



BGAS-CSWIP CERTIFICATION SCHEME FOR PERSONNEL

DOCUMENT No. BGAS-CSWIP-BG-22-12

Requirements for the Certification of Personnel in accordance with the BGAS-CSWIP Scheme

2nd Edition, April 2019

Issued under the authority of the Governing Board for Certification
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CSWIP is administered by TWI Certification Ltd
The use of the UKAS Accreditation Mark indicates accreditation in respect of those activities covered
by Accreditation Certificate No 25

FOREWORD

The Certification Scheme for Personnel (CSWIP) is a comprehensive scheme that 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 Welding Inspectors, Welding Supervisors, Welding Instructors, Plant Inspectors, Underwater Inspection personnel, NDT personnel and Heat Treatment operatives.

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 BGAS-CSWIP scheme is a comprehensive scheme that provides for the examination and certification of individuals seeking to demonstrate specific knowledge and competency in those disciplines relevant to the construction and maintenance of pipelines and associated installations. TWI Certification Ltd is accredited by UKAS to BS EN ISO/IEC 17024 for certification of personnel.

TWI Certification Ltd understand the importance of impartiality in carrying out its certification activities, managing conflict of interest and ensuring the objectivity of all its certification activities, in accordance with BS EN ISO/IEC 17024.

ACCESS TO CERTIFICATION

Access to certification 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 GENERAL

1.1 Scope

This document prescribes procedures by which personnel may be examined, and, if successful, certificated for; BGAS Senior Pipeline Inspector Grade 1R, 1A and 2, BGAS Senior Welding Inspector, BGAS Welding Inspector, BGAS Ultrasonic Operator, BGAS Ultrasonic Inspector (Plate), BGAS Radiographic Interpreter, BGAS Magnetic Particle Inspector, BGAS Site Coating Inspector, BGAS Mill Coating Inspector, BGAS Painting Inspector Grades 1 and 2, BGAS Painting Supervisor Grade 4, BGAS Blast Cleaning/Preparation Operative Grade 5A, BGAS Painting Operative Grade 5B and BGAS Agricultural/Environmental Inspector.

The examination procedure is designed to test the candidate's knowledge of the methods and techniques relevant to the discipline in which they are being examined, and their understanding of the operations they perform. The examination procedure involves both theoretical and practical elements and may include an oral interview.

1.2 Responsibilities of personnel

Typical areas of work activity are given below:

1.2.1 BGAS Senior Pipeline Inspector Grade 1 and 2

- Ensuring all aspects of inspection function efficiently and that all technical specifications are complied with.
- Undertaking inspection tasks and reports.
- Maintaining accurate records and ensuring that all inspection staff on site are fully conversant with and have access to the relevant specifications and codes of practice.

- Acting in support of the Engineer in all technical matters relating to inspection.

1.2.2 BGAS Senior Welding Inspector

- Acting in support of the Engineer or Senior Pipeline Inspector in all matters related to welding.
- Ensuring that welding standards are observed and maintained at all stages of pipeline and associated installation construction.
- Relating visual defects and defects found by NDT to possible faults in materials, good welding practice or non-compliance with agreed procedures (eg handling) or to other causes.
- Undertaking inspection tasks and reports.

1.2.3 BGAS Welding Inspector

- Ensuring that all specified welding and mechanical handling standards are observed.
- Ensuring that welding parameters and pre-heat conditions are maintained according to the specifications and procedure qualifications.
- Inspecting and recording all welds and relating visual defects and defects found by NDT to possible faults in materials, non-compliance with agreed procedures (eg handling) or to other causes.
- Maintaining visual inspection at intermediate and completion stages and where necessary, requesting relevant NDT.

1.2.4 BGAS Ultrasonic Operator

- Examining completed welds as required in accordance with approved procedures and producing accurate reports and records.
- Carrying out accurate wall thickness measurements and pipe lamination checks.
- Knowledge of allied NDT techniques is desirable.

1.2.5 BGAS Ultrasonic Inspector (Plate)

- Carrying out accurate wall thickness measurements and check for pipe laminations in accordance with approved procedures.
- Producing accurate reports of the test results.

1.2.6 BGAS Radiographic Interpreter

- Responsible for the review of radiographs, ensuring that full compliance with relevant safety legislation and safety procedure are achieved.
- Providing support and supervision for Radiographic Contractors to enable them to meet necessary safety and radiographic requirements.
- Ensuring that the specified requirements for radiography are met ie radiographic films are produced and processed in accordance with the approved radiographic procedures and techniques. Confirming that radiographic quality is acceptable prior to interpretation.

- Carrying out interpretation and sentencing of radiographs in accordance with relevant acceptance criteria and produce accurate records of the test results.

1.2.7 BGAS Magnetic Particle Inspector

- Implementing Magnetic Particle Inspection (MPI) and/or Liquid Penetrant Inspection (LPI) of welds and steel materials in accordance with relevant standards and specifications.
- Interpreting and recording the results of each examination.
- Reporting the results of the MPI or LPI tests.

1.2.8 BGAS Site Coating Inspector

- Acting in support of the Engineer and/or Senior Pipeline Inspector on all matters relating to site coating operations.
- Assessing and measuring of environmental conditions to ensure that specification requirements are met prior to coating.
- Ensuring surface preparation and coating operations are carried out in accordance with the specification and/or approved and qualified procedures.
- Monitoring procedures used for the safe handling and disposing of materials used in coating operations, to prevent environmental contamination.
- Maintaining accurate records and compiling relevant reports.

1.2.9 BGAS Mill Coating Inspector

- Acting in support of the Engineer and/or Quality Manager on all matters relating to mill coating inspection.
- Assessing and measuring of environmental conditions to ensure that specification requirements are met prior to mill coating.
- Ensuring surface preparation and mill coating operations are carried out in accordance with the specification and/or approved and qualified procedures.
- Monitoring procedures used for the safe handling and disposing of materials used in mill coating operations, to prevent environmental contamination.
- Maintaining accurate records and compiling relevant reports

1.2.10 BGAS Painting Operative Grade 5B

- Painting and coating surfaces with brushes, rollers or spray application in accordance with the manufacturers' recommendations and relevant specification requirements.
- Considering potential impacts on the environment and other personnel when handling, using and disposing of materials associated with painting operations.

1.2.11 BGAS Blast Cleaning/Preparation Operative Grade 5A

- Preparing surfaces to the required standard in accordance with the relevant specifications prior to the application of paints and related products.
- Considering potential impacts on the environment and other personnel when handling, using and disposing of materials associated with painting operations.

1.2.12 BGAS Painting Supervisor Grade 4

- Supervising industrial blasters and painters in the preparation and application of painting/coating systems in accordance with relevant standards, manufacturer's data sheets and environmental considerations.

1.2.13 BGAS Painting Inspector Grade 2

Acting in support of the Engineer and/or Painting Inspector Grades 1 on all technical matters relating to painting inspection

- Ensuring that requirements of the paint and painting specifications are met, including the safe environment handling and disposing of materials associated with painting operations.
- Carrying out all aspects of painting inspection and maintaining accurate records.

1.2.14 BGAS Painting Inspector Grade 1

- Acting in support of the Engineer on all technical matters relating to paint and painting inspection with particular emphasis to painting operations in an offshore environment.
- Co-ordinating the work of Painting Inspectors Grade 2 when required, ensuring that they are fully conversant with, and having access to, the relevant codes of practice and specifications.
- Ensuring that all painting operations are in accordance with the relevant standards and specifications, including the safe environmental handling and disposing of materials associated with painting operations.
- Carrying out all aspects of painting inspection and maintaining accurate records.

1.2.15 BGAS Agricultural/Environmental Inspector

- Demonstrating a comprehensive knowledge of relevant legislation and working practices.
- Carrying out agricultural/environmental inspection in accordance with specifications/management procedures and producing accurate reports and record.

2 Eligibility for Examination

Candidates shall have a combination of education, training and experience adequate to ensure that they have the potential to understand the principles and procedures of the applicable method.

To be eligible for certification the candidate shall provide evidence of successful completion of a recognised training programme approved by TWI Certification Ltd. Details of current training establishments approved by TWI Certification Ltd. can be found on the BGAS and CSWIP websites.

2.1 Experience Requirements

To be eligible for certification candidates shall have the minimum experience indicated below in the method in which they are seeking certification.

| BGAS Method | Minimum Months Experience |
|---|----------------------------------|
| Senior Pipeline Inspector Grade 1R | 24 |
| Senior Pipeline Inspector Grade 1A | 24 |
| Senior Pipeline Inspector Grade 2 | 24 |
| Senior Welding Inspector | 12 |
| Welding Inspector | 1 |
| Ultrasonic Operator | 6 |
| Ultrasonic Inspector Plate | 1 |
| Radiographic Interpreter | 6 |
| Magnetic Particle Inspector | 1 |
| Mill Coating Inspector | 3 |
| Site Coating Inspector | 1 |
| Painting Inspector Grade 1 | 12 |
| Painting Inspector Grade 2 | 6 |
| Painting Supervisor Grade 4 | 6 |
| Blast Cleaning/Preparation Operative Grade 5A | 1 |
| Painting Operative Grade 5B | 1 |
| Agricultural/Environmental Inspector | 3 |

The minimum months experience requirement detailed above may be substituted where the candidate can provide evidence of a minimum of six months work experience in a relevant engineering environment for categories where a maximum of six months experience is required.

Candidates must provide evidence of experience by providing relevant information authenticated by a senior responsible person in the candidate's employing organisation or by a major client.

Experience maybe acquired prior to or following success in the examination. In the event that the experience is sought following successful examination, the results of the examination shall remain valid for two years.

2.2 Entry Requirements

For the higher grades of certification, the following entry requirements are required.

2.2.1 Senior Pipeline Inspector Grade 1R

To be eligible to take the BGAS Senior Pipeline Inspector Grade 1R examination, in addition to having the required industrial experience, candidates must also hold valid BGAS Welding Inspector, Site Coating Inspector, Ultrasonic Operator, Magnetic Particle Inspector and Radiographic Interpreter certificates.

2.2.2 Senior Pipeline Inspector Grade 1A

To be eligible to take the BGAS Senior Pipeline Inspector Grade 1A examination, in addition to having the required industrial experience, candidates must also hold valid BGAS Welding Inspector, Site Coating Inspector, Ultrasonic Operator, Magnetic Particle Inspector and hold a valid ISO 9712 Phased Array Data Analysis or Phased Array Data Interpreter, Level 2.

2.2.3 Senior Pipeline Inspector Grade 2

To be eligible to take the BGAS Senior Pipeline Inspector Grade 2 examination, in addition to having the required industrial experience, candidates must also hold valid BGAS Welding Inspector, Site Coating Inspector, Ultrasonic Inspector Plate, Magnetic Particle Inspector and Radiographer or Radiographic Interpreter certificates.

2.2.4 Senior Welding Inspector

To be eligible to take the BGAS Senior Welding Inspector examination, in addition to having the required industrial experience, candidates must also hold valid BGAS Welding Inspector, Ultrasonic Inspector Plate, Magnetic Particle Inspector and Radiographic Interpreter certificates.

2.2.5 NDT Bridging Examinations

Candidates who do not hold BGAS Ultrasonic Inspector Plate or Pipe, Magnetic Particle Inspector or Radiographic Interpreter who wish to be certified as a BGAS Senior Welding Inspector or BGAS Senior Pipeline Inspector Grade 1 or 2 who hold a valid ISO 9712 Level 2 certification in Ultrasonic, Magnetic Particle or Radiography can sit a BGAS NDT bridging examination in that discipline consisting of 10 multiple choice questions based on the relevant National Grid Specifications.

2.2.6 Painting Inspector Grade 1

To be eligible to take the BGAS Painting Inspector Grade 1 examination, in addition to having the required industrial experience, candidates must hold a valid BGAS Painting Inspector Grade 2 certificates.

2.3 Vision Requirements

The candidate shall provide documented evidence of satisfactory vision in accordance with the following requirements:

- a) Unaided or corrected near visual acuity in at least one eye shall be such that the candidate is capable of reading a minimum of Jaeger number 1 or Times Roman N4.5 or equivalent letters (having a minimum height of 1.6mm) type at a distance of not less than 30cm with one or both eyes on a standard reading test chart.
- b) Colour vision shall be sufficient that the candidate can distinguish and differentiate contrast between the colours used. All candidates and holders of BGAS certification will be required to have a colour perception assessed by the Ishihara 24 plate test, in the event of colour perception deficiency indicated by misreading any of the first 17 plates, the candidate must notify their employer and a further trade test shall be carried out by the employer to ascertain whether the detected colour perception deficiency affects the individual's ability to perform in the method for which they are to be certificated.

The evidence must be in the form of a certificate issued by a medically recognised person or a trained appointed representative of the medically recognised person within the previous 12 months, covering all the above points.

With all the above eligibility requirements the onus is on the candidate to provide the necessary evidence prior to examination. An examination appointment will not be confirmed until the evidence has been received. Subsequent to certification, tests of visual acuity shall be carried out annually.

3 Application for Examination and Fees

When the eligibility for examination has been achieved, the next step is to take the examination.

Candidates will be required to submit an application form. 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.

In the event of a false statement being discovered on forms any examination undertaken will be declared null and void. A certificate is automatically invalidated if there are any outstanding examination fees in respect of that certificate.

Candidates proved to have cheated or found to have attempted to remove or found to have removed examination material in a BGAS/CSWIP examination will not be accepted as a candidate for any BGAS/CSWIP or 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.

Examinations may be taken at any one of a number of test centres in the UK and overseas. Lists are available on request.

4 CATEGORIES OF CERTIFICATION

Candidates may apply for one of the following certification categories:

BGAS Senior Pipeline Inspector Grade 1R
BGAS Senior Pipeline Inspector Grade 1A
BGAS Senior Pipeline Inspector Grade 2
BGAS Senior Welding Inspector
BGAS Welding Inspector
BGAS Ultrasonic Operator
BGAS Ultrasonic Inspector Plate
BGAS Radiographic Interpreter
BGAS Magnetic Particle Inspector
BGAS Mill Coating Inspector
BGAS Site Coating Inspector
BGAS Painting Inspector Grade 1
BGAS Painting Inspector Grade 2
BGAS Painting Supervisor Grade 4
BGAS Blast Cleaning/Preparation Operative Grade 5A
BGAS Painting Operative Grade 5B
BGAS Agricultural/Environmental Inspector

5 Examination Content

The examinations will consist of the following:

5.1 BGAS Senior Pipeline Inspector Grade 1R

Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
Paper 2: Practical examination consisting of 50 multiple choice questions, time allowed 75 minutes.
Paper 3: SPI general knowledge paper consisting of 10 narrative questions, time allowed 60 minutes
Practical: Ultrasonic weld – lamination check one weld, thickness check one weld, one pipe weld plus one sub arc weld, time allowed 3 hours
Radiographic Interpretation – interpretation of six weld radiographs; time allowed 90 minutes
Magnetic Particle – one welded sample, time allowed 60 minutes
Passmark 70%

5.2 BGAS Senior Pipeline Inspector Grade 1A

Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
Paper 2: Practical examination consisting of 50 multiple choice questions, time allowed 75 minutes.
Paper 3: SPI general knowledge paper consisting of 10 narrative questions, time allowed 60 minutes

Practical: Ultrasonic weld – lamination check one weld, thickness check one weld, one pipe weld plus one sub arc weld, time allowed 3 hours
 Phased Array – interpretation of six scans, time allowed 90 minutes
 Magnetic Particle – one welded sample, time allowed 60 minutes
 Passmark 70%

5.3 BGAS Senior Pipeline Inspector Grade 2

Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
 Paper 2: Practical examination consisting of 50 multiple choice questions, time allowed 75 minutes.
 Paper 3: SPI general knowledge paper consisting of 10 narrative questions, time allowed 60 minutes
 Practical: Ultrasonic plate – lamination check one sample, one thickness check. Time allowed 60 minutes
 Radiographic Interpretation – interpretation of six weld radiographs; time allowed 90 minutes
 Magnetic Particle – one welded sample, time allowed 60 minutes
 Passmark 70%

5.4 BGAS Senior Welding Inspector

Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
 Paper 2: Practical examination consisting of 50 multiple choice questions, time allowed 75 minutes.
 Paper 3: SWI general knowledge paper consisting of 10 narrative questions, time allowed 60 minutes
 Practical: Ultrasonic plate – lamination check one sample, one thickness check. Time allowed 60 minutes
 Radiographic interpretation – interpretation of six weld radiographs; time allowed 90 minutes
 Magnetic Particle – one welded sample, time allowed 60 minutes
 Passmark 70%

5.5 BGAS Welding Inspector

Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
 Paper 2: Practical examination consisting of 50 multiple choice questions, time allowed 75 minutes.
 Passmark 70%

5.6 BGAS Ultrasonic Operator

Paper 1 General theory paper consisting of 15 narrative questions, time allowed 90 minutes
 Paper 2 General theory paper consisting of 30 multiple choice questions, time allowed 45 minutes
 Practical: Lamination check one sample, thickness check three samples, three pipe welds plus one sub arc weld, time allowed 3 hours 45 minutes.
 Passmark 70%.

5.7 BGAS Ultrasonic Inspector Plate

- Paper 1: General theory paper consisting of 15 narrative questions, time allowed 90 minutes
- Paper 2: General theory paper consisting of 20 multiple choice questions, time allowed 30 minutes
- Practical: Lamination check one sample, thickness check three samples, time allowed 2 hours
Passmark 70%.

5.8 BGAS Radiographic Interpreter

- Paper 1: General theory paper consisting of 15 narrative questions, time allowed 90 minutes
- Paper 2: Radiographic safety paper consisting of 15 narrative questions, time allowed 90 minutes
- Paper 3: General theory paper consisting of 20 multiple choice questions, time allowed 30 minutes
- Practical: Oral interview re pipe radiography technique and interpretation of 20 weld radiographs, time allowed 3 hours 30 minutes
Passmark 70%.

5.9 BGAS Magnetic Particle Inspector

- Paper 1: General theory paper consisting of 15 multiple choice questions, time allowed 25 minutes
- Paper 2: General theory paper consisting of 15 narrative questions, time allowed 90 minutes
- Practical: Three welded samples, time allowed 2 hours
Passmark 70%.

5.10 BGAS Mill Coating Inspector

- Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
- Paper 2: Practical examination consisting of 50 multiple choice questions, time allowed 75 minutes.
Passmark 70%.

5.11 BGAS Site Coating Inspector

- Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
- Paper 2: Practical examination consisting of 50 multiple choice questions, time allowed 75 minutes.
Passmark 70%.

5.12 BGAS Painting Inspector Grades 1, and 2

- Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
- Paper 2: Practical examination consisting of 50 multiple choice questions, time allowed 75 minutes.
Passmark 70%.

5.13 BGAS Painting Supervisor Grade 4

- Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
- Paper 2: Practical examination consisting of 50 multiple choice questions, time allowed 75 minutes.
Passmark 70%.

5.14 BGAS Blast Cleaning/Preparation Operative 5A and Painting Operative 5B

- Paper 1: General theory paper consisting of 50 multiple choice questions, time allowed 75 minutes
- Practical: Candidates will be required to demonstrate their ability to prepare surfaces for painting or to apply paint films in accordance with the grade of certification required. Time allowed 2 hours

5.15 BGAS Agricultural/Environmental Inspector

- Paper 1: General theory paper consisting of 25 multiple choice questions, time allowed 30 minutes
- Practical: Drainage exercise, time allowed 60 minutes
Passmark 70%.

6 Certification

6.1 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.

6.2 Successful candidates

Two copies of a certificate of proficiency will be issued to the candidate or sponsoring organisation. Duplicate certificates to replace those lost or destroyed will be issued only after extensive enquiries.

6.3 Unsuccessful candidates

Candidates who fail to obtain a certificate may attempt one retest on 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.

6.4 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 6.5.1. Certificates are only valid provided:

- a) they are within date.
- b) they are on standard cream CSWIP paper bearing the BGAS/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.
- e) the holder is still employed by the sponsoring organisation.

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

6.5 Renewal

6.5.1 Five year renewal

In order for the certificate to be renewed after five years, the holder has to demonstrate that he/she has maintained his/her competence by supplying evidence of reasonably continuous work activity in the relevant method during the period of validity of the certificate¹, providing evidence of continuing professional development and a current satisfactory vision certificate (see Clause 2.3).

The certificate will not be renewed without further test if a substantiated complaint is notified by the Governing Board during the period of its validity. Further instruction and retest may then be required.

Renewal must take place not later than 21 days after the date of expiry. 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.

6.5.2 Ten year recertification

Certificates are renewed beyond ten years from the initial examination (or from a previous ten year renewal) by the holder successfully completing a recertification examination prior to the expiry of the certificate in addition to the renewal procedure given in Clause 6.5.1. Requests for the appropriate documentation should be sent to TWI Certification Ltd.

The 10 year examination will consist of:

6.5.2.1 BGAS Senior Pipeline Inspector Grade 1R

- | | |
|------------|---|
| Paper 1: | General theory papers consisting of 20 multiple choice theory questions for each subject (welding, site coatings, radiographic interpretation, ultrasonics, magnetic particle inspection) time allowed 30 minutes per subject paper. Total time allowed 2 hours 30 minutes. |
| Paper 2: | Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes |
| Paper 3: | SPI general knowledge paper consisting of 10 narrative questions, time allowed 60 minutes |
| Practical: | Ultrasonic weld – lamination check one weld, thickness check one weld, one pipe weld plus one sub arc weld, time allowed 3 hours Radiographic Interpretation – interpretation of six weld radiographs; time allowed 90 minutes Magnetic Particle – one welded sample, time allowed 60 minutes Passmark 70% |

6.5.2.2 BGAS Senior Pipeline Inspector Grade 1A

- | | |
|----------|--|
| Paper 1: | General theory papers consisting of 20 multiple choice theory questions for each subject (welding, site coatings, phased array, ultrasonics, magnetic particle inspection) time allowed 30 minutes per subject paper. Total time allowed 2 hours 30 minutes. |
| Paper 2: | Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes |

¹ As a guide, 'reasonable continuity' in any given five year period means that absences from work for which the certificate was granted should not exceed one year in one or several periods.

- Paper 3: SPI general knowledge paper consisting of 10 narrative questions, time allowed 60 minutes
- Practical: Ultrasonic weld – lamination check one weld, thickness check one weld, one pipe weld plus one sub arc weld, time allowed 3 hours
 Phased array – interpretation of six scans; time allowed 90 minutes
 Magnetic Particle – one welded sample, time allowed 60 minutes
 Passmark 70%

6.5.2.3 BGAS Senior Pipeline Inspector Grade 2

- Paper 1: General theory paper consisting of 20 multiple choice theory questions, for each subject (welding, site coatings, radiographic interpretation, ultrasonics, magnetic particle inspection) time allowed 30 minutes per subject paper. Total time allowed 2 hours 30 minutes.
- Paper 2: SPI general knowledge paper consisting of 10 narrative questions, time allowed 60 minutes
- Practical: Ultrasonic plate – lamination check one sample, one thickness check. Time allowed 60 minutes
 Radiographic Interpretation – interpretation of six weld radiographs; time allowed 90 minutes
 Magnetic Particle – one welded sample, time allowed 60 minutes
 Passmark 70%

6.5.2.4 BGAS Senior Welding Inspector

- Paper 1: General theory paper consisting of 20 multiple choice theory questions, for each subject (welding, radiographic interpretation, ultrasonics, magnetic particle inspector) time allowed 30 minutes per subject paper. Total time allowed 2 hours
- Paper 2: Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes
 Passmark 70%.
- Practical: Ultrasonic plate – lamination check one sample, one thickness check. Time allowed 60 minutes
 Radiographic interpretation – interpretation of six weld radiographs; time allowed 90 minutes
 Magnetic Particle – one welded sample, time allowed 60 minutes
 Passmark 70%

6.5.2.5 BGAS Welding Inspector

- Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
- Paper 2: Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes
 Passmark 70%.

6.5.2.6 BGAS Ultrasonic Operator

- Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
- Practical: Lamination check one sample, thickness check one sample, one pipe weld and one sub arc weld, time allowed 3 hours 45 minutes

Passmark 70%.

6.5.2.7 BGAS Ultrasonic Inspector Plate

Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
Practical: Lamination check one sample, thickness check one sample, time allowed 60 minutes
Passmark 70%.

6.5.2.8 BGAS Radiographic Interpreter

Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
Paper 2: Radiation safety paper consisting of 15 narrative questions, time allowed 90 minutes
Practical: Oral interview re pipe radiography technique and interpretation of 10 weld radiographs, time allowed 2 hours
Passmark 70%.

6.5.2.9 BGAS Magnetic Particle Inspector

Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
Practical: One welded sample, time allowed 60 minutes
Passmark 70%.

6.5.2.10 BGAS Mill Coating Inspector

Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
Paper 2: Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes
Passmark 70%

6.5.2.11 BGAS Site Coating Inspector

Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
Paper 2: Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes
Passmark 70%

6.5.2.12 BGAS Painting Inspector Grade 1, and 2

Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
Paper 2: Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes
Passmark 70%

6.5.2.13 BGAS Painting Supervisor Grade 4

Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
Paper 2: Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes
Passmark 70%

6.5.2.14 BGAS Blasting/Painting Operative Grade 5A

- Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
- Paper 2: Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes
- Practical: Preparation of cleaned samples. Time allowed 1 hour
Passmark 70%

6.5.2.15 BGAS Painting Operative Grade 5B

- Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
- Paper 2: Practical paper consisting of 20 multiple choice questions, time allowed 30 minutes
- Practical: Preparation of painted samples. Time allowed 1 hour
Passmark 70%

6.5.2.16 BGAS Agricultural/Environmental Inspector

- Paper 1: General theory paper consisting of 20 multiple choice theory questions, time allowed 30 minutes
- Practical: Oral interview, time allowed 60 minutes
Pass mark 70%

6.6 Unsuccessful Candidates

One retest, within six months of the 10 year recertification examination, will be allowed for all categories.

Candidates who fail the retest, will return to initial status and will be required to sit the full initial examination, it is recommended that refresher training be undertaken prior to the examination.

For multiple approval certificates (SPI/SWI) where one of the categories of the re-certification examination has been failed by the candidate. Individual certificates for the successful categories may be issued. The overall SPI/SWI certificates will only be issued once the failed categories have been successfully completed.

(It may be the case that the individual intends to re-sit the failed part of their SPI/SWI as soon as practicable – and does not wish to have individual pass certificates issued. In that case an email of their successful results can be issued to show the status of certifications in the meantime to permit them to carry on working using only the categories they have passed.)

6.7 Complaints and appeals

An aggrieved party in a dispute which considers itself to have reasonable grounds for questioning the competency of a BGAS/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 inspector or the employer upon application in writing to the Governing Board.

7 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.

8 ADDRESSES

For further general information contact:

TWI Certification Ltd
Granta Park
Great Abington
Cambridge
CB21 6AL
UK

Phone: +44 (0) 1223 899000
Email: twicertification@twi.co.uk

Fax: +44 (0) 1223 894219
Website: www.cswip.com

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

TWI Training and Examinations
Granta Park
Great Abington
Cambridge
CB21 6AL
UK

Phone: +44 (0) 1223 899000
Email: trainexam@twi.co.uk

Fax: +44 (0) 1223 891630
Website: www.twi.co.uk

Appendix A – Examination Syllabus

Any aspect of the syllabus may be included in the written and oral examinations. The level of knowledge required by the candidate varies according to topic. To ensure comprehension by all parties the following terms have been defined to demonstrate an increasing level of knowledge.

Background knowledge The candidate must have a working knowledge of the subject and be able to apply it.

Comprehensive knowledge The candidate must have a depth of knowledge sufficient to enable them to exercise judgement.

A1. Welding Inspector

Comprehensive knowledge of the following:

A1.1. Welding Theory

- Material composition, relevant welding specifications and the application and theory of preheat.
- Implications of using a particular welding process and consumable type for the various different applications (eg pipe/pipe, pipe/fitting, hot taps), consideration being given to the application, characteristics and limitations of each welding process.
- The influence of electrical, operational and physical variables on the weld zone.
- Pipeline construction procedures.
- Control and use of welding consumables.
- Types of defect found in welds or associated with welds, including their origin and the corrective action required to overcome these defects.

A1.2. Welding Practical

The candidate shall identify various weld types and the manufacturing welding process used, acceptable and unacceptable weld preparations, weld caps and roots and associated defects. They will demonstrate a comprehensive knowledge of typical pipeline welding consumable types, shielding gases and their classification.

- The application of T/SP/P/2 and T/SP/P/1.
- The application of T/SP/P/9.

A1.3. Mechanical Testing

The candidate shall identify specific weld, HAZ and base material mechanical test specimens and have a detailed understanding of the required level of specimen preparation, testing and acceptance levels.

A2. Radiographic Interpreter

Comprehensive knowledge of:

A2.1. Radiation Safety

- Relevant regulations and code of practice specific to radiation safety, including permissible dose rates for classified and non-classified personnel and terminologies used. They will show a comprehensive understanding of the properties, effects and measurement of radiation, and maintaining necessary records to comply with regulations.

A2.2. Radiography Theory

- Basic industrial radiographic theory including the nature of X-rays and gamma rays and how they should be used to produce high quality radiographs. The geometry of shadow image formation.
- Calculations involving the inverse square law which affect strength and distance. Calculations relating to image quality indications (various types), change of either mA, minutes or distance.
- Standards of radiographic practice, choice of techniques and applications in accordance with the specification. Knowledge of allied NDT techniques is desirable.

A2.3. Radiography Practical

- Which X-ray and gamma ray techniques are available and the correct method to use. The geometry of techniques and their limitations as specified in BS EN ISO 17636-1 & 2 and T/SP/NDT/2.
- Setting up the correct exposures for internal and external applications, i.e. double wall or panoramic, diagnostic film length and the processing of film. Factors affecting sensitivity, definition, contrast and density.

A2.4. Interpretation of Radiographs

- Correct weld identification, interpretation, sentencing and commenting on the quality of typical weld radiographs taken by either X-ray or gamma ray techniques.

Background knowledge of:

A2.5. Welding Theory

- Implications of using a particular welding process and consumable type for the various different applications (eg pipe/pipe, pipe/fitting, hot taps), consideration being given to the application, characteristics and limitation of each welding process.
- Types of defect found in welds or associated with welds, including their origin and the corrective action required to overcome these defects.

A2.6. Welding Practical

- Identification of weld types and the welding process used, acceptable and unacceptable weld preparations, weld caps and roots and associated defects, weld caps and roots and associated defects. Knowledge of typical pipeline welding consumable types, shielding gases and their classification.
- The application of T/SP/P/2 and T/SP/P/1.

A2.7. Crack Detection Theory

- Principles and application of the magnetic particle (MPI) and dye penetrant (DPI) crack detection techniques and methods used on pipelines and associated fabrications

A3. Ultrasonic Operator

Comprehensive knowledge of:

A3.1. Ultrasonic Theory

- The nature and properties of sound waves and their generation. Beam shape and the measurement of sound intensity of the ultrasonic beam.
- Calculations of skip distances, beam paths, near zones, half angles and Snell's Law.
- Knowledge of the relevant standards and specifications applicable to ultrasonic testing.

A3.2. Ultrasonic Practical

- Use of international test blocks. Lamination checks on steel plate. Wall thickness checks on steel specimens.
- The correct identification of the angles of unmarked probes. The examination and reporting of three weld specimens of differing weld configuration and /or welding process.

Background knowledge of:

A3.3. Welding Theory

- Implications of using a particular welding process and consumable type for the various different applications (e.g. pipe/pipe, pipe/fitting, hot taps), consideration being given to the application, characteristics and limitation of each welding process.
- Types of defect found in welds or associated with welds, including their origin and the corrective action required to overcome these defects.

A3.4. Welding Practical

- Identification of weld types and the welding process used, acceptable and unacceptable weld preparations, weld caps and roots and associated defects, weld caps and roots and associated defects. Demonstrate knowledge of typical pipeline welding consumable types, shielding gases and their classification.
- The application of T/SP/P/2 and T/SP/P/1.
- The application of T/SP/P/9.

A3.5. Interpretation of Radiographs

- Correct weld identification, interpretation, sentencing and commenting on the quality of typical weld radiographs taken by either X-ray or gamma ray techniques.

A3.6. Crack Detection Theory

- Principles and application of the magnetic particle (MPI) and liquid penetrant (LPI) crack detection techniques and methods used on pipelines and associated fabrications

A3.7. Crack Detection Practical

- Examination of various samples with electromagnet and using magnetic particle methods for acceptability of the weld area.

A4. Ultrasonic Inspector Plate

Comprehensive knowledge of:

A4.1. Ultrasonic Theory

- The nature and properties of sound waves and their generation. Beam shape and the measurement of sound intensity of the ultrasonic beam.
- Calculations of skip distances, beam paths, near zones, half angles and Snell's Law.

Background knowledge of:

- Knowledge of the relevant standards and specifications applicable to ultrasonic testing.

A4.2. Ultrasonic Practical

Comprehensive knowledge of:

- Use of international test blocks. Lamination checks on steel plate. Wall thickness checks on steel specimens.

A4.3. Welding Practical

Background knowledge of:

- The application of T/SP/P/9.

A5. Magnetic Particle Inspector

Comprehensive knowledge of:

A5.1. Crack Detection Theory

- The principles and application of the magnetic particle (MPI) and liquid penetrant (LPI) crack detection techniques and methods used on pipelines and associated fabrications.
- The sequence of application, position of defects which can be detected, materials and techniques, soaking times necessary, magnetism, de-magnetism, orientation of magnetic field, strength of inks etc.
- Knowledge of relevant standards and specifications applicable to MPI and LPI.
- Background knowledge of liquid penetrant inspection methods and techniques.

A5.2. Crack Detection Practical

- Examination of various samples with electromagnet and using magnetic particle methods for acceptability of the weld area.
- Correct identification of manufacturing/in service defects and action to be taken. Reporting and recording of findings.

Background knowledge of:

A5.3. Welding Theory

- Implications of using a particular welding process and consumable type for the various different applications (eg pipe/pipe, pipe/fitting, hot taps), consideration being given to the application, characteristics and limitation of each welding process.
- Types of defect found in welds or associated with welds, including their origin and the corrective action required to overcome these defects.

A5.4. Welding Practical

- Identification of weld types and the welding process used, acceptable and unacceptable weld preparations, weld caps and roots and associated defects, weld caps and roots and associated defects. Demonstrate a knowledge of typical pipeline welding consumable types, shielding gases and their classification.
- The application of T/SP/P/2 and T/SP/P/1.
- The application of T/SP/P/9.

A6. Site Coating Inspector

Comprehensive knowledge of:

A6.1. General theory

- The principal of corrosion and protection by application of coatings systems including surface preparation, effect of environmental conditions and the handling of coated items.

Background knowledge of:

- Environmental considerations regarding the toxicity, handling and disposal of materials associated with coating operations.

A6.2. Site Coating

- Site coating procedures and practices, including knowledge of National Grid specifications T/SP/CW/5, T/SP/CW/6 Parts 1 & 2 and T/SP/CW/9 Parts 1, 2 and 3 as appropriate and relevant inspection techniques.

A6.3. Coating Practical

- Measurement of environmental conditions, surface preparation techniques, use of abrasives, degree of cleanliness and identification of a variety of coating systems including faults.

A7. Mill Coating Inspector

Comprehensive knowledge of;

- Mill coating procedures and practices including:
 - a) Knowledge of National Grid specifications T/SP/CW/2, T/SP/CW/6 Parts 1 & 2 and T/SP/CW/9 Parts 1, 2 & 3 (as appropriate), and relevant inspection techniques with respect to external coating systems.
 - b) Knowledge of National Grid specifications T/SP/CM/1 and T/SP/CM/2 (as appropriate), and relevant inspection techniques with respect to internal coating systems

A8. Blast Cleaning/Preparation Operative Grade 5A

Comprehensive knowledge of:

A8.1. Painting theory

- General principle of corrosion, the conditions that cause it to occur and the mechanisms by which paint and coating systems prevent corrosion.
- Fully conversant with current H.S.E. legislation and company safety rules relating to painting or coating equipment/operations and relevant environmental considerations.
- The candidate shall be able to correctly interpret current painting and coating specification requirements.

A8.2. Cleaning practical

- Candidates will be examined with regard to knowledge of rust grading, blast cleaning and hand & power tool cleaning, to provide suitable cleanliness and surface profiles which comply with relevant standards and specifications. Successful candidates shall also be competent in the safe set up and dismantling of all associated equipment.

A9. Painting Operative Grade 5B

Comprehensive knowledge of:

A9.1. Painting theory

- General principle of corrosion, the conditions that cause it to occur and the mechanisms by which paint and coating systems prevent corrosion.
- Fully conversant with current H.S.E. legislation and company safety rules relating to painting or coating equipment/operations and relevant environmental considerations.
- The candidate shall be able to correctly interpret current painting and coating specification requirements

A9.2. Painting practical

- Mixing and application of different one and two coat paint/coating systems to relevant specifications.
- Assembling, checking, using and safely cleaning the various types of equipment used for paint/coating application.
- Recognising common paint faults and knowledge of methods to eradicate the root cause of such faults will be tested. An ability to observe good housekeeping practices at all times is required.

A10. Painting Supervisor Grade 4

Comprehensive knowledge of:

A10.1. Painting theory

- Fully conversant with current environmental considerations regarding the toxicity, handling and disposal of materials associated with the preparation and painting operations.

- General principles of corrosion, the conditions that cause it to occur and the mechanisms by which paint and coating systems prevent corrosion.
- Good working knowledge of current H.S.E. and QA/QC legislation and be fully conversant with good working practices and environmental considerations.
- Demonstrate good management, organisational and administrative skills, and should be aware of and be able to correctly interpret, current painting and coating specification requirement.

A10.2. Painting practical

- Surface preparation and cleanliness, the measurement of environmental conditions, surface profiles, and paint film thickness. Paint systems and faults and methods used to test the properties of new and existing paints and painted pipe work.
- Overseeing the correct mixing of two pack paint products, correct assembly and use of equipment and the correct application and inspection of paint systems.
- Various types of surface contamination including how they are identified and removed taking into account environmental considerations.
- Knowledge of rust grading, blast cleaning and hand and power tool cleaning, to provide suitable cleanliness and surface profiles which comply with relevant standards and specifications. Successful candidates shall also be competent in the safe set up and dismantling of all associated equipment.
- Safe handling and movement of materials being prepared for painting or coating, and a sound knowledge of good housekeeping practices.

A11. Painting Inspector Grade 2

Comprehensive knowledge of:

A11.1. Painting theory

- Fully conversant with current environmental considerations regarding the toxicity, handling and disposal of materials associated with the preparation and painting operations.
- General principles of corrosion, the conditions that cause it to occur and the mechanisms by which paint and coating systems prevent corrosion.
- Examination and inspection methods necessary to verify compliance with the requirements of T/SP/PA/9 and T/SP/PA/10.

A11.2. Painting practical

- Surface preparation and cleanliness, the measurement of environmental conditions, surface profiles, and paint film thickness. Paint systems and faults and methods used to test the properties of new and existing paints and painted pipe work.
- Various types of surface contamination including how they are identified and removed taking into account environmental considerations.
- Knowledge of rust grading, blast cleaning and hand and power tool cleaning, to provide suitable cleanliness and surface profiles which comply with relevant standards and specifications. Successful candidates shall also be competent in the safe set up and dismantling of all associated equipment.

- Safe handling and movement of materials being prepared for painting or coating, and a sound knowledge of good housekeeping practices.

A12. Paint Inspector Grade 1

Comprehensive knowledge of:

A12.1. Painting theory

- Systems and procedures used both onshore and offshore and of the current relevant specifications.
- Fully conversant with current environmental considerations regarding the toxicity, handling and disposal of materials associated with the preparation and painting operations.
- General principles of corrosion, the conditions that cause it to occur and the mechanisms by which paint and coating systems prevent corrosion.
- Examination and inspection methods necessary to verify compliance with the requirements of T/SP/PA/9 and T/SP/PA/10.

A12.2. Painting practical

- Surface preparation and cleanliness, the measurement of environmental conditions, surface profiles, and paint film thickness. Paint systems and faults and methods used to test the properties of new and existing paints and painted pipe work.
- Various types of surface contamination including how they are identified and removed taking into account environmental considerations.
- Knowledge of rust grading, blast cleaning and hand and power tool cleaning, to provide suitable cleanliness and surface profiles which comply with relevant standards and specifications. Successful candidates shall also be competent in the safe set up and dismantling of all associated equipment.
- Safe handling and movement of materials being prepared for painting or coating, and a sound knowledge of good housekeeping practices.

A12. Agricultural/Environmental Inspector

A12.1. Combined theory and practical examination

Working knowledge of the Control of Pesticides Regulations and COSHH.

Animal and crop husbandry.

Animal and plant diseases, including notifiable diseases.

Practical exercise: Calculate areas of land and demonstrate use of scale rule in the written paper.

Land drainage principles and design.

Mole drainage, suitability of soils for this treatment.

Subsoil compaction and the equipment to remedy same.

Standard farm cultivations.

Agricultural land management.

Hill gripping.

Pipeline right of way clearance and fencing.

Topsoil stripping and storage.

Trenching/land drain recording.

Backfill.

Subsoil 'ripping' and regrading.

Topsoil reinstatement.

Ditch reinstatement and revetment.

Permanent fencing and hedge re-planting.

Animal, crops husbandry and land management requirements.

Hedge removal I.A.W Hedgerow Regulations.

Reinstatement and Revetment of Watercourses.

Wildlife Protection and removal I.A.W: - UK & EU Legislation.

Organic Production, both arable and animal.

Diversification and various environmental schemes e.g. Countryside Stewardship, Community Forest Programme etc.

Tree felling, tree preservation (TPO), conservation areas and environmental considerations.

Familiarisation with Safe Working Practices.

Causes and Remedies for Compaction.

A13. References

This document makes reference to the standards and specifications listed below. Unless otherwise specified the latest editions of these documents, including all addenda and revisions, shall apply.

A13.1 British Standards

| | |
|-------------------|---|
| BS EN ISO 17636-1 | Non Destructive Testing of welds – Radiographic testing Part 1: X -and gamma – ray techniques with film |
| BS EN ISO 17636-2 | Non Destructive Testing of welds – Radiographic testing Part 2: X - and gamma – ray techniques with digital detectors |

A13.2 National Grid Engineering Specifications

| | |
|-----------|---|
| T/SP/CM/1 | Internal coating operations for steel line pipe and fittings. |
| T/SP/CM/2 | Internal coating materials for steel line pipe & fittings. |

| | |
|-------------------|--|
| T/SP/CW/2 | Performance tests for the supply of cold applied wrapping tapes and tape systems. |
| T/SP/CW/5 | Field applied external pipework coatings for buried pipe work and tape systems. |
| T/SP/CW/6: Part 1 | External protection of steel line pipe and fittings using fusion bonded epoxy and other coating systems: Part 1 – Requirements for coating materials and method of test. |
| T/SP/CW/6: Part 2 | External protection of steel line pipe and fittings using fusion bonded epoxy and other coating systems: Part 2 – Factory applied coatings. |
| T/SP/CW/9: Part 1 | Concrete coating of pipes: Part 1 – Negative buoyancy coatings. |
| T/SP/CW/9: Part 2 | Concrete coating of pipes: Part 2 – Security coatings. |
| T/SP/CW/9: Part 3 | Concrete coating of pipes: Part 3 – Thrust boring coatings. |
| T/SP/NDT/2 | Non-destructive testing of welded joints on construction and fabrication projects. |
| T/SP/PA/9 | Paint Systems. Properties and performance requirements. |
| T/SP/PA/10 | New and maintenance painting at works and site for above ground pipeline and plant installations. |
| T/SP/P/2 | Welding of steel land pipelines designed to operate at pressures greater than 7 bar (Supplementary to BS 4515-1:2009). |
| T/SP/P/8 | Welding of steel onshore natural gas installations designed to operate at pressures greater than 7 bar. |
| T/SP/P/1 | Welding of steel pipe designed to operate at pressures not greater than 7 bar. |
| T/SP/P/9 | Welding of fittings to pipelines operating under pressure (Supplementary to BS 6990). |

APPENDIX B

RECOMMENDED READING

B.1 GENERAL

The publications listed in B.2-8, while not referred to in the main body of this document, are considered a relevant and useful source of reference information for examination candidates. They are listed under their separate headings for convenience.

B.2 WELDING

B.2.1 British Standards

| | |
|------------------|--|
| BS EN ISO 6892-1 | Metallic materials. Tensile testing. Method of testing at ambient temperature |
| BS 499 Part 1 | Welding terms and symbols. |
| BS EN ISO 2560 | Welding consumables - Covered electrodes for the manual arc welding of non alloy and fine grain steels – Classification. |
| BS 4515 -1 | Specification for welding of steel pipelines on land and offshore. Part 1: Carbon and carbon manganese steel pipelines |

Other relevant standards relating to arc welding, power sources, equipment and accessories are available from BSI for reference

A.2.2 National Grid Engineering Standards

| | |
|-----------|---|
| T/SP/P/1 | Welding of steel pipe designed to operate at pressures not greater than 7 bar |
| T/SP/P/2 | Welding of steel land pipelines designed to operate at pressures greater than 7 bar (Supplementary to BS 4515-1: 2009) |
| T/SP/P/8 | Welding of steel onshore natural gas installations designed to operate at pressures greater than 7 bar. |
| T/SP/P/9 | Welding of fittings to pipelines operating under pressure (Supplementary to BS 6990). |
| T/PM/P/11 | Management procedure for inspection, assessment and repair of damaged (non-leaking) steel pipelines above 150mm nominal diameter and designed to operate at pressures greater than 2 bar. |
| T/PM/P/20 | Management procedure for inspection, assessment and repair of damaged (non-leaking) steel pipelines up to 150mm nominal diameter designed to operate at pressures greater than 2 bar. |

B.2.3 American Petroleum Institute publications

| | |
|----------|--|
| API 5L | Specification for line pipe. |
| API 1104 | Standard for welding pipelines and related facilities. |

B.2.4 American Society for Testing and Materials publications

ASTM E23 Notched bar impact testing of metallic materials.

B.3 RADIOGRAPHY

B.3.1 British Standards

| | |
|-----------------------------|--|
| BS EN ISO 17636 Parts 1 & 2 | Non-destructive examination of welds – Radiographic testing Part 1: X - and Gamma ray techniques with film Part 2: X - and Gamma ray techniques with digital detectors |
| BS EN 25580 | Minimum requirements for industrial radiographic illuminators for non-destructive testing. |
| BS EN ISO 19232 - 1 | Non-destructive testing – Image quality of radiographs Part 1: Determination of the image quality value using wire -type image quality indicators (ISO 19232-1: 2013) |
| BS EN ISO 19232– 3 | Non-destructive testing – Image quality of radiographs Part 3: Image quality classes (ISO 19232-3: 2013) |

B.3.2 General publications

An introduction to industrial radiology - J C Rockley – Butterworth

The physics of industrial radiography - R Halmshaw – Heywood

Industrial radiography - Kodak Limited, London

Industrial radiography - Agfa-Gevaert, Brentford

Radiation Safety for site radiography - H M Factory Inspectorate - Kluwer-Harrap Handbooks, London

EITB Training elements for industrial site radiographers

B.4 ULTRASONICS

B.4.1 British Standards

| | |
|----------------|---|
| BS EN ISO 2400 | Non-destructive testing – Ultrasonic testing – Specification for Calibration block No 1. |
| BS EN ISO 7963 | Specification for Calibration block No 2 for ultrasonic examination of welds |
| BS EN ISO 5577 | Non-destructive testing. Ultrasonic testing. Vocabulary |
| BS EN 17640 | NDT Testing of welds. Ultrasonic testing, Techniques, testing levels and assessment. |
| BS EN 10160 | Ultrasonic testing of steel flat product of thickness equal or greater than 6mm (Reflection Method) |

B.4.3 General publications

Non destructive testing handbook - edited by Robert C McMaster - The Ronald Press Co., New York

Ultrasonic flaw detection for technicians – Drury

Ultrasonic flaw detection in metals - Banks, Oldfield, Rawding - Iliffe Books Ltd.. London

Ultrasonic testing of materials - J & J Krautkramer - George Allen & Unwin Ltd., London

B.5 MAGNETIC PARTICLE AND DYE PENETRANT

B.5.1 British Standards

| | |
|------------------|---|
| BS EN 9934-1 | Non-destructive testing of welds Magnetic Particle testing: Part 1: General principles |
| BS EN 9934-2 | Non-destructive testing – Magnetic Particle testing Part 2 Detection media |
| BS EN 9934-3 | Non-destructive testing – Magnetic Particle testing Part 3: Equipment |
| BS EN ISO 17638 | Non-destructive testing of welds – Magnetic particle testing. |
| BS EN ISO 23278 | Non-destructive testing of welds – Magnetic particle testing – Acceptance levels. |
| BS EN ISO 3452–1 | Non-destructive testing – Penetrant testing. Part 1:General principles. |
| BS EN ISO 3059 | Non-destructive testing- Penetrant testing and Magnetic Particle testing - Viewing conditions |

B.6 COATINGS (AND BACKFILL)

B.6.1 National Grid Engineering Standards

| | |
|-----------|---|
| T/SP/CW/2 | Specification for Performance tests for the supply of cold applied wrapping tapes and tape systems. |
| T/SP/CW/5 | Specification for field applied external coatings for buried pipework and systems |

| | |
|---------------------------|---|
| T/SP/CW/6 | Specification for the external protection of steel line pipe and fittings using fusion bonded powder and other coating systems. |
| Part 1 | Requirements for coating, materials and methods of test. |
| Part 2 | Factory applied coatings. |
| T/SP/P/10 | Specification for general pipelining designed to operate at pressures greater than 7 bar |
| IGEM/TD1 Edition 5 Supp 1 | Handling transport and storage of steel pipes, bends and fittings. |
| OC 634/7 | HSE Operational Circular - Direct pressure blasting equipment |

B.7 PAINT/PAINTING

B.7.1 British Standards

| | |
|--------------|--|
| BS 4800 | Specification for paint colours for building purposes. |
| BS 5493 | Code of practice for protective coating of iron and steel structures against corrosion (see also EN ISO 12944 Pts. 1-8 and BS EN ISO 14713). |
| BS EN 3900-0 | Methods of tests for paints – Part 0; Index of test methods |
| BS 7079 | Preparation of steel substrates before application of paints and related products. |

B.7.2 National Grid Engineering Standards

| | |
|------------|---|
| T/SP/PA/9 | Technical specifications for paint systems – properties and performance requirements. |
| T/SP/PA/10 | Technical specification for new and maintenance painting at works and site for above ground pipeline and plant installations. |

B.7.3 General Publications

Outline of paint technology - W Morgans - Griffin International

Advanced paint chemistry - P M Fiske - Leonard Hills Books

Physical and chemical examination of paints - Sward and Co Ltd

Paint testing manuals: Physical examination of paints, varnishes, lacquers and colours – Chapman-Hall. ASTM

Introduction to paint chemistry – G P A Turner

Solvents - T H Durrans