approval
We give approval to enter candidates for practical assessments.

To be approved by us to offer a training and assessment course you must send a completed application to your local City & Guilds office.

To enter candidates for assessment you must be approved by us.

Approved centres must provide suitable facilities for taking practical assessments, secure places to keep assessment materials, and will have an appointed external verifier to review practical work.

After we have received and accepted an application, we will send an approval letter confirming this.

Please note that in this section we have provided an overview of centre approval procedures. Please refer to the current issue of 'Delivering International Qualifications – Centre Guide' for full details of these procedures.

City & Guilds reserves the right to suspend an approved centre, or withdraw its approval to conduct City & Guilds programmes, for reasons of debt, malpractice or for any reason that may be detrimental to the maintenance of authentic, reliable and valid qualifications or that may prejudice the name of City & Guilds.

Numbering system

We use a numbering system to allow entries to be made for our awards.

To carry out what is needed for the Skills Proficiency awards in Basic Fabrication, Welding and Pipework candidates must be successful in one of the following assessments:
3528-08-008 Skills Foundation Certificate (Basic Engineering Skills)
3529-11-011 Skills Proficiency Certificate (Basic Fabrication, Welding and Pipework)

We use these numbers throughout this booklet. You must use these numbers correctly if you send forms to us.

Making entries for assessments

Candidates must enter through an assessment centre we have approved to carry out the assessments for Skills Proficiency awards.

There are two ways of entering candidates for assessments.

Internal candidates
Candidates can enter for assessments if they are taking or have already finished a course at a school, college or similar training institution that has directed their preparation, whether by going to a training centre, working with another institution, or by open-learning methods.

External candidates
These are candidates who have not finished a programme as described above. To be eligible for assessment external candidates must be able to provide suitable evidence of previous training or work experience through which the required competencies have been demonstrated on more than one occasion in the past. The assessment centres must receive their application for assessment well before the date of the assessment concerned. This allows them to act on any advice you give about assessment arrangements or any further preparation needed.

External candidates must meet all the requirements for the assessment.

In this publication we use the term 'centre' to mean a school, college, place of work or other institution.

Submitting results to City & Guilds

Successful candidates entering for the Skills Proficiency awards will receive a 'Notification of Candidate Results' giving details of how they performed.

We grade practical assessments as pass (P) or not yet competent (X).

If candidates successfully finish all the requirements for the Skills Proficiency award at a specific level, they will receive the appropriate certificate.

We will send the 'Notification of Candidate Results', and certificates to the assessment centre to be awarded to successful candidates. It is your responsibility to give the candidates the certificates. If candidates have a question about the results and certificates, they must contact you. You may then contact us if necessary.

We will also send you a results list showing how all candidates performed.

Roles and responsibilities

This section gives details of the requirements and responsibilities of each role involved in the assessment, verification and examinations processes. Centres should identify members of staff to fulfill these roles.

Please refer to the 'Delivering International Qualifications – Centre Guide' for more information.

Programme coordinator
The person in the training centre responsible for ensuring that:

- printouts sent by City & Guilds are correct
- results are sent to City & Guilds in accordance with specified procedures
- all interested parties are notified of assessment dates well in advance
- candidates and centre staff fully understand their role and responsibilities
- facilities and equipment are available so that assessments can be conducted in accordance with City & Guilds requirements
- documents received from City & Guilds are securely stored
- results and/or certificates are properly issued to candidates at the centre
- monitoring the work of assessors.

Assessor
The primary role of an assessor is to assess candidates' performance and related knowledge in a range of tasks and to ensure that the competence/knowledge demonstrated meets the requirements of the programme. Assessors will therefore need to have occupational experience in the vocational area to be assessed.

They will also need to be familiar with the candidates whom they are assessing; so assessors are likely to be the candidates' own instructors, who are best able to decide when individuals are able to perform competently, and therefore are ready to be formally assessed for the award.

Assessors are responsible for:

- agreeing an assessment plan with each candidate
- briefing candidates on the assessment process
- following assessment guidance provided
- observing candidates' performance and/or conducting other forms of assessment
- recording all questions used and answers given for the purposes of meeting the evidence requirements
- justifying the evidence and making assessment decisions against the standards
- providing candidates with prompt, accurate and constructive feedback
- maintaining records of candidates' achievement
- confirming that candidates have demonstrated competence/knowledge and completing the required documentation
- keeping themselves up to date with City & Guilds publications relating to quality assurance
- agreeing new assessment plans with candidates where further evidence is required
- making themselves available for discussion with the external verifier.

Candidate
Candidates are those individuals who are working towards a qualification at a centre approved by City & Guilds.

Candidates are responsible for:

- confirming to assessors that they understand the requirements of the programme
- confirming to assessors that they understand the relationship between the requirements and the tasks they need to perform to demonstrate competence and/or related knowledge
- discussing and agreeing assessment plans with their assessors
- identifying possible sources of evidence
- maintaining and presenting evidence in a well organised way
- ensuring that the evidence is adequate to present for assessment
- making themselves available for assessment and to discuss their evidence.

External verifier
External verifiers are appointed by City & Guilds for specific programmes to ensure that all assessments undertaken within City & Guilds centres are fair, valid, consistent and meet the requirements of the programme.

External verifiers are responsible for:

- making approval visits/recommendations (where necessary) to confirm that organisations can satisfy the approval criteria
- helping centres to develop internal assessment and evidence evaluation systems that are fair, reliable, accessible and non-discriminatory
- monitoring internal quality assurance systems and sampling, including by direct observation, assessment activities, methods and records
- checking claims for certification to ensure they are authentic, valid and supported by auditable records
- acting as a source of advice and support, including help with the interpretation of standards
- promoting best practice
- providing prompt, accurate and constructive feedback to all relevant parties on the operation of centres' assessment systems
- confirming that centres have implemented any corrective actions required
- reporting back to City & Guilds
- maintaining records of centre visits and making these available for auditing purposes.

Quality inspector/auditor
Quality inspectors or auditors are appointed by City & Guilds to ensure that centres comply with our centre approval criteria. Their responsibilities relate to systems and quality assurance rather than specific assessment requirements.

Quality inspectors or auditors are responsible for:

- conducting inspection or audit trails to ensure centres comply with City & Guilds centre approval criteria
- making approval visits/recommendations (where appropriate) to confirm that potential centres satisfy/will be able to satisfy the centre approval criteria
- providing prompt, accurate and constructive feedback to all relevant parties
- providing advice to centres on internal quality arrangements
- reporting back to City & Guilds
- maintaining records of centre visits and making these available for auditing purposes.

Designing courses of study

Candidates for the Skills Proficiency awards will have come from different backgrounds and will have different employment and training experiences.

We recommend the following:

- carry out an assessment of the candidates' achievements so you can see what learning they already have; and
- consider what learning methods and places will best suit them.

When you assess a candidate's needs, you should design training programmes that consider:

- has the candidate completed any previous education, training or qualifications?
- does the candidate have any previous practical experience which is relevant to the aims of the programme and from which they may have learned the relevant skills and knowledge?

As long as the candidates meet the aims of this learning programme the structure of the course of training is up to you. So, it is possible to include extra topics that meet local needs.

Practical work must be carefully planned both to illustrate the application of theory and to provide exercises of skill. The maximum opportunity must be provided for workshop practice and demonstrations. As far as possible, candidates must be able to apply their theoretical knowledge to practical work within a realistic work environment. Candidates should keep records of the practical work they do so they can refer to it at a later date.

Resources

If you want to use these qualifications as the basis for a course, you must read this booklet and make sure that you have the staff and equipment to meet all the requirements. If there are no facilities for realistic practical work, we strongly recommend that you develop links with local industry to provide opportunities for hands-on experience.

Presentation format ofsyllabus

Practical competences
Each unit starts with a section on practical competences which shows the practical skills candidates must have.

At times we give more detail about important words in each 'competence statement'.

> For example:
> 1.2 Apply good housekeeping practices at all times.
> **Practices:** clean/tidy work areas, removal/disposal of waste products, protect surfaces

In the above statement the word 'practices' is given as a range which the candidate should be familiar with. If a range starts with the abbreviation 'eg' the candidates only need to cover some of the ranged areas or you can use suitable alternatives.

The end of each unit contains practical assessments which deal with the practical competences. Candidates must carry out the practical assessments either in a real or a simulated work environment.

Carry out assessments

The practical assessments for these awards may be carried out during the learning programme, but they may also take place during a special assessment period once training has been completed.

We describe these assessments as 'free date' because they are carried out at a college or other training establishment on a date or over a period which the college chooses.

Assessments must be carried out in accordance with the requirements described in 'Delivering International Qualifications – Centre Guide'. Assessors/instructors should familiarise themselves with the **Guide to the assessment of practical skills** contained in thisbooklet.

Practical assessments
The practical assessments for the Skills Proficiency awards are derived from the practical competences.

The **competence checklist** (tick boxes) serves as the marking criteria for these assessments and should be used by the assessor/instructor to record the outcome of each candidate's performance.

The competence checklist is a list of activities or performance outcomes that a candidate must be seen to be able to do in order to be considered competent in the tasks being assessed for these awards. The checklists are written in the same way, so that for each competence statement it is possible to say either:

'Yes, the candidate successfully carried out this activity' or

'No, the candidate has not yet achieved this standard.'

The use of local legislation, tools, equipment and practices is allowed within the specifications of the 'range' supporting each practical competence statement. The results of the assessment must be documented and available for audit by the external verifier.

All assessments must be successfully completed.

All assessments must be completed in the context of one specific job role in which the candidate is working, or for which the candidate is being trained. The context must be stated on each candidate's assessment record.

The competence checklists in this publication must be photocopied and must be completed for every candidate.

The practical assessments for these awards are not suitable for entirely classroom-based teaching. Candidates must demonstrate competence in a **realistic work environment**.

This may be:

- the workplace in which the candidate is undertaking training
- a simulated work environment.

A simulated work environment is an area such as a training room specifically designed to replicate the work place as closely as possible. A classroom is unsuitable as a simulated work environment.

A candidate transferring from a realistic work environment to a real workplace should perceive no difference.

Candidates may demonstrate competence in a combination of real and simulated situations.

Candidates must be able to show that they can perform the required tasks to the standards that would be expected if they were actually working in industry. This is likely to include factors such as the time taken to complete the tasks and the quality of any products produced. In addition to demonstrating practical skills, candidates will have to show that they can cope with psychological and environmental conditions of real work, eg pressures and consequences of producing products for customers, working with other people, planning and organising work, following procedures, and dealing with variations and problems that may occur in performing the specified tasks.

Candidates undertaking practical activities for the purposes of assessment must, at all times, be under the supervision of a competent and qualified supervisor.

Preparation, supervision and marking

It is essential that the instructor/assessor ensures all necessary preparations are carried out. This will involve ensuring:

- the candidate is ready to demonstrate his or her practical skills
- every candidate understands what is involved
- any necessary materials, tools or equipment are available for the assessment.

Assessment of the practical performance is determined on outcomes as defined by the practical competences. The candidate must be successful in all competences included in the checklist before it can be 'signed off' and its results transferred to the summative record.

All practical assessments should be supervised and assessors should make sure that the results reflect the candidate's own performance. Separate records must be kept of the dates of all attempts by each candidate.

The candidate should be informed of the result as soon as possible. If he/she does not meet the standard of 'competent' in any of the practical requirements, the decision of either immediate resit or further practice must be taken.

Assessment of underpinning knowledge

The knowledge requirements in this programme are tested by asking questions at the end of the practical assessment to verify that the candidate understands the reasons why a particular activity has been performed.

The programme coordinator must arrange in advance with their local City & Guilds office to obtain the underpinning knowledge questions and candidate record sheets required for conducting the oral assessment. He/she is responsible for ensuring that all oral questioning materials are kept securely and the assessments conducted in accordance with City & Guilds requirements.

The underpinning knowledge questions may be asked in any language that is understood by both candidate and assessor. The centre must ensure that the external verifier is provided with translations of questions asked, as well as candidate responses, if he/she does not speak the language in which questioning was conducted.

Please refer to the section **Oral questioning** in the **Guide to the assessment of practical skills** contained in this booklet.

Records, results and certification
When all the required assessments have been achieved, the result must be entered onto **Form S** which must be countersigned by the external verifier and sent to City &Guilds.

You must keep all assessment documentation and material in a file for each candidate until the results have been agreed by the external verifier and until confirmation of the result has been received from City & Guilds. You must hold all the evidence for a minimum of six months and candidate records for a minimum of three years.

After results have been confirmed, copies of assessment documentation other than Form S may be returned to candidates.

The operation of this programme requires the appointment of an external verifier. **The external verifier must countersign the results of the practical assessments on Form S.**

The external verifier should also be able to inspect records and candidates' work to verify the results before submission.

Health and safety

All work must be carried out in a safe and efficient manner, and safety must be inherent in the candidate's approach to the practical assessments.

Centres must ensure that due attention is paid to safety and safe working practices during **all** practical assessments.

It is expected that the assessor will intervene if a candidate is acting in a dangerous manner, explaining to the candidate the reason for stopping the assessment.

Candidates should not be allowed to continue with the test if acting in an unsafe manner.

Equal opportunities

We are committed to giving everyone who wants to gain one of our awards an equal opportunity of achieving it. We support equal opportunities in education, training and employment, and will take positive action to:

- promote practice and procedures in our centres that give equal opportunities to everybody, regardless of their culture, sex, ability, disability, age, ethnic background, nationality, religion, sexual orientation (sexuality), marital status, employment status or social class
- work towards removing all practice and procedures that discriminate unfairly (directly or indirectly)
- widen access to our awards to include people who are under-represented
- set the awards standards according to equal opportunities best practice.

We will make sure that our centres use an equal opportunities policy that works together with ours, and that they maintain an effective appeals procedure.

We will expect centres to tell candidates how to find and use their own equal opportunities policy and appeals procedure.

Progression routes and recognition

We have a range of related qualifications for onward progression. These include relevant International Vocational Qualifications listed in the City & Guilds International Handbook.

Candidates achieving this award at Skills Proficiency Certificate level will be eligible to apply for assessment in relevant units within 1155 IVQ in Engineering Skills at Certificate level.

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Syllabus
Skills Proficiency awards in Basic Fabrication, Welding and Pipework

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Introduction

The aim of this module is to enable the candidate to:

a. carry safe working practices and procedures to ensure the safety of themselves, other personnel and members of the public
b. identify metals and compare their properties
c. use hand tools and sheet metal cutting and folding equipment
d. use the off hand grinding machine and the fixed drilling machine
e. select and use temporary and permanent methods of joining materials f carry out oxy-acetylene gas cutting.

The use of national/local regulations and working practices must be included in all practical competences.

Practical competences

The candidate must be able to do the following:

Health and Safety

1.1 Select protective clothing and equipment use and return to store.

1.2 Carry out safe working practices when using nonportable powered machinery in accordance with national/local standards.

1.3 Carry out manual handling operations.

1.4 Carry out the safe movement of materials and components, observing safe working loads, using mechanical lifting and ancillary equipment.

1.5 Identify faults in lifting aids and equipment.

1.6 Use and transport ladders safely.

1.7 Use electrical equipment in accordance with national/local standards.

1.8 Carry out the correct procedure to isolate a person in contact with a simulated live single phase electrical supply.

1.9 Carry out resuscitation treatment.

1.10 Observe safe working practices to reduce health hazards when in contact with toxic materials, liquids, dust or fumes.

1.11 Select correct equipment and carry out basic firefighting techniques in simulated conditions.

1.12 Apply good housekeeping practices at all times.
Practices: clean tidy work areas, removal/disposal of waste products, no overhanging sharp edges, no unmarked hot objects left on bench, gangways free from obstructions.

1.13 Participate in emergency procedures.
Procedures: raising alarm, alarm types

1.14 Participate in safe/efficient evacuation.
Evacuation: means of escape, assembly points, emergencies, fire drill, bomb warning

Materials

1.15 Compare the mechanical properties of metals by twisting, repeated bending, hammering, rolling of strip, hollowing of a cup, filing.

1.16 Identify metals by colour, weight, filing and using a magnet.

Hand and Machine Tools

1.17 Select, use, clean and store basic hand tools.

1.18 Select, use, clean and store drills, reamers, taps and dies.

1.19 Select, use, clean and store stud extractors.

1.20 Select, use, clean and store portable electric and pneumatic powered hand tools.

1.21 Measure the wedge angles of tools.

1.22 Use a fixed drilling machine to carry out drilling, countersinking, counter boring, spot facing and reaming: investigate the effects of different drill point angles and unequal lip lengths.

1.23 Use the single or double ended off hand grinding machine; grind work to a prescribed accuracy; sharpen hand tools: centre punch, scriber, flat chisel, twist drill.

1.24 Fold sheet metal to an angle using a sheet metal folding machine.

1.25 Cut sheet metal to size using hand shears and bench shears/guillotine.

Fastening and Joining

1.26 Select, use, clean and store personal protective equipment.

1.27 Select, use, clean and store mechanical fastening devices.

1.28 Examine a range of thread types and mechanical fastening devices.

1.29 Select, use, clean and store spanners and torque wrenches.

1.30 Calculate allowances for and form self-secured sheet metal joints.

1.31 Select, use, clean and store soft soldering equipment and consumables.
Soldering: sheet metal lap joints, pipe joints, electrical wiring terminations

1.32 Weld simple butt joints using oxy-acetylene welding equipment (leftward technique only).

1.33 Weld simple butt joints using manual metal arc welding equipment.

1.34 Use manual oxy-fuel gas cutting equipment to cut low carbon steel.

Underpinning knowledge

Oral questioning should be used to provide evidence of the candidate's knowledge of:

Health and Safety

1.1 Human and environmental conditions leading to accidents in the workplace and the means of controlling them.
Conditions: human causes of accidents (ie carelessness; improper behaviour and dress, lack of training, supervision and experience, fatigue, drug taking and drinking), environmental causes of accidents (ie unguarded or faulty machinery and tools, inadequate ventilation, untidy, dirty, overcrowded or badly-lit work places)

1.2 Protective clothing and equipment suitable for given situations.
Protective clothing and equipment: overalls, footwear, snood/cap, helmets, aprons, eye and face protection, ear defenders, dust masks, gloves, special equipment eg respirators

1.3 Dangerous items of clothing.
Dangerous clothing: ties, long sleeves, torn clothing, and long hair near moving parts of machinery

1.4 Protective equipment for non- portable powered machinery.
Protective equipment: machine guards, screens, fences, warning notices, stop buttons/isolation devices

1.5 Safe working practices to be observed when carrying out manual handling operations.
Safe practices: correct posture when lifting and carrying, use of crowbars, levers and rollers

1.6 Types and applications of lifting aids and accessories.
Lifting aids: block and tackle, pull lifts, rope, wire and chain slings, lifting clamps and dogs, eyebolts and shackles, jacks, trestles and stands

1.7 Dangers of using faulty/misusing lifting aids and techniques.
Dangers: knots in slings, damaged slings, loads with sharp corners, loose and swinging loads, wrapped and greased loads, handling materials under adverse conditions

1.8 Precautions to be taken when transporting/using ladders.

1.9 Dangers associated with the use of electrical equipment.
Dangers: electric shock, fire, damaged equipment, explosion

1.10 How the human body can become part of an electrical circuit.

1.11 Procedure to be adopted when a person is in contact with a live single phase electrical supply.

1.12 Types and applications of firefighting equipment.
Firefighting equipment: extinguishers (ie water, powder, foam, gas, vaporizing liquid), sand/water bucket, fire blanket, water hose

1.13 Purpose of evacuation procedures.
Procedures: fire drills, escape routes, assembly points

Materials

1.14 Basic properties of engineering materials.
Properties: ductility, malleability, strength (ie compression, tension, shear), elasticity, toughness, brittleness, hardness, electrical and heat conductivity, machinability
Materials: carbon steels, cast irons, aluminium, copper, brass, austenitic stainless steel

Hand and Machine Tools

1.15 Basic hand tools and their uses.
Hand tools: vices, .les, hammers, chisels, screwdrivers, pliers, wire cutters, punches, drifts

1.16 Defects in the hand tools mentioned in 1.15 and methods of rectification.

1.17 Effects of pitch and set of hacksaw blade teeth and the point angle of chisels.

1.18 Angles of wedge-shaped cutting tools, their terminology and meaning.

1.19 Drill types and state their applications.
Drill types: parallel shank (ie jobber, long series, stub), morse taper shank, drills with more than two flutes, special purpose drills (ie countersinking, counter boring, taper drilling, drills with integral lubricant/cooling feeds)

1.20 Working principles of drills.

1.21 Types of reamers and their applications.

1.22 Process of reaming a hole using vertical spindle machines.

1.23 Methods of cutting internal and external screw threads.

1.24 Methods of removing broken studs and taps.

1.25 Operation of sheet metal folding machines.

1.26 Operation of bench shears for hand cutting operations.

1.27 Lubricating and cooling effects of cutting fluids.

1.28 Types of drilling machine, their main construction features and applications.

1.29 Tool-holding devices for drilling: the principles of restraint.

1.30 Work holding and work holding devices for drilling operations.

1.31 Operations which can be carried out on a fixed drilling machine.

1.32 Safety precautions specific to drilling operations.

1.33 Types of portable, electric and pneumatic powered hand tools.

1.34 Single/double ended off hand grinding machine.

1.35 Purposes of safety guards.

1.36 Safety precautions to be observed when grinding.

Fastening and Joining

1.37 Types and applications of mechanical fastening devices.
Fastening devices: nuts (ie wing, lock, castle, hexagonal, castellated, slotted, split, fibre insert), bolts (ie black, turned barrel [fitted], high strength friction grip, stud), washers (ie .at, taper, spring, serrated, tab, high strength friction grip), screws (ie cheese, countersunk, slotted, socket, cross), rivets (ie solid: snap or round, flat: tubular, 'pop')

1.38 Types and applications of screw threads.
Screw threads: vee (ie ISO metric, BSW, BSF, BA, BSP, UNF, UNC), modified (ie acme, buttress, square)

1.39 Types and applications of spanners and torque wrenches.
Spanners and torque wrenches: spanners (ie open jawed, ring, socket, box, strap, splined, adjustable), torque wrenches (ie breakback, dial reading, torque setting)

1.40 Riveted and boltedjoints.
Joints: lap, single and double cover plate butt joints

1.41 Defects in riveted and bolted joints.
Defects: bolted (ie lack of .at or taper washer, incorrect bolt/thread length, hole diameter too large), riveted (ie rivet length short or excessive, sheets not close together, rivet head off centre)

1.42 Self secured sheet metal joints and their applications.
Sheet metal joints: grooved, knocked up, pittsburgh lock

1.43 Equipment and consumables used for soft soldering.
Soft soldering: surface cleaning materials, soldering irons (ie electric, gas), flux (ie active, passive), solders

1.44 Basic principles of soft soldering sheet metal and wire joints.
Principles: joint types, joint structure, capillary action, process, applications, safety precautions

1.45 Equipment and consumables used for brazing.
Equipment for brazing: surface cleaning materials, blowpipe/torch, fluxes, spelter filler metal

1.46 Basic principles of brazing.
Principles of brazing: joint types, joint structure, capillary action, process, applications, safety precautions and equipment

1.47 Equipment and consumables used for oxy-fuel gas welding.
Equipment for oxy-fuel welding: cylinders (ie oxygen, acetylene), torch, regulators, hose, fillerwire

1.48 Basic principles of oxy-fuel gas welding.
Principles of oxy-fuel welding: jointtypes (ie butt, corner, fillet and lap), process, applications, safety precautions and equipment

1.49 Flame settings; oxidising, carburising, neutral.

1.50 Equipment and consumables used for manual metal arc welding.
Equipment for metal arc welding: regulator, transformer/rectifier, cables, electrode holder

1.51 Basic principles of manual metal arc welding.
Principles of metal arc welding: joint types (ie butt, corner, fillet and lap), process, applications, safety precautions and equipment

1.52 Manual oxy-fuel gas cutting equipment.
Equipment for oxy-fuel cutting: cylinders, regulators, hoses, cutting torches, safety precautions and equipment

1.53 Gases used for manual oxy-fuel gas cutting.

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Skills Proficiency Certificate (Basic Fabrication, Welding and Pipework)

Introduction

The aim of this module is to enable the candidate to:

a. maintain safe working conditions
b. mark out, cut to size, hole, bend and assemble, plate, sections of tube
c. develop patterns
d. lift and move loads, use scaffold platforms and ladders
e. join metal by soldering and welding
f. cut metal by the oxy-fuel gas process
g. carry out the inspection and testing of welds and identify possible causes of defects h produce pipelines and pipe branches
h. construct curves of intersection and surface developments
i. extract details from drawings and prepare working sketches.

The use of national/local regulations and working practices must be included in all practical competences.

Practical competences

The candidate must be able to do the following:

Health and Safety

2.1 Select, use, clean and store personal safety equipment.

2.2 Carry out safe working practices to prevent hazards and to ensure the safety of working personnel and members of the public.

2.3 Use and store materials in a safe manner.

2.4 Apply good housekeeping practices at all times.
Practices: eg clean tidy work areas, removal/disposal of waste products, no overhanging sharp edges, no unmarked hot objects left on bench, gangways free from obstruction

Fabrication

2.5 Use measuring and marking out equipment appropriate to fabrication, welding and pipework.
Equipment: scriber, straight edge, chalk and chalk line, dividers, trammels, engineers and flat squares, hammers, punches, tapes, flange and web gauges, backmark gauges

2.6 Mark out
a squares, rectangles; checking cross corners for accuracy b circles, arcs
c shapes, tangents
d pipes, flanges
e simple structural details including back marks, cross centres, edge distances.

2.7 Produce and use templates.

2.8 Set out camber diagrams: parabolic curves.

2.9 Cut sheet metal and plate to shape and size using the guillotine and nibbler.

2.10 Cut tube and sectional material to length using a power saw.

2.11 Produce holes by drilling and punching.

2.12 Bend simple shapes on a press brake.

2.13 Fold simple shapes on sheet metal folding machines.

2.14 Stiffen sheet metal and plate.

2.15 Roll a cylinder.

2.16 Assemble components: produce a level bench
- a. welded work
- b. simple bolted structural work.

2.17 Develop patterns between parallel planes, cut out and form to shape
- a. conic frustum
- b. square to round transformer.

2.18 Lift and move materials by hand and with the use of lifting and handling equipment
Equipment: turn over dogs, rollers, crowbar, jacks.

2.19 Use scaffold platforms less than 2m high and use and transport ladders.

Welding

2.20 Hard solder a lap joint between two pieces of sheet metal/copper pipe.

2.21 Braze weld two pieces of cast iron.

2.22 Assemble oxy-fuel gas welding equipment and check for leaks.

2.23 Produce oxy-fuel gas welded joints in low carbon steel, using the leftward technique
- a. butt welds
- b. open outside corners.

Material: 3mm thick, and at least 150mm long welded in the flat position.

2.24 Investigate the effects of oxy-fuel gas welding with oxidising, neutral and reducing flames.

2.25 Close down oxy-fuel gas equipment
   a. blow pipe valves turned off in correct
   b. sequence cylinder/supply valves closed
   c. pressure regulators
   d. relieved hoses purged.

2.26 Assemble oxy-fuel gas cutting equipment and check for leaks.

2.27 Oxy-fuel gas cut low carbon steel up to 25mm thick with and without guides
   a. straight lines
   b. curves and circles
   c. bevels
   d. pipes.

2.28 Set up manual metal arc welding equipment.

2.29 Produce manual metal arc welded joints in low carbon steel
   a. flat position (i) open outside corner (ii) butt weld
   b. horizontal vertical position (i) fillet weld (ii) lap weld

   Material: up to 10mm maximum thickness, at least 150mm long.

2.30 Electrically isolate the welding set from the mains: cables and other accessories stored safely and correctly.

2.31 Carry out inspection and testing of welds using
   a. visual inspection
   b. penetrant ink
   c. magnetic crack detection nick break test
   d. bend tests
   e. macro etching.

2.32 Investigate the effects on weld quality due to changes in
   a. current
   b. voltage
   c. speed of travel
   d. height of electrode
   e. angle of electrode.

Pipework

2.33 Hot and cold bend small bore thin walled pipes.

2.34 Thread pipe ends using hand and power tools.

2.35 Fabricate pipeline sections and pressure test; screwed, welded, bolted.

2.36 Fabricate a pipe branch.

2.37 Fabricate a cut and shut 90° bend.

2.38 Carry out parallel line development techniques of right and oblique angled branches
   a. cylinders of equal and unequal diameters on and off centre, true shape of hole in main.
   b. cylindrical branches on the corners of rectangular ducting on centre; true shape of hole in main.
   c. right cylindrical segmental bends
   d. right cylinder on right segmental bend on centre.

2.39 Carry out radial line development techniques
   a. right cone cut obliquely
   b. right pyramid cut obliquely
   c. oblique cone cut square and obliquely.

2.40 Produce curves of intersection using the principle of the common central sphere
   a. pipe connections
   b. elbows formed by right cylinders and right cones.

2.41 Produce curves of intersection using the principles of projection.

2.42 Produce curves of intersection using the principles of cutting planes confined to examples of simple form only
   a. circular section planes
   b. square section planes.

2.43 Carry out triangulation development techniques
   a. right and oblique cones of long taper
   b. square or rectangle-to-circle transformers between parallel planes
   c. square and rectangular tapered hoppers between parallel planes
   d. on and off centre.

2.44 Identify weld symbols and their application.

2.45 Identify pipe contents from colour coding
   a. water: drinking, fire fighting, untreated
   b. compressed air, steam
   c. natural gas
   d. oil (basic colour only)
   e. acids, alkaline.

2.46 Produce sketches of simple fabrications and pipework.

2.47 Extract details from general arrangement drawings of fabricated work.

2.48 Interpret pipe arrangement drawings
   a. orthographic, simple isometric
   b. sketch pipe details
   c. prepare materials list.

Knowledge requirements

Oral questioning should be used to provide evidence of the candidate's knowledge of:

Health and Safety

2.1 Personal safety measures for fabrication, welding and pipework tasks.
Safety measures: use of compressed gas equipment (storage, siting, transportation, handling, explosive risks), dangers of working in confined spaces, dangers of working with acid fluxes, electrical hazards, checking and
inspecting leads and cables, fire prevention, methods of dealing with chemical and electrical fires, fumes, use of protective clothing and equipment, personal hygiene after handling fluxes and solders

2.2 Principles ofworkshop layout.
Layout: non-slip flooring, cleanliness, ventilation, provision of adequate gangways, safe movement of materials, exits

Fabrication

2.3 Principles of cutting action and applications of the methods of cutting by shear. **Cutting:** powered (ie guillotine, plate shears, rotary shears, bevelled cutting wheels, punches and dies, cropper, nibbler), manual/portable (ie bench shears, portable hand nibblers, hand shears and snips, portable hand bevellers), safety precautions to be observed in use

2.4 Advantages and limitations of cutting by shear.
Advantages and limitations: shearing is the fastest method of cutting, restricted to metal thickness, prone to edge deformation, prone to cracking along the cutting line

2.5 Principles and cutting action of chip forming machines and applications. **Cutting:** saws (ie power operated, circular, hacksaw, band saw), edge planing/milling, end milling, safety precautions to be observed in use

2.6 Reasons for machining the ends of work such as beams and stanchions.

2.7 Principles of forming action, uses and special advantages of forming equipment. **Forming equipment:** folding, edging, flanging, wiring, swaging, universal forming machines

2.8 Use of bending rolls.
Bending rolls: pinch, pyramid (ie presetting, setting square in the rolls, application of pressure, allowance for springback), conical and helical rolling (ie aids used), safety precautions to be observed

2.9 Use of the press brake and folding machines.
Uses: production of complex shapes such as transition pieces, guides and stops for batch work, planning of folding/bending sequence, safety precautions to be observed, rated capacity

2.10 Factors to be considered when forming and their effects.
Factors and effects: springback, pinching, material grain direction, bend radius, material thickness, width of die opening

2.11 Calculating the allowances for metal thickness applied to rolling and bending sheet metal andplate.

2.12 Calculating material allowance for sheet metal safe edges.
Safe edge calculation: single edge, double edge, wired

2.13 Methods of stiffening sheet metal and thin plate.

2.14 Sequence of operations for ease of construction.

2.15 Methods used for economic use of materials.

2.16 Location of joints.
Joint location: ease of fabrication, reduction of welding distortion

2.17 Methods of marking out pipework, sheet metal, plate and structural sections.
Marking out: directly, from templates

2.18 Structural steel forms of supply.
Identify: rolled steel sections (ie angle bar, tee bar, rolled steel channel, rolled steel joist, universal beam, universal column), structural hollow sections (ie rectangular hollow section, circular hollow section)

2.19 Meaning of the terms: backmark, cross centres, edge distance and pitch of holes.

2.20 Method of setting out cambers in girders and roof trusses: parabolic form; reasons for producing a camber in steelwork.

2.21 Identify template materials and their applications.
Template materials: template paper and card, plastic, plywood and wood lath, sheet metal and steel plate

2.22 Methods of producing a level bench.
Methods: spirit level with straight edge or steel wire, water level, tilting level, laser level

2.23 Sequence of assembly and methods of setting up to avoid twist and buckling: use of stays and other means of maintaining shape.

2.24 Safety requirements in relation to lifting and handling equipment.
Safety requirements: static, mobile and overhead cranes, shear legs, pulley systems, slings, jacks, crowbars, single purchase winch, shifting skates, mobile ramps

2.25 Precautions to be observed when using scaffold platforms less than 2m high and in the use and transportation of ladders.

Welding

2.26 Basic principles of hard soldering and braze welding.
Principles: joint types and materials joined, solders, fluxes, heating equipment, applications, safety precautions

2.27 Methods used to protect the weld pool from atmospheric contamination during welding.
Protection: oxy – fuel gas, manual metal arc

2.28 Oxy – fuel gas welding and ancillary equipment.
Equipment: blow pipes, cylinders, filler metals and fluxes, pressure gauges, regulators, gas economiser, hose, connectors, protectors, safety devices, thread identification; hose, pipeline and cylinder colours, manifold system

2.29 Oxy – fuel gas welding process.
Process: setting up the equipment, leak testing, oxy-fuel gas mixing, flame adjustment (including oxidising, neutral and carburising flames), melting parent and filler metals, fusion and solidification, shutting down procedure

2.30 Oxy – fuel gas cutting process.
Process: exothermic reaction (ie metals cut, limitations), lighting, adjusting and extinguishing the flame, factors influencing the quality of cut, applications, freehand cutting (ie cutting from an edge of plate, inside from the edge, sections, round bar), guided hand cutting (ie bevel cutting, circle cutting guides, spade or wheel guides)

2.31 Oxy-fuel gas cutting and ancillary equipment.
Equipment: blow pipes (eg arrangements of the mixing of oxygen and fuel gas), construction and application of typical cutting nozzles, hoses (eg connections, safety devices, identification), pressure gauges and regulators, gases (eg acetylene, propane, hydrogen, oxygen) flame temperature, relative cutting speed, operating costs, cylinder identification

2.32 Potential safety hazards associated with oxyfuel gas welding and cutting and precautions which should be taken.

2.33 Manual metal arc welding power sources.

2.34 Manual metal arc welding equipment and reasons for use.
Equipment and uses: welding lead and electrode holder, welding return cable and clamp, welding earth, isolator switches, electrodes (ie types, functions of flux coating, storage), head screens, chipping hammer, wire brush

2.35 Manual metal arc welding process.

2.36 Oxy-fuel gas and manual metal arc joint types.

2.37 Causes and control of distortion.

2.38 Methods of inspecting and testing welds.

2.39 Weld defects and state possible causes.

2.40 Potential safety hazards associated with manual metal arc welding and precautions which should be taken.

2.41 Weld features.

2.42 Solidification of a weld pool and identify the resulting microstructure.

Pipework

2.43 Applications of fastening devices used in fabrication.
Fastening devices: bolts (ie black, fitted [turned barrel], high strength friction grip, torshear load indicating, advantages, tightening sequences), washers (ie flat, taper, load indicating, reasons for use)

2.44 Common pipe materials and applications and reasons for use.
Materials: plastic, steel, low alloy steel, non ferrous metal.

2.45 Advantages and limitations of protective coatings for pipes.
Advantages and limitations: dipped, sprayed, painted, wrapped, linings, bituminous coatings, cathodic protection (ie sacrificial and impressed current)

2.46 Pipelines and pipework systems and components.
Systems and components: heating and hot water services, water treatment systems, steam services, gas and air services, petroleum products, chemicals, slurries and solids

2.47 Methods of threading pipe ends and the equipment required.

2.48 Use of compression and capillary fittings.

2.49 Mechanical pipe connections and their applications.
Pipe connections: screwed joint types, pipe thread types, parallel and taper threads, pipe preparation, use of screwed fittings, flanged joints (ie the use of screwed-on and weld-on flanges), gaskets (ie types and materials)

2.50 Components of pipework systems and applications: valves, pumps, traps, bellows and expansion bends.

2.51 Welded pipe connections, methods of welding.
Connections: applications, edge preparation and tacking procedures, use of weldable fittings: elbows, bends, tee pieces, techniques for butt welds in steel pipes up to 90mm nominal bore

2.52 Inspection and testing of pipework.
Inspection and testing: dimensional checking (ie ovality, buckles, sand adhesion, flange squareness, hole positions [on and off centre], quality of pipe), hydraulic testing

2.53 Pipe bending methods, tools and equipment.
Methods and tools: cold bending springs, use of formers, mandrels, gripback plates, clamps and wiper dies (ie compression bending with and without filling, draw bending), hot bending, use of low metal temperature fillers; methods of cooling, effect of inadequate filling (ie low melting point alloys, resin, pitch, sand)

2.54 Reasons for preheating and post heating pipe.
Pre- and post-heating: temperature ranges for different metals, holding period and cooling rates, stress relieving: methods used

2.55 Types of support for fabricated pipework.
Support: u-bolts, hangars, rollers, anchors, girder/beam clamps, guides

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Candidate assessment record sheets

Instructions

One complete set of competence achievement records must be provided for each candidate being assessed. The following section contains competence achievement records for both the Skills Foundation Certificate and the Skills Proficiency Certificate programmes.

The assessor should confirm achievement of each requirement with a tick in the appropriate box and note the date of achievement. The candidate should also initial and date each requirement to confirm the successful completion of the assessment.

Unsuccessful attempts should not be recorded on these sheets but recorded separately.

Upon completion of all requirements for the award the competence assessment record must be dated and signed by the candidate, assessor and external verifier before results can be submitted and certification requested.

Skills Foundation Certificate in Basic Engineering Skills

Competence achievement record (3528-08-008)

Candidate name (please print)

Practical competences			Standard achieved			
			Date	Assessor initial	Date	Candidate initial
Health and Safety		**(✓)**				
1.1	Select protective clothing and equipment use and return to store.					
1.2	Carry out safe working practices when using non portable powered machinery in accordance with national/local standards.					
1.3	Carry out manual handling operations.					
1.4	Carry out the safe movement of materials and components, observing safe working loads, using mechanical lifting and ancillary equipment.					
1.5	Identify faults in lifting aids and equipment.					
1.6	Use and transport ladders safely.					
1.7	Use electrical equipment in accordance with national/local standards.					
1.8	Carry out the correct procedure to isolate a person in contact with a simulated live single phase electrical supply.					
1.9	Carry out resuscitation treatment.					
1.10	Observe safe working practices to reduce health hazards when in contact with toxic materials, liquids, dust or fumes.					
1.11	Select correct equipment and carry out basic firefighting techniques in simulated conditions.					
1.12	Apply good housekeeping practices at all times.					
1.13	Participate in emergency procedures.					

1.14	Participate in safe/efficient evacuation.					
Materials		**(✓)**				
1.15	Compare the mechanical properties of metals by twisting, repeated bending, hammering, rolling of strip, hollowing of a cup, filing.					
1.16	Identify metals by colour, weight, filing and using a magnet.					
Hand and Machine Tools		**(✓)**				
1.17	Select, use, clean and store basic hand tools.					
1.18	Select, use, clean and store drills, reamers, taps and dies.					
1.19	Select, use, clean and store stud extractors.					
1.20	Select, use, clean and store portable electric and pneumatic powered hand tools.					
1.21	Measure the wedge angles of tools.					
1.22	Use a fixed drilling machine to carry out drilling, countersinking, counter boring, spot facing and reaming: investigate the effects of different drill point angles and unequal lip lengths.					
1.23	Use the single or double ended off hand grinding machine; grind work to a prescribed accuracy; sharpen hand tools: centre punch, scriber, flat chisel, twist drill.					
1.24	Fold sheet metal to an angle using a sheet metal folding machine.					
1.25	Cut sheet metal to size using hand shears and bench shears/guillotine.					

Fastening and Joining		(✓)
1.26	Select, use, clean and store personal protective equipment.	
1.27	Select, use, clean and store mechanical fastening devices.	
1.28	Examine a range of thread types and mechanical fastening devices.	
1.29	Select, use, clean and store spanners and torque wrenches.	
1.30	Calculate allowances for and form self secured sheet metal joints.	
1.31	Select, use, clean and store soft soldering equipment and consumables.	
1.32	Weld simple butt joints using oxy- acetylene welding equipment (leftward technique only).	
1.33	Weld simple butt joints using manual metal arc welding equipment.	
1.34	Use manual oxy-fuel gas cutting equipment to cut low carbon steel.	

Context:

Comments:

This is to confirm that the candidate has successfully completed the required tasks:

Candidate name (please print) and signature

Assessor name (please print) and signature

Verifier name (please print) and signature

Completion date

Skills Proficiency Certificate in Basic Fabrication, Welding and Pipework

Competence achievement record (3529-11-011)

Candidate name (please print)

Practical competences			Standard achieved			
			Date	Assessor initial	Date	Candidate initial
Health and Safety		**(✓)**				
2.1	Select, use, clean and store personal safety equipment.					
2.2	Carry out safe working practices to prevent hazards and to ensure the safety of working personnel and members of the public.					
2.3	Use and store materials in a safe manner.					
2.4	Apply good housekeeping practices at all times.					
Fabrication		**(✓)**				
2.5	Use measuring and marking out equipment appropriate to fabrication, welding and pipework.					
2.6	Mark out a. squares, rectangles; checking cross corners for accuracy b. circles, arcs c. shapes, tangents d. pipes, flanges e. simple structural details including backmarks, cross centres, edge distances.					
2.7	Produce and use templates.					
2.8	Set out camber diagrams: parabolic curves.					
2.9	Cut sheet metal and plate to shape and size using the guillotine and nibbler.					
2.10	Cut tube and sectional material to length using a power saw.					

2.11	Produce holes by drilling and punching.					
2.12	Bend simple shapes on a press brake.					
2.13	Fold simple shapes on sheet metal folding machines.					
2.14	Stiffen sheet metal and plate.					
2.15	Roll a cylinder.					
2.16	Assemble components: produce a level bench a. welded work b. simple bolted structural work.					
2.17	Develop patterns between parallel planes, cut out and form to shape a. conic frustum b. square to round transformer.					
2.18	Lift and move materials by hand and with the use of lifting and handling equipment.					
2.19	Use scaffold platforms less than 2m high in accordance with national/local standards and use and transport ladders.					
Welding		**(✓)**				
2.20	Hard solder a lap joint between two pieces of sheet metal/copper pipe.					
2.21	Braze weld two pieces of cast iron.					
2.22	Assemble oxy-fuel gas welding equipment and check for leaks.					
2.23	Produce oxy-fuel gas welded joints in low carbon steel, using the leftward technique a. butt welds b. open outside corners.					
2.24	Investigate the effects of oxy-fuel gas welding with oxidising, neutral and reducing flames.					

2.25	Close down oxy-fuel gas equipment a. blow pipe valves turned off in correct sequence. b. cylinder/supply valves closed c. pressure regulators relieved d. hoses purged.					
2.26	Assemble oxy-fuel gas cutting equipment and check for leaks.					
2.27	Oxy-fuel gas cut low carbon steel up to 25mm thick with and without guides a. straight lines b. curves and circles bevels c. pipes.					
2.28	Set up manual metal arc welding equipment.					
2.29	Produce manual metal arc welded joints in low carbon steel a. flat position (i) open outside corner (ii) butt weld b. horizontal vertical position (i) fillet weld (ii) lap weld.					
2.30	Electrically isolate the welding set from the mains: cables and other accessories stored safely and correctly.					
2.31	Carry out inspection and testing of welds using a visual inspection b penetrant ink c magnetic crack detection d nick break test e bend tests f macro etching.					
2.32	Investigate the effects on weld quality due to changes in a. current b. voltage c. speed of travel d. height of electrode e. angle of electrode.					

Pipework	(✓)				
2.33 Hot and cold bend small bore thin walled pipes.					
2.34 Thread pipe ends using hand and power tools.					
2.35 Fabricate pipeline sections and pressure test; screwed, welded, bolted.					
2.36 Fabricate a pipe branch.					
2.37 Fabricate a cut and shut 90° bend.					
2.38 Carry out parallel line development techniques of right and oblique angled branches a. cylinders of equal and unequal diameters on and off centre, true shape of hole in main. b. cylindrical branches on the corners of rectangular ducting on centre; true shape of hole in main. c. right cylindrical segmental bends d. right cylinder on right segmental bend on centre.					
2.39 Carry out radial line development techniques a. right cone cut obliquely b. right pyramid cut obliquely c. oblique cone cut square and obliquely.					
2.40 Produce curves of intersection using the principle of the common central sphere a. pipe connections b. elbows formed by right cylinders and right cones.					
2.41 Produce curves of intersection using the principles of projection.					
2.42 Produce curves of intersection using the principles of cutting planes confined to examples of simple form only a. circular section planes b. square section planes.					

2.43	Carry out triangulation development techniques a. right and oblique cones of long taper b. square or rectangle-to-circle transformers between parallel planes c. square and rectangular tapered hoppers between parallel planes d. on and off centre.					
2.44	Identify weld symbols and their application.					
2.45	Identify pipe contents from colour coding a. water: drinking, firefighting, untreated b. compressed air, steam natural gas c. oil (basic colour only) acids, alkaline.					
2.46	Produce sketches of simple fabrications and pipework.					
2.47	Extract details from general arrangement drawings of fabricated work.					
2.48	Interpret pipe arrangement drawings a. orthographic, simple isometric b. sketch pipe details c. prepare materials list.					

Context:

Comments:

This is to confirm that the candidate has successfully completed the required tasks:

Candidate name (please print) and signature

Assessor name (please print) and signature

Verifier name (please print) and signature

Completion date

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The performance outcomes in the competence checklist are often stated as activities performed to a particular standard, that can be observed by the assessor. The outcomes may also require assessment of practical skills through **appraisal of products**, objects made by the candidate in the course of the activity being assessed.

The checklist ensures that everyone involved in observation of practical performance the Skills Proficiency award is working to the same checklist and standards.

Assessor skills

We do not require assessors to have a formal qualification in assessment, although we do ask centres to confirm that all staff involved in teaching programmes are appropriately qualified, as part of the centre approval process. We reserve the right to check this, and we moderate the quality of assessor performance through the external verifier.

Observation of performance requires personal skills and judgment skills to make assessment decisions based on the evidence and criteria available.

Personal skills are related to the assessor's behaviour towards candidates during the observation. Although assessors need to be objective, they must also be supportive.

Assessors with good personal skills will:

✓ Plan a realistic environment – normal workplace, normal workshop activity
✓ Be friendly towards the candidate, and using first name
✓ Check that the candidate understands everything and is not nervous
✓ Be attentive
✓ Not stand so close to the candidate that the candidate is distracted or made to feel nervous
✓ Offer words of encouragement – provided these do not distract
✓ Ask questions that offer encouragement
✓ End the observation with a final word of encouragement.

Assessors with poor personal skills:

✗ Dress inappropriately (for example wearing unusually formal clothes)
✗ Use threatening expressions, eg 'I hope you understand this, because it's too late if you don't!'
✗ Be inattentive, not watching, talking to people not involved in the assessment
✗ Stand very close to the candidate so that candidate feels nervous
✗ Show disapproval, eg by shaking the head
✗ End the assessment with an expression of disapproval

During the assessment, the assessor should focus on one activity at a time. The candidate may be performing activities in a sequential order. The assessor must watch for each activity as it happens, in sequence, and make a judgment quickly and decisively, in order to be prepared to move to the next observable activity. If assessing one candidate at a time, the assessor can follow the activities in a sequence.

Candidates may also be assessed in groups, although we suggest not more that 10 - 15. The assessor will need to move from candidate to candidate to collect evidence for all the outcomes being observed. More than one assessor may be required.

The assessor should consider:

- Has the candidate normally performed this task successfully up to the time of the assessment?
- Is it likely that the candidate will continue to perform this task to the standard required in the future?

If the answer to these questions is 'yes', then the assessor should be confident about recording successful achievement.

Preparing assessment plans

Unplanned assessment of practical skills is ineffective and wastes time.

In best practice, the assessment process is a natural part of the learning programme, is cost-effective and fair, and is held in respect by all involved.

The first stage is to be clear about what has to be assessed. What is the candidate being asked to do, show, know, produce – to what standard and under what conditions? This information can also come from lesson plans. A good lesson plan will have specific achievements as the outcome of the lesson or series of lessons.

The meaning of the outcome must be understood and agreed as part of the planning process. Some outcomes are intentionally written to allow for local interpretation according to particular circumstances. The training programme should provide opportunities to discuss all the possible interpretations and to consider why different companies have different policies and why practices can vary from country to country. It will also focus on what is most appropriate for the particular situation in which the candidates are working.

The assessment plan must involve the selection of assessment methods that are valid and reliable, cost-effective, achievable in terms of time and resources and which cover the competences to be assessed.

City & Guilds has a policy that all of its assessments should be fair and accessible. The practical assessments are not a test of English, or indeed any other language, unless knowledge and use of specific terminology is an essential part of the job in question. The assessor must explain any instructions or performance objectives that a candidate does not understand before the assessment takes place.

The following tips may be useful in making an assessment plan:

- Make plans clearly legible with good handwriting or typed
- Write plans in clear language which avoids jargon
- Order stages logically
- Identify the aim of assessment
- Identify suitable venue for assessment to take place
- List resources to be used
- Explain the aim of assessment to candidate and how information gained by the assessment will be used
- Establish candidate's current and prior achievements and preferred learning style
- Select assessment methods best suited for the learning objectives
- Select assessment methods which cause minimum disruption and are cost effective
- Select assessment methods which take account of any special factors
- Select assessment methods which occur during normal work activities
- Complete the assessment plan and state where records are stored

The external verifier will want to know what plan was used to arrive at the practical assessment results.

Please refer to section 9.6 in 'Delivering International Qualifications – Centre Guide' for a sample assessment plan (Form 7).

Conducting practical assessments by observation

Assessment by observation of performance takes place whilst the activity is being done. This method of assessment, especially in the workplace, is popular with candidates and employers because there is a high degree of realism and it is a good indicator of the ability to perform particular tasks.

Before the assessment takes place, it is essential to **brief the candidates**. This can be done as a group, or individually. Observing performance is not intended to be an examination, or cause candidates undue stress. It should never be a surprise, unannounced activity.

The briefing should:

- describe what the assessor plans to do
- show candidates the performance outcomes to be assessed
- explain what candidates will be asked to do in order to demonstrate the skills
- clarify what will be looked for in the demonstration of skill
- confirm when the assessment will take place, where and how long it will last
- explain what will happen to information collected during the assessment
- provide opportunities for candidates to ask questions on any aspect of the assessment.

Each candidate needs to know what will happen if the decision is **'not yet achieved the standard required'**. Candidates should be able to attempt the activity again, after the assessor has explained what evidence is still needed.

Appraisal of products

Where observation of performance is not used, our policy is to include **appraisal of products** as a means of assessing practical skills.

> Example:
> **Practical competences**
> The candidate must be able to do the following:
> 1.3 Assemble and finish components to form basic products

This method of assessment is sometimes used because a practical task brings together the mental, physical and social skills needed to carry out the planning, undertaking and checking of a specified task. In this case the product required is a product made up of components. A product could also be a plan, a design, or a piece of processed information.

Here the instructor uses the competence checklist to plan a set of activities that will allow the candidate to demonstrate competence in the required practical skills. Often this will involve using equipment in a workshop. It may involve working outside.

Workshop activities are particularly useful in the early stages of assessing practical skills and can be used in combination with work placement. To reduce the risk of candidates making mistakes that have a real value, workshop activities can be used to practice highly technical skills until both the trainer and the candidate are confident that the task can be performed safely and competently in a real work situation.

Workshop practice, combined with work experience, is also useful where there is a high element of risk or where the relationship between customer and customer satisfaction is immediate and critical.

Although it can contribute to the demonstration of practical skills and has its advantages in certain situations, to rely on workshop activities alone for the assessment of practical skills has several disadvantages. It does not give the candidate the opportunity to experience a work environment and therefore it is only possible to **infer** that **if the candidate were in a workplace,** then **probably the candidate would perform the task competently** based on successful performance under observed conditions in the workshop, or while carrying out practical tasks.

Supplementary questions

An additional technique for supporting formative assessment is to use **supplementary questions**. The instructor may observe a candidate performing correctly, but want to know whether the candidate is likely to always perform in such a way. Supplementary questions can be used to probe specific areas of a candidate's knowledge, about which there may be some doubt, or where the possession of knowledge is critical.

They are asked as a natural part of an activity – asking about what the instructor is seeing – so they are less likely to intimidate the candidate.

However, on their own, supplementary questions are not sufficient evidence for confirming that a candidate has the practical skills to carry out tasks to the standard required.

Supplementary questions must be relevant to the task, and must have been covered in the training. It is unfair to ask about things that have not been taught. A variety of supplementary questions may be used and different questions can be used with different candidates, although questions should be similar in construction and degree of dificulty.

Supplementary questions should be planned to ensure they are relevant and fair. Open questions should be used, which require the candidate to supply the answer. Closed questions, which require only 'Yes' or 'No' answers, should be avoided.

Oral questioning

By asking every candidate the same set of questions, requiring a spoken response, the assessor obtains evidence of underpinning knowledge to support assessment of each candidate's practical skills. By using the same set of questions for each candidate the same demand is made of each candidate. This is important if more than one person is involved in the training and assessment of candidates.

The set of questions asked to every candidate is useful evidence to give to the external verifier to support the completed competence checklists. The external verifier may use the same questions to randomly check candidates' knowledge.

It is important not to confuse oral questioning that requires candidates to give answers to specific questions, from observation of performance that involves speaking.

In oral questioning the assessor is looking for the ability of the person to give the required knowledge, using speech. The ability to speak well (clearly, varied pitch and pace, well-constructed sentences) should not be the purpose of the assessment. If candidates struggle to speak well, assessors should consider alternative, more appropriate assessment methods.

Distractions and disruptions

Internal distractions come from the candidate. The most likely candidate distractions are sudden loss of confidence, either immediately before or during the observation and resistance to assessment – where the candidate argues against or actually refuses to carry out the task.

The assessor must be alert to candidate signals and respond appropriately. If the task can be completed, the candidate should be encourage to do so, but if necessary the candidate may take a break to regain their composure, and re-start the observation. The assessor must explain that the reason for the break is to allow the candidate to demonstrate best performance, and that it is not a signal of failure.

Resistance to assessment is more serious. The candidate may resist for a number of reasons, ranging from nerves (encouragement should be offered), to not understanding what is required or not being able to perform the tasks (they should be explained again, and review the learning programme to identify gaps).

Resistance may occur because the candidate does not have confidence in the assessor's ability to make a fair judgment. This may be because the assessor:

- has not briefed the candidate properly
- is untrained and/or does not demonstrate an understanding of the process
- has consistently criticised the candidate's performance and has not offered constructive training and support.

External distractions during an observation of performance should be minimised during the planning process. The assessor must minimise disturbance to the candidate. If it is necessary to interrupt an assessment in order to deal with a disruption, the assessor should reassure the candidate first and explain what is happening, stop the assessment and then deal with the problem. When resuming the assessment, the candidate should be reassured once more. In an extreme situation, the assessor should agree with the candidate arrangements for repeating or rescheduling the assessment.

Giving feedback on performance

Feedback on the demonstration of practical skills is essential to explain to the candidate how the result has been decided.

Feedback should always be a one to one conversation between the candidate and the assessor. The assessor should have a completed record sheet available to show to the candidate.

The approach to feedback should be open and constructive and avoid unfriendliness or intimidation. The purpose of assessment is to find out what a person can do; it should not be a means to find fault or catch the candidate out through unexpected tasks and deliberately difficult questions.

A good way of beginning feedback would be to start by saying 'well done' and then asking for the candidate's evaluation on their own performance. This approach immediately involves the candidate in the feedback process, showing value and respect.

The assessor should explain those activities or products completed well, and congratulate the candidate on what has been achieved. At this stage it is also useful to explain why it was achieved. By maintaining a positive approach throughout, a good relationship should have been developed with the candidate, and the candidate is prepared to accept any feedback on performance as fair and valid.

Giving feedback on unsuccessful performance is always more difficult, but equally important.

At no time should the assessor feel under pressure to say that something has been successfully achieved when it has not.

The assessor should explain what parts of an activity were done well, even if overall performance did not meet the required outcome. It is necessary to explain objectively which specific outcomes were not achieved, and why, and to be able to give examples of what could be done to achieve a successful outcome. During the assessment notes should be taken so that there is a written record of objective observations to give to the candidate during the feedback session.

A candidate is most likely to become upset or aggressive if the result is not understood, or considered to be unfair. Remain calm, objective and supportive. Keep talking to the candidate until agreement to listen has been reached. Subjective expressions like 'I think that…..' or 'In my opinion you should have…' should be avoided.

It is essential to agree with the candidate what the future action will be. If the outcome of the assessment activity is the successful completion of all competence requirements, the next stage is to inform the candidate that the successful performance will be recorded and registered with City & Guilds. If the outcome is that some of the tasks have not yet been achieved, discuss what still needs to be practiced, and when an opportunity can be given to repeat the assessment.

Skills to help with employment

Introduction

It is recommended that candidates who are thinking about employment in this sector should prepare themselves for employment by following a course of study or other form of preparation based on the following activities.

Tips and hints

Employability

1 Find out about employment opportunities in the industry.
Opportunities: within city, state, nationally and internationally

2 Complete a job search and identify training opportunities.
Training opportunities: eg full time and part time courses, apprenticeship programmes, on-the-job training, government funded programmes

3 Obtain information about a job.

4 Find out about documents that may be required for a job application and reasons for including them.
Documents: eg curriculum vitae, education certificates, identification

5 Practice completing job application forms.

6 Practice job-interview techniques.

7 Understand and demonstrate productive work habits and positive attitudes. **Work habits and positive attitudes:** general (eg timekeeping, health and safety, consideration for others) and job specific

8 Identify ethical and responsible work practices.

9 Follow acceptable hygiene practices and adopt a professional appearance.

10 Demonstrate the principles of time management, work simplification, and teamwork when performing assigned tasks.

11 Understand the importance of taking pride in the quality of work performed.

12 Understand the importance of a drug-free workplace and industry policies toward drug and alcohol use.

13 Explain to a supervisor the importance of confidentiality in the workplace.

Customer relations skills

14 Demonstrate positive customer relations skills.
Customer relations skills: self-control, appropriate responses to criticism, courtesy

15 Demonstrate appropriate responses to criticism.

16 Respond to customer complaints in a positive, professional manner.

17 Demonstrate respect for people and property.

Problem-solving skills

18 Practice organising and planning multiple tasks, using various resources such as time, personnel and materials.

19 Analyse problems, identify the causes and devise plans of action.

20 Identify obstacles and choose the best alternatives.

21 Create new and better ways to perform tasks.

Safety for workers

Introduction

Going to work for the first time can be exciting and a bit strange. It can sometimes be dangerous. This is true whether you work in a factory or an office or on a farm or building site. Fortunately most dangers are recognisable and can be avoided.

Your own workplace will also have its own safety rules – perhaps in a booklet or on a notice board. Some you will be told. **Make sure you know and obey them**.

Remember these four important rules:
✓ **Learn** how to work safely
✓ **Obey** safety rules
✓ **Ask** your supervisor if you don't understand any instruction
✓ **Report** to your supervisor anything that seems dangerous, damaged or faulty

Games and practical jokes
Work is not the place for practical jokes or silly tricks. Serious injuries and even deaths have been caused this way.

Tidiness
Keep work areas and walk ways tidy and clear. Do not leave things lying around which people can trip over or bump into. Wet patches on the floor should be mopped up straight away or someone might slip and fall.

Hygiene
Always wash your hands, using soap and water or a suitable cleanser, before meals and before and after using the toilet.

It is recommended that you use barrier cream to protect your skin when you are doing dirty jobs.

Dry your hands carefully on the towels and driers provided. Do not wipe them on old rags or on your clothes.

Protective equipment and clothing
Use all protective equipment and clothing provided, such as ear and eye protectors, dust masks, overalls and safety shoes, helmets or boots. It may feel strange at first. Keep using it and you will get used to it. Ask your supervisor to replace any item that gets damaged or worn.

Moving about the workplace
Walk, do not run or rush about.

Use the walk ways provided and never take short cuts.

Look out for and obey warning notices and safety signs.

Only drive a works vehicle if you have been trained to use it and your supervisor allows you to use it.

Never hitch a ride on a vehicle not made to carry passengers. Do not stand on a fork lift truck or on a tractor trailer drawbar.

Lifting and carrying
You must learn how to lift correctly. Only lift or carry what you can easily manage. When lifting, get a good grip, lift smoothly and close to your body.

Get help if you are not sure you can lift or carry something safely and easily by yourself. Use trolleys or wheelbarrows where these are provided.

Ladders
Do not use ladders with split, missing or loose rungs. Use proper ladders.

Always make sure that the ladder is placed in the right position, at the right angle and cannot slip.

If working from a ladder, do not lean too far to the side, come down and move the ladder to a more convenient place.

Always use ladders, scaffolding or lifts to reach high places. Never hitch a lift in a crane bucket or on the forks of a lift truck.

Roofs
Roofs may be fragile or the tiles loose. Never go on to a roof unless you are told to do so by your supervisor and have been shown the precautions you should take.

Compressed air
Only use compressed air when your supervisor tells you to.

Do not use it for cleaning machines, benches or clothing.

Electricity
Remember electricity can kill or cause severe burns. Treat it with care.

Make sure you understand your supervisor's instructions before using any electrical equipment. It you do not understand, ask your supervisor to show you again.

Always switch off before connecting or disconnecting any electrical appliance.

Machinery
Operate only machines you have been trained to use and told to use.

Make sure you can reach the controls easily and know how to stop any machine you use.

Safety guards are fitted to machines to protect you and must be used.

Wait until a machine has stopped and has been switched off before you clean or clear it. Dangling chains or loose clothing could get caught up in the moving parts. Keep long hair tucked under a cap or tied back.

Do not distract other people who are using machines.

Tell your supervisor at once if you think a machine is not working properly.

Harmful substances
Learn to recognise the hazard warning signs or labels which tell you about the type of danger. They should tell you if a substance is poisonous, easily set on fire, or can cause burns.

Follow all instructions given on the container or by your supervisor.

Before you use a substance, find out what to do if it spills onto your skin or clothes.

If you are splashed with a chemical wash it off at once in the way your have been shown. Then report to your supervisor or whoever is responsible for first aid.

Overalls or protective clothing that get soaked or badly stained by harmful substances must not be taken home from work.

Do not put liquids and substances into unlabelled or wrongly labelled bottles and containers such as lemonade bottles or empty tins. This can be dangerous to everyone you work with.

Fire
Take care when handling petrol or other flammable substances. Keep them away from naked flames or sparks. Do not smoke.

Do not throw rubbish or cigarette ends and matches in corners, or under benches.

Obey 'No Smoking' rules.

First aid
Make sure you know the first aid arrangements for your workplace.

Report any injury, however slight, to your supervisor.

Always be careful.

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