



CERTIFICATION SCHEME FOR PERSONNEL

## **DOCUMENT No. CSWIP-WInst-1-91**

### **Requirements for the Certification of Welding Instructors and Specialist Welding Instructors**

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Issued under the authority of the Governing Board for Certification  
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Accreditation Certificate No 25

## **FOREWORD**

The Certification Scheme for Personnel (CSWIP) is a comprehensive scheme which provides for the examination and certification of individuals seeking to demonstrate their knowledge and/or competence in their field of operation. The scope of CSWIP includes all levels of Welding Inspectors, Welding Supervisors, Welding Instructors, Plant Inspectors, Plastics Welders and Underwater Inspection personnel.

CSWIP is managed by the Certification Management Board, which acts as the Governing Board for Certification, in keeping with the requirements of the industries served by the scheme. The Certification Management Board, in turn, appoints specialist Management Committees to oversee specific parts of the scheme. All CSWIP Boards and Committees comprise member representatives of relevant industrial and other interests.

The requirements governing the Registration of Master Welder Instructors are detailed in a separate document. Possession of a CSWIP Welding Instructor certificate is one of the pre-requisites of Registration.

Registration is strongly recommended as it helps to satisfy the CSWIP certificate renewal requirements, see Clause 11.5.

## **ACCESS TO CERTIFICATION**

Access to certification schemes is not improperly restricted. The sole criteria for certification are given in the document (and any subsequent amendments) and no other criteria will be applied. Certification is not conditional on the candidate applying for other services or membership from TWI Certification Ltd, its parent, or any other groups or associations.

### **1. Objectives**

The manufacture of safe, cost-effective welded products and structures is critically dependent on the skill of individual welders. In order to ensure welders are properly trained and instructed, a scheme for qualifying welding instructors is essential. As well as bringing benefits to the trainee, it also provides nationally recognised status for the instructor and the training organisation employing him/her.

### **2. Scope**

The scheme identifies personnel who have relevant experience in welding instruction, a high level of welding skill and who have attained a minimum level of knowledge. This document provides the procedures by which certification is sought and the requirements for the approval of the related training course.

### **3. Categories of Certification and Definitions**

There are two categories of certification as defined below:

#### **3.1. CERTIFIED WELDING INSTRUCTOR**

A Certified Welding Instructor is a person responsible for the initial assessment and instruction in the safe and correct practical welding skills required by the trainee to meet his/her or the sponsor's specification. The instructor has duties in supervising trainees, course planning, course delivery, inspection and testing of welds and in trainees' record keeping.

#### **3.2. CERTIFIED SPECIALIST WELDING INSTRUCTOR**

A Certified Specialist Welding Instructor is a person whose welding qualifications may not be sufficient to satisfy the requirements for Welding Instructor although the person can provide

safe and correct practical training within his/her welding capabilities in one or more of the following areas:

- a) assisting a Welding Instructor when course numbers exceed practical limits of instructor/trainee levels,
- b) providing specialist training courses within their competency,
- c) undertaking welder competency assessments within their competency under the overall supervision of a Welding Instructor.

A Certified Specialist Welding Instructor is not eligible to be Registered as a Master Welding Instructor.

#### 4. Skill Requirements

Instructors are required to provide proof of their welding skill through the successful completion of welder qualification tests to an acceptable standard. EN 287, ISO 9606, ASME IX, EN 13067 and approved equivalents are all acceptable<sup>1</sup>. Applications involving qualification tests conducted to other standards may be acceptable: full details must be provided.

Qualification tests must be witnessed by a recognised third party and certificates must have been obtained, or have been updated, no more than one year before the date of application. Originals or authenticated copies of certificates must be submitted.

##### 4.1. CERTIFIED WELDING INSTRUCTOR

To become a Certified Welding Instructor, qualifications must be held in three combinations of processes and materials, that is, any three of the boxes in one of the tables shown below

**Table 1 Conventional materials/components**

	Carbon med.alloy steels	Stainless steels	Aluminium alloys	Copper alloys	Nickel alloys	Others
MMA						
MIG/MAG and related						
TIG/plasma						
Gas						
Other Processes						

<sup>1</sup> For rail welding instructors qualifications in accordance with Network Rail Standards NR/L2/TRK/0032 and 0132 are acceptable

**Table 2 Rail materials and processes**

	Group A Rail Steels	Group B Rail Steels	Group C Rail Steels	Other Rail Steels
MMA				
MIG/MAG and related				
Tubular cored wire				
Aluminothermic process 1				
Aluminothermic process 2				
Flash butt				

The categories of materials detailed in the above table comply with the groups of materials given in Network Rail Standard NR/L2/TRK/0032. The categories are as follows:

- Group A rail steels: R200  
R220 (Normal grade)  
R260 (Wear-resisting Grade A)  
UIC 700  
UIC 900A  
AREA 900A  
UIC Grade A
- Group B rail steels: R 260Mn (Wear-resisting Grade B)  
R 320Cr (110kg/mm<sup>2</sup> Cr)  
90kg/mm<sup>2</sup>  
UIC Grade B
- Group C rail steels: R 350HT  
HT (340-370)
- Other rail steels: High Performance (HP)  
400MHH (R370CrHT)

**Table 3 Plastics materials**

Sector	Welding technique	Materials				
		PVC	PP	PE	PVDF	Other
Fabrication	Hot gas					
	Extrusion					
Pipe	Heated tool butt					
	Socket fusion					
	Electrofusion					
Geomembrane	Heated wedge					
	Extrusion					

Qualifications may be held in one welding process used on a range of materials, one material for a range of processes or any combination. For all round competence, a Welding Instructor is normally expected to demonstrate skill in manual welding of pipe in all positions for each process/material qualification held. In specific situations, where the training establishment does not train welders in all positions, e.g. for automobile assembly, plastics welding or rail

welding, the requirement for all positional welding skill may be relaxed. In such situations, the certificate is to be endorsed to indicate the reduced scope.

#### **4.2. CERTIFIED SPECIALIST WELDING INSTRUCTOR**

Where an instructor has welding skills in a specialist field or is only employed as a skilled instructor under the supervision and control of a Welding Instructor, he or she may be certified as a Specialist Welding Instructor. Qualifications must be held in at least one process/material combination from the boxes in the tables in 4.1. Qualification testing is carried out in the same manner as for Welding Instructor.

### **5. Knowledge Requirements**

#### **5.1. WELDING TECHNOLOGY**

Candidates for Certified Welding Instructor and Certified Specialist Welding Instructor must demonstrate knowledge in the processes on which they give instruction. A typical description of the required knowledge base is given in Appendix 1. Candidates are expected to provide evidence of training covering the appropriate knowledge base.

Candidates are recommended to attend a CSWIP approved training course (see Section 9) where appropriate.

#### **5.2. INSTRUCTION TECHNIQUES**

In addition to satisfying the above candidates must also demonstrate skill in instruction techniques as evidenced by successful completion of a relevant course\* or through documented and authenticated instructor experience. Candidates submitting evidence of past experience must include detailed information of the courses they have been associated with as an instructor in the previous three years including: the candidate's role, course title, programme, content and duration. Evaluation of the candidate's performance in the course should be included.

### **6. The Examination**

#### **6.1. WRITTEN PART – CERTIFIED WELDING INSTRUCTORS ONLY**

A multiple-choice question and narrative answer examination is designed to test the candidate's knowledge of the welding technology identified in the training syllabus, see Appendix 1. Modified papers may be used in situations where an instructor is attached to a training centre which operates with a limited training scope.

#### **6.2. PRACTICAL PART - CERTIFIED WELDING INSTRUCTORS AND SPECIALIST WELDING INSTRUCTORS**

Candidates are required to demonstrate their competence in instructional techniques by:

- a) Producing a welded test piece with a verbal commentary in the presence of an examiner or invigilator.
- b) Running a classroom session including a minimum of 20 minutes verbal communication.

In addition, the Specialist Welding Instructor must undergo an oral examination.

Further details of the examination are given in Appendix 2.

### **7. Required Experience**

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\* Holders of TDLB units D32 or D33 (A1/A2) are deemed to satisfy this requirement.

Candidates for Welding Instructor must have a practical welding background as a welder<sup>2</sup>, welding operator or welding instructor and must have a minimum of five years relevant welding experience. In exceptional cases, a candidate with experience as a welder in industry may be accepted for certification with a shorter period of experience, but not less than three years, if he or she can demonstrate a competence that would be expected in a mature candidate with five or more years practical experience.

Candidates for Specialist Welding Instructor must have a practical welding background with at least one year as a welder or welding operator, in industry or in a welder training school.

## **8. Instructors' Responsibilities**

Applicants for certification as Welding Instructor will be expected to demonstrate responsibilities and capability in all of the items listed below:

### **a) Supervisory**

- Discipline and control of trainees\*\*
- Ordering of materials\*
- Preventative maintenance of equipment\*\*
- General housekeeping\*\*
- Counselling trainees.\*

### **b) Course planning**

- Preparation of training programme\*
- Preparation for weld test/assessment\*
- Writing course notes and hand outs.\*

### **c) Course delivery**

- Safety and related subjects\*\*
- Instructing trainees to the syllabus requirements\*\*
- Lectures and shop talks to support practical training\*\*
- Practical demonstrations\*\*
- Reading of drawings\*\*
- Instruction in repair procedures.\*\*

### **d) Inspection and testing**

- Testing to recognised standards or industry specifications as appropriate\*\*
- Inspection of trainee test pieces.\*\*

### **e) Record keeping**

- Measurement and recording of trainee competence\*\*
- Logging trainee progress\*\*
- Written reports.\*

Applicants for certification as Specialist Welding Instructor will be expected to demonstrate knowledge and understanding of all those items in the above lists marked with a single asterisk\* and to demonstrate capability in those items marked with two asterisks.\*\*

## **9. Training Courses for Instructors**

Training establishments seeking approval by CSWIP to run training courses covering the requirements of Appendix 1 for potential welding instructors must first submit to TWI

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<sup>2</sup> Five years' experience as a welding instructor is acceptable in lieu of experience as a welder

Certification Ltd an enquiry form to justify an application. If accepted, the establishment must then submit written application accompanied by a detailed training programme with course texts and visual aids. If acceptable in principle, the establishment will be visited to examine the facilities in place and to interview the staff who will provide the instruction. Courses will only be approved if presented by staff appropriately qualified.

A fee is charged for this work and operation of the course is subject to a franchise fee per student.

## **10. Application for Examination and Fees**

Candidates will be required to submit an application form and a CV. All the information requested must be on these forms. No applications can be considered confirmed until receipt of correctly completed documents. Application forms ask for specific details of experience and training and must be signed to the effect that these details are correct.

Candidates proved to have cheated, or found to have attempted to remove or found to have removed examination material in a CSWIP examination will not be accepted as a candidate for any CSWIP examination for a minimum period of five years from the date of the examination where cheating, attempt to remove or removal of examination material, was established to have taken place.

## **11. Certification**

### **11.1. RESULTS NOTICES**

All candidates will be sent a results notice. This notice will also be sent to the organisation paying the examination fee, if not paid by the candidate.

### **11.2. SUCCESSFUL CANDIDATES**

Two copies of a certificate of proficiency will be issued to the organisation or person that pays the examination fees. A Duplicate certificate to replace those lost or destroyed will be issued only after extensive enquiries.

### **11.3. UNSUCCESSFUL CANDIDATES**

Candidates who fail to obtain a certificate may attempt one retest of those parts of the examination in which success was not achieved. The retest must be completed within one year of the initial test, otherwise candidates will have to repeat the complete examination. Candidates who fail the retest revert to initial status.

### **11.4. PERIOD OF VALIDITY**

The certificate is valid for five years from the date of completion of the initial test and may be renewed for a further five years on application, provided evidence is produced in accordance with Clause 11.5.1. Certificates are only valid provided:

- a) they are within date.
- b) they are on standard cream CSWIP paper bearing the CSWIP logo in black on gold signed by an officer of CSWIP and embossed with the CSWIP stamp.
- c) they have been signed by the individual to whom the certificate is awarded.
- d) they are accompanied by a valid official CSWIP identity card.

Photocopies are unauthorised by CSWIP and should only be used for internal administrative purposes.

### **11.5. RENEWAL**

### **11.5.1. Five year renewal**

In order for the certificate for Welding Instructor or Specialist Welding Instructor to be renewed after five years, the holder has to demonstrate that he/she has maintained his/her competence by:

- i) providing evidence of continuous work activity in welding instruction
- ii) providing evidence that the holder has kept up to date in welding technology.

One way of satisfying Part (ii) for a Welding Instructor is by Registration as a Master Welder Instructor – see Document No CSWIP-WI-1-91 Registration Scheme for Visual Welding Inspectors, Welding Inspectors, Senior Welding Inspectors, Welding Instructors and Welding Supervisors. Registration includes membership of the Welding and Joining Society.

Specialist Welding Instructors may find it helpful to join the Welding and Joining Society.

Part (i) can be satisfied either by the employer signing the reverse of the certificate or, if the holder has had a number of different jobs, by submitting a log sheet of relevant work activity covering the period of validity of the certificate.

Renewal must take place not later than 21 days after the date of expiry of the certificate. It is the certificate holder's responsibility to ensure that renewal takes place at the appropriate time. Only under extreme circumstances will certificates be renewed up to a maximum of six calendar months from the date of expiry shown on the certificate and late renewal will be subject to a special fee.

### **11.5.2. Ten year renewal**

Welding Instructor and Specialist Welding Instructor certificates are renewed beyond ten years from the initial examination (or from a previous ten year renewal) by the holder successfully completing a renewal examination prior to the expiry of the certificate in addition to the renewal procedure given in Clause 11.5.1.

The 10 year examination will consist of the following:

Multi choice written paper.

The initial practical examination.

One retest, within 4 months of the 10 year renewal examination, will be allowed.

Failure at the retest point will mean that the candidate must take the full course and initial examination again to regain the qualification.

## **11.6. COMPLAINTS AND APPEALS**

An aggrieved party in a dispute which considers itself to have reasonable grounds for questioning the competency of a CSWIP qualified person may petition the Governing Board for non-renewal of the certificate. Such a petition must be accompanied by all relevant facts, and if in the opinion of the Board an adequate case has been presented, a full investigation of the circumstances under dispute will be initiated. If the petition is substantiated to the satisfaction of the Board, the certificate will not be renewed without further test.

Appeals against failure to certify or against non-renewal of the certificate may be made by the instructor or the employer upon application in writing to the Governing Board.

## **12. Exemptions**

Welding Instructors who successfully complete the approved course and examination will be exempt from Modules 1 and 2 of the International/European Welding Specialist training

course. I/EWS Diploma holders seeking Welding Instructor Certification are exempt the welding technology course.

### **13. Records**

TWI Certification Ltd maintains records of successful and unsuccessful candidates. These records are accessible to the Governing Board or its nominees at all reasonable times.

#### **ADDRESSES**

For further general information about the approval schemes covered in this document contact:

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For specific information on examinations and arranging for them to be carried out, contact the approved Examining Body:

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## **Certification of Welding Instructors**

### **APPENDICES TO DOCUMENT No: CSWIP-WInst-1-91**

- Appendix 1: Syllabus for the approved training course. (Copyright TWI Certification Ltd)
- Appendix 2: Specimen questions for the written part of the examination

## **APPENDIX 1: Syllabus for the Approved Instructor Knowledge Training Course**

### **1. INTRODUCTION AND OBJECTIVES**

This appendix lists the subjects that must be covered by an approved training course for the welding instructor certification scheme. The order in which the subjects are taught need not necessarily be the same as the order in which they are listed here.

Where the course is directed at a specific industrial sector, eg, automobile assembly, plastics welding or railway track welding, the course content may be modified to concentrate on the particular aspects of materials, welding and relevant related technology, application and safety, that are of specific relevance to that sector. Specific knowledge requirements for instructors in the aluminothermic welding of rails and for plastics welding instructors are provided at the end of this Appendix.

The duration of the course must, as a minimum, be 70 hours.

### **2. SUPERVISION, PRODUCTION AND PLANNING**

#### **Introductory**

Responsibilities, duties, qualifications and supervisory skills of instructors (see main document, Section 8).

#### **Codes and Standards**

Terms, symbols and definitions in welding  
Standards for welding operations and activities.

#### **Instructional Practice**

### **3. MATERIALS OF CONSTRUCTION**

Classification, properties and typical applications of steels, stainless steels, aluminium alloys and other engineering materials in common use. The elementary structure of metals and the effect of adding alloying elements. Carbon equivalent formula.

### **4. WELDING TECHNOLOGY**

#### **Welding and allied processes**

Description, characteristics and application of the following:

Manual metal arc welding  
Submerged arc welding  
Flux-cored arc welding  
Gas metal arc welding  
Tungsten inert gas welding  
Oxy-acetylene welding  
Flame cutting and gouging  
Arc cutting and gouging.

#### **Welding equipment**

Principles of operation; principal components of power sources and their ancillary equipment.

Care and maintenance.

## **Welding practice**

Welding consumables (electrodes, filler metals, fluxes, gases etc) and their selection:

Standards and classification  
Storage, drying and baking  
Hydrogen control.

Welding process variables and their effects:

Current, voltage, travel speed, arc length, electrode angle, electrode stick-out, polarity, flow rates of shielding and purging gases.

Joint preparation:

Weld preparation requirements and examples  
Cleanliness of weld preparations.

Welding procedures specifications:

Content, key role in quality assurance.

Control of distortion:

Factors influencing distortion, for example, joint preparation, fit-up, welding speed, welding process used, welding sequence, material thickness, and the use of jigs and fixtures.

Remedial action, for example, approved heating or mechanical techniques.

Preheat, interpass and post-weld heat treatment:

Methods of heating, and measurement and control of temperatures.

Weld defects:

Common weld defects: misalignment, poor shape, undercut, excess penetration, slag, porosity, lack of fusion, lack of penetration.

Repair of welds.

## **Properties of welded joints**

Properties of welded joints including: strength, toughness, hardness, corrosion resistance.  
Effect of heat treatment, including normalising, annealing, preheating, solution treatment, and post-weld heat treatment  
Influence of heat input and cooling rate on the deposited weld metal and heat-affected zone  
Influence of composition of parent metal and consumables on weld properties  
Dilution  
Influence of restraint  
Weldability  
Hydrogen cracking (HAZ and weld), solidification cracking, reheat cracking, transverse cracking and lamellar tearing  
Common modes of failure: brittle fracture and fatigue. Influence of stress.

## **5. QUALITY ASSURANCE AND CONTROL**

### **Quality Assurance (QA):**

Quality manual (or quality plan), ISO 3834

Quality documentation for welding: welding procedure specifications (WPS), welding procedure qualifications (WPQ), welder qualification and welder records.  
Calibration of welding equipment and instruments.

### **Quality Control (QC):**

Requirements of inspection before, during and after welding; qualification of inspection personnel.

Checking performance and accuracy; calibration.

Methods of inspection and testing in accordance with the relevant application standards:

Visual: weld size, form and shape; undercut, overlap, surface.

Destructive: chemical analysis, tensile, bend, impact, nick-break, macro and hardness tests.

Non-destructive: visual, magnetic, penetrant, ultrasonic and radiographic inspection; hydrostatic and proof testing.

Detection and measurement of weld defects.

## **6. SAFETY**

Identification of hazards and necessary action to eliminate or reduce hazards:

Examples of hazards:

Electric shock  
Fire and explosion  
Fumes  
Cylinder handling  
Use of scaffolding  
X and gamma radiation  
Welding arcs.

Typical safety procedures:

Safety education  
Ventilation and monitoring of the workplace  
Eye, ear and skin protection  
Storage of gases  
First aid.

Statutory requirements: Health and Safety at Work Act regulations covering:

Workplace  
Provision and Use of Work Equipment  
Manual Handling operations  
Personal Protective Equipment at Work  
Management of Health and Safety at Work  
COSHH

### **Additions to Appendix 1 - Specific knowledge requirements for instructors in the aluminothermic welding of rails**

These items can replace the generic knowledge requirements (see above) as appropriate but many of the generic requirements will still apply particularly in the areas of QA and safety.

## **Codes and Standards**

Terms, symbols and definitions for rail welding.  
Railtrack Group Standards and Line Specifications that deal with rail welding.

## **Materials**

Classification, properties and typical applications of steels used for track, including switches and crossings. The iron carbon diagram and the effect of cooling rate.  
Rail sizes and sections in common use.

## **Welding technology**

Description, characteristics and application of aluminothermic welding as applied to rails.

## **Welding equipment**

Principles of operation of aluminothermic welding and ancillary equipment (e.g. cutting and heating).

## **Welding practice**

Content and use of process manuals.

Welding consumables (gases, portions, etc.) and their storage and selection.

Welding process variables and their effects.

Preheating  
Reaction times.

Joint preparation

Rail marking  
Cutting and aligning rails to the required standard and within specified tolerances  
Taking rail wear into account  
Selecting the correct moulds  
Fitting and sealing moulds  
Narrow gap and wide gap welds  
Protecting the weld area from bad weather.

Preparation for welding

Preheating the crucible  
Preheating the joint  
Fitting the crucible, slag traps, etc.  
Adding the portion  
Special requirements for dissimilar metal welds.

Welding

Igniting the portion  
Reaction time  
Melting and pouring  
Cooling time and use of mufflers as appropriate.

Post weld activities

Removal of risers  
Use of shearing tools to remove excess metal

Grinding the rail head to the required standard  
Use of tensor equipment.

Weld defects

Common weld defects: misalignment, poor shape, cavities, lack of fusion, etc.  
Repair of welds.

### **Properties of aluminothermic welded joints**

Strength, toughness, hardness.

Metallurgical structure - influence of heat input and cooling rate on the deposited weld metal and heat affected zone.

Weldability – achieving acceptable weld quality with high carbon steels.

Influence of composition of rail steel and consumables on weld properties.

Dilution.

### **Quality Assurance and Control**

Quality manual (or quality plan).

Process manuals.

Welder qualification and welder records.

Care and maintenance of equipment.

Inspection before, during and after welding.

Acceptance criteria.

Visual inspection and non-destructive testing.

### **Safety**

Personal track safety regulations.

Special safety precautions when dealing with exothermic reactions.

### **Additions to Appendix 1 – Specific knowledge requirements for plastics welding instructors**

These items can replace the generic knowledge requirements (see above) as appropriate but many of the generic requirements will still apply, particularly in the areas of QA and safety.

#### **Materials**

Classification, properties and typical applications of polyvinylchloride, polypropylene, polyethylene, polyvinylidene fluoride and other thermoplastics in common use. The elementary structure of polymers.

#### **Welding and allied processes**

Description, characteristics and application of the following:

Hot gas welding

Extrusion welding

Heated tool welding

Heated socket welding

Electrofusion welding

Machine hot wedge welding

#### **Welding practice**

Welding consumables (weld rod, pipe fittings) and their selection:

Standard and classification

Storage and handling.

Welding process variables and their effects:

Temperature, pressure, speed/time, torch angle.

Joint preparation:

Weld preparation requirements and examples

Cleanliness of weld preparations

Methods of preparation.

Weld defects:

Common weld defects: misalignment, poor shape, undercut, excessive penetration, porosity, lack of fusion, lack of penetration, contamination.

## **APPENDIX 2: Specimen Questions for the Written Part of the Examination**

### **Multiple Choice Paper**

This section of the examination requires forty (40) questions to be answered in one hour. The pass mark is 70%.

Specimen questions are given below:

- 1 Arc blow in DC welding arcs is caused by:
  - a) the effect of wind on an exposed welding arc
  - b) magnetism set up within the work and its effect on the welding arc
  - c) the electrode burning at one side only due to poor manufacture
  - d) none of the above.

(correct answer – b)
  
- 2 Which of the following analyses would give an austenitic stainless steel?
  - a) 12% chromium, 2%nickel
  - b) 0.2% carbon, 6% nickel, 2% manganese
  - c) 18% chromium, 8% nickel
  - d) all of the above.

(correct answer – c)
  
- 3 Electrical power is normally measured in:
  - a) Horsepower
  - b) Newtons
  - c) Joules
  - d) Watts.

(correct answer – d)

### **WRITTEN ANSWER PAPER**

This Section of the examination requires a total of four (4) questions to be answered out of eight (8) in two hours. There are four groups of questions covering different subject areas and one question from each group must be answered. The pass mark is 70%. Specimen questions are given below:

- 1 With the aid of drawings explain the difference between dip, globular and spray transfer in MIG/MAG welding when using bare wires.
  
- 2 A trainee asks you how to decide which welding process to use to butt weld two large 38mm thick low C steel plates. Discuss the factors to be considered.

### **Practical instruction test**

#### **Part B**

The practical instructor test will involve a classroom training session in which the applicant will be expected to give a minimum of 20 minutes verbal presentation.

The assessment of the applicant's performance will take account of:

- session objectives
- session instructor notes
- use of handouts
- training aids employed
- involvement of trainees
- instructor presentation skills.