BGAS-CSWIP

APPROVAL SCHEME

EXAMINATION REQUIREMENTS

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FOREWORD

This document dated February 2003 supersedes the British Gas Document (BG/PS/Q4) dated October 1988, and the 1995 edition of the exam Requirements.

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BRITISH GAS APPROVAL SCHEME (BGAS) EXAMINATION REQUIREMENTS

1. SCOPE

This Document details the technical requirements, both theoretical and practical, for each type of approval in the scheme.

2. SAFETY AND SAFE WORKING PRACTICE

All inspectors shall have a comprehensive knowledge and experience of safe working practice and the application of the safety regulations relevant to their own function and allied functions.

3. NOTES FOR GUIDANCE ON QUALIFICATION REQUIREMENTS

3.1 Table 1 outlines the major duties of each type of inspector, the materials which should be studied to qualify for the various types and categories of inspector or operator are specified in Clauses 4 to 9 inclusive.

Requirements for Agricultural/Environmental Inspector are shown in Section 10.

3.2 Table 2 identifies the clauses which are applicable to each type and category of inspector or operator, and indicates the minimum level of knowledge required.

3.3 Two levels of knowledge are recognised and these are defined below with the corresponding symbol used in Table 2:

A comprehensive knowledge – a detailed working knowledge of all aspects of the subject covered by the clause (symbol*)

A background knowledge – a basic knowledge of principles or techniques covered in the clause (symbol +).

3.4 Inspectors may be required by the pipelaying authority to undertake practical inspection at any level within the scope of their approved qualification. Where inspectors are required on pipeline or installations operating at pressure below 7 bar, a comprehensive knowledge of BGC/T/S/P1 is required.

3.5 Senior Pipeline Inspectors Grade 1 shall have a comprehensive knowledge and experience of all aspects of the inspection disciplines listed in Table 2.1

3.6 Senior Pipeline Inspectors Grade 2 shall have a comprehensive knowledge of all aspects of inspection except practical ultrasonics where they need only to be qualified to inspector (plate) standards.

4. EXAMINATION REQUIREMENTS: WELDING INSPECTION

4.1 Welding Theory

4.1.1 Knowledge of material composition, relevant welding specifications and the applications and theory of pre-heat.

4.1.2 The implications of using a particular welding process and electrode type for the various different applications (e.g. pipe/pipe, pipe/fitting, hot taps), consideration being given to the application, characteristics and limitations of each welding process.

4.1.3 The influence of electrical, operational and physical variables on the weld zone.

4.1.4 Pipeline construction procedures.

4.1.5 The control and use of welding consumables.

4.1.6 Types of defect found in welds or associated with welds, including their origin and the corrective action required to overcome these defects.

4.2 Welding Practical

4.2.1 Identification of weld types and the welding processes used, acceptable and unacceptable weld preparations, weld caps and roots and associated defects.

4.2.2 The application of T/SP/P2 and P1.

4.2.3 The application of T/SP/P9.

4.3 Mechanical Testing

The function of particular mechanical tests, their preparation and acceptance levels.

5. EXAMINATION REQUIREMENTS: RADIOGRAPHY

5.1 Radiation Safety

Detailed knowledge of relevant regulations and code of practice, including permissible dose rates for classified and non-classified personnel. The properties, effects and measurement of radiation. The keeping of necessary records and terminologies used.

5.2 Radiography Theory

5.2.1 Basic Industrial 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.

5.2.2 Calculations involving the inverse square law which affect strength and distance. Calculations relating to image quality indications (various types) change of mA min or of distance.

5.2.3 Standards of radiographic practice, choice of techniques and applications as per specification. Knowledge of allied NDT techniques is desirable.

5.3 Radiography Practical

5.3.1 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 1435: 1997

5.3.2 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.

5.4 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.

6. EXAMINATION REQUIREMENTS: ULTRASONICS

6.1 Ultrasonic Theory

6.1.1 The nature and properties of sound waves and their generation. Beam shape and the measurement of sound intensity of the ultrasonic beam.

6.1.2 Calculations of skip distances, beam paths, near zones, half angles and Snell's Law.

6.1.3 A knowledge of Standards and Specifications applicable to Ultrasonic testing.

6.2 Ultrasonic Practical

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

6.2.2 The correct identification of the angles of unmarked probes. Examination of at least three welds of different weld processes and reporting.

7. EXAMINATION REQUIREMENTS: MAGNETIC AND PENETRANT TECHNIQUES

7.1 Crack Detection Theory

7.1.1 The principal and application of penetrant and magnetic particle methods of crack detection techniques used on pipelines and associated fabrications.

7.1.2 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.

7.1.3

7.1.3 A knowledge of Standards and Specifications applicable to MPI.

7.2 Crack Detection Practical

7.2.1 Examination of various samples with electromagnet and or permanent magnet using magnetic particle methods for acceptability of the weld root area.

7.2.2 Correct identification of manufacturing / in service defects and action to be taken. Reporting of findings.

8. EXAMINATION REQUIREMENTS: COATINGS (SITE AND MILL APPLIED)

8.1 General Theory (for both site and mill applications)

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

8.2 Mill Coating

Mill coating procedures and practices including knowledge of Transco Specifications CW2, CW4, CW6 and CW9 in respect of external coating systems and CM1, CM2 and PA8 in respect of internal systems.

8.3 Site Coating

Site coating procedures and practices and knowledge of CW5, CW6 and CW9 specification and inspection techniques.

8.4 Coating Practical (both Mill and Field application)

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

9. EXAMINATION REQUIREMENTS: PAINTING INSPECTORS

9.1 There are three grades of painting inspector, and three of Painting Site Operative.

9.1.1 **Grade 3 Painting Inspector.**

Theory

Candidates shall be questioned on the general principles of corrosion and the conditions that cause it to occur and therefore the mechanisms by which paint and/or coating systems prevent corrosion.

Practical

Measurement of environmental conditions, surface profile and cleanliness, paint film thickness, and discussion paint systems and faults.

9.1.2 **Grade 2 Painting Inspector.**

The Grade 2 approved inspector requires the same breadth of knowledge as Grade 3, however, a greater theoretical and practical understanding is required.

A comprehensive knowledge of paint inspection as detailed in Table 2.

9.1.3 **Grade 1 Painting Inspector.**

The Grade 1 approval is related to offshore painting and systems.

The Grade 1 inspector is likely to be working in difficult conditions and without advice being readily available. A candidate must therefore demonstrate a comprehensive knowledge of systems and procedures used both onshore and offshore and of the current Transco specifications.
In view of the above, it is expected that successful candidates would have had at least one years prior experience in industrial painting inspection, preferably offshore.

9.1.4 **Grade 4 Painting Supervisor.**

The Painting Supervisor will need to have a good working knowledge of current H.S.E, and QA/QC legislation.
They should be aware of and be able to correctly interpret current painting and coating Specification Requirements.
They should demonstrate an ability to oversee the correct mixing of two pack paint products, the correct assembly and use of equipment and the correct application and inspection of paint systems.
They should further demonstrate good management, administration and organisational skills, as well as a sound knowledge of good working practices.
Environmental considerations.

9.1.5 **Grade 5A Blast Cleaning / Preparation Operative.**

The Blast cleaning / Preparation Operative shall demonstrate a knowledge of and be able to work to current Safety rules and H.S.E Legislation.
They should be able to recognise and subsequently remove the various types of surface contamination.
Their knowledge of blast cleaning, wire brushing and rust grading to relevant standards and specification will enable them to provide surface profiles to requirements. They will be able to safely set up and dismantle all associated equipment.
They shall demonstrate safe handling and movement of materials being prepared for painting or coating, and a sound knowledge of good housekeeping practices.
Environmental considerations

9.1.6 **Grade 5B Painting Operative.**

The Painting Operative shall demonstrate a knowledge of and ability to work to current Safety rules and H.S.E Legislation.
They should be able to interpret protective painting and coating systems to Specification Requirements.
Their detailed product knowledge will enable them to correctly mix and apply different one or two coat paint/coating systems to the required specifications.
They should be able to assemble, check, use and safely wash out the various types of equipment used for paint/coating application.
They should be able to recognise and eradicate common paint faults; and observe good housekeeping practices at all times.
Environmental considerations.

10. EXAMINATION REQUIREMENTS: AGRICUTURAL/ENVIRONMENTAL INSPECTOR

10.1 Working knowledge of the Control of Pesticides Regulations.

10.2 Animal and crop husbandry.

10.3 Animal and plant diseases including "notifiable ones"

10.4 Calculate areas of land and demonstrate use of scale rule in the written paper.

10.5 Land drainage principles and design.

10.6 Mole drainage, suitability of soils for this treatment.

10.7 Subsoil compaction and the equipment to remedy same.

10.8 Standard farm cultivations.

10.9 Agricultural land management.

10.10 Hill gripping.

10.11 Pipeline right of way clearance and fencing.

10.12 Topsoil stripping *and storage.*

10.13 Trenching/land drain recording.

10.14 Backfill.

10.15 Subsoil 'ripping' and regrading.

10.16 Topsoil reinstatement.

10.17 Ditch reinstatement and revetment.

10.18 Permanent fencing and hedge re-planting.

10.19 UK animal, crops husbandry and land management requirements.

10.20 Hedge removal I.A.W Hedgerow Regulations 1997.

10.21 Reinstatement and Revetment of Watercourses.

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

10.23 Organic Production both arable and animal.

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

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

10.26 Pesticide Regulations and COSHH Requirements.

10.27 Familiarisation with Safe Working Practices.

10.28 Pipeline Design and Safety Measures.

10.29 Causes and Remedies for Compaction.

TABLE 1 – Major Duties of Inspectors

SENIOR PIPELINE INSPECTOR (Two alternative categories Grade 1 and 2 according to qualifications and experience)	• Act in support of the Engineer in all technical matters relating to inspection. • Ensure that all aspects of inspection function efficiently and that all technical specifications are complied with. • Undertake inspection tasks and report. • Maintain accurate records and ensure that all inspection staff on site are fully conversant with and have access to the relevant specifications and codes of practice.
Senior Inspector (Welding)	• Ensure that welding standards are observed and maintained at all stages of pipeline construction.
Welding Inspector	• Ensure that all specified welding and mechanical handling standards are observed. • Ensure that welding parameters and pre-heat conditions are maintained according to the specifications and procedure qualifications. • Inspect and record all welds and relate visual defects and defects found by NDT to possible faults in materials, non-compliance with agreed procedures (e.g. handling) or to other causes. • Maintain visual inspection at intermediate and completion stages and, where necessary, request NDT.
Ultrasonic Operator	• Inspect and report on completed welds as required. • Implement tests for lamination and checks of wall thickness. • Knowledge of allied NDT techniques is desirable.
Ultrasonic Inspector (Plate)	• Implement tests for lamination and checks of wall thickness. • Report of all such tests.

Radiographer	• Ensure compliance with all specified requirements for radiography, including safety procedures. • Ensure that the approved techniques for taking radiographs and processing radiographic film are maintained. • Maintain records of all interpretations undertaken. • Report results obtained.
Radiographic Assistant	• Implement the loading of radiographic film, radiographic operations and the processing of radiographic film. • Ensure compliance with the relevant specifications, codes of practice and safety regulations.
MPI Inspector	• Record and implement MPI (magnetic particle inspection) and interpret the results. • Report such results.
Painting Inspector Grade 1 (Offshore)	• Act in support of the Engineer on all technical matters relating to paint and painting inspection. • Co-ordinate for the Engineer the work of the Painting Inspectors Grades 2 and 3 when required. • Ensure that the requirements of the paint and painting specifications are met. • Carry out all aspects of Painting Inspection. • Maintain records and ensure that the Painting Inspectors Grades 1 and 2 are fully conversant with, and have access to, the relevant codes of practice and specifications.
Painting Inspector Grade 2	• Act in support of the Engineer (and/or the Painting Inspector Grade 1) on all technical matters relating to paint and painting inspection. • Co-ordinate for the Engineer the work of the Painting Inspectors Grade 3 when required. • Ensure that requirements of the paint and painting specifications are met. • Carry out all aspects of Painting Inspection. • Maintain records and ensure that the Painting Inspectors Grade 3 are fully conversant with, and have access to, the relevant codes of practice and specifications.

Painting Inspector Grade 3	• Act in support of the Engineer and/or Painting Inspectors Grades 1 and 2 on technical matters related to painting inspection. • Carry out all aspects of painting inspection. • Ensure that the requirements of the painting specifications are met. • Maintain adequate records.
Painting Supervisor Grade 4	• To supervise industrial Blasters and Painters in the preparation and application of Painting/Coating systems in accordance with all relevant standards, manufacturers data sheet recommendations , and environmental considerations.
Blast Cleaning/Preparation Operative Grade 5A	• To prepare surfaces to various standards prior to the application of paints and related products. Taking environmental considerations into account
Grade 5B Painting Operative	• To paint or coat surfaces by brush roller or spray application to manufacturers and operators specifications. Taking environmental considerations into account.
Site Coating Inspector	• Ensure environmental conditions are within specification prior to coating. • Ensure surface preparation and coating operations are carried out in accordance with the specification and/or procedure qualifications. • Maintain records and report as necessary.
Mill Coating Inspector	• Act in support of the Engineer and/or QA surveyor on all matters relating to inspection. • Ensure environmental conditions are within specification prior to coating. • Ensure surface preparation and coating operations are carried out in accordance with the specification and/or procedure qualifications. • Maintain records and report as necessary.

Table 2.1

APPROVAL GRADE	WELDING										RADIOGRAPHY							ULTRASONIC				MAGNETIC & PENETRANT TECHNIQUES			
	Theory						Practical			Testing	Safety	Theory			Practical		Interp.	Theory		Practical		Theory		Practical	
	4.11	4.1.2	4.1.3	4.1.4	4.1.5	4.1.6	4.2.1	4.2.2	4.2.3	4.3	5.1	5.2.1	5.2.2	5.2.3	5.3.1	5.3.2	5.4	6.1.1	6.1.2	6.2.1	6.2.2	7.1.1	7.1.2	7.2.1	7.2.2
Senior Pipeline Inspector 1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Senior Pipeline Inspector 2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*
Senior Inspector Welding	*	*		*	*	*	*	*	*	*	*	+	+	+	*	*	*	+		*		+		+	
Welding Inspector	+	+		*	*	*	*	*	+	*							+					+		+	
Ultrasonic Operator		+				+	+	+	+	+							+	*	*	*	*	+		+	
Ultrasonic Inspector Plate									+	+								+		*					
Radiographer		+				+	+	+			*	*	*	*	*	*	*					+		+	
Radiographic Assistant											*	+	+	+	*	*	+								
Magnetic Particle Inspector		+				+	+	+	+													*	*	*	*

* COMPREHENSIVE KNOWLEDGE
\+ BACKGROUND KNOWLEDGE

Table 2.2

APPROVAL GRADE	COATINGS				PAINTING			
	Theory			Practical	Theory			Practical
	8.1	8.2	8.3	8.4	9.1.1	9.1.2	9.1.3	9.1.4
Site Coating Inspector	*	+	*	*				
Mill Coating Inspector	*	*	+	*				
Painting Inspector 3	*				*			*
Painting Inspector 2	*	+	+	+	*	*		*
Painting Inspector 1	*	+	+	+	*	*	*	*

* COMPREHENSIVE KNOWLEDGE
\+ BACKGROUND KNOWLEDGE

Appendix 1.

REFERENCES.

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

NOTE:- A list of publications not referred to in the text but relevant to the subject of pipeline inspections is included as "Recommended Reading".

British Standard.

BS EN 1435/1997 - Non-destructive examination of Welds – Radiography of Welded Joints.

Transco Engineering Specifications.

T/SP/P2 - The welding of steel pipe for distribution systems & Installations (Operating at pressures greater than 7 bar)

P1 - The welding of steel pipe for distribution systems & Installations (Operating below 7 bar)

P9 - The welding of fittings to gas pipelines under pressure and having a wall thickness not less than 5mm.

CM1 - Internal coating operations for steel line pipe & fittings.

CM2 - Internal coating materials for steel line pipe & fittings.

CW2 - Performance tests for the supply of cold applied wrapping tapes and tape systems.

CW4 - Polythene cladding on steel pipe.

CW5 - The selection and application of field applied external pipework coatings.

CW6 - The external protection of steel line pipe and fittings using Fusion Bonded Epoxy and associated coating systems.

CW9 - The concrete coating of pipes.

PA9 - Paint Systems. Properties and performance requirements.

PA10 - New and Maintenance painting @ works and site for above ground pipeline and plant installations.

APPENDIX 1

RECOMMENDED READING

A.1 GENERAL

The publications listed In A.2 to A.8. Inclusive are all relevant to the subject of this document and are a useful source of reference and recommended reading. They are listed under their separate headings for convenience.

A.2 WELDING

A.2.1 British Standards

BS EN 10002-1 Methods for tensile testing of metals (including aerospace materials)

BS 499 --Welding terms and symbols

BS 638 - Arc welding power sources, equipment and accessories

BS EN 499 - Specification for covered carbon and carbon manganese steel electrodes for the manual metal-arc welding

BS 166,167,168,169 - Specification for filters for use during welding and similar industrial Operations

BS EN 560, BS EN 1256 - Specification for hose connections and hose assemblies for equipment for gas welding, cutting and related processes

A.2.2

Transco Engineering Standards

T/SP/LX1 (Supplement to BS EN 10208-2) - Specification for submerged-arc welded line pipe 600 mm to 1400 mm nominal size (supplementary and amending specification to API Standard 5LX)

LX4 - Specification for seamless pipe 150 mm up to and including 450 mm nominal size for operating pressures above 7 bar

LX5 - Specification for electric-welded pipe 150 mm up to and including 450 mm nominal size for use at pressures above 7 bar (supplementary and amending specification to API Specification 5L)

T/SP/P2 - Specification for field welding of steel pipelines and installations for high pressure gas transmission

P9 - Specification for the welding of fittings to gas pipelines under pressure and having a wall thickness not less than 5 mm

P11 - Procedures for inspection and repair of damaged welded steel pipeline operating at pressures above 7 bar

A.2.3 American Petroleum Institute publications

API 5L - Specification for line pipe

API 1104 - Standard for welding pipelines and related facilities

A.2.4 American Society for Testing and Materials publications

ASTM E23 - Notched bar impact testing of metallic materials

A.3 RADIOGRAPHY

A.3.1 British Standards

BS EN 1435 – Non destructive examination of welds - Radiographic examination of welded joints.

BS EN 25580:1992 – Minimum requirements for industrial radiographic illuminators for non-destructive testing.

BS EN 462: Part 3 – Image quality of radiographs for ferrous materials.

A.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

A.4 ULTRASONICS

A.4.1 British Standards

BS EN 12223 / 2000 - Specification of calibration block No 1

BS EN 1330-4 2000 - Terms used in non destructive testing
Part 4 - Ultrasonic flaw detection

BS EN 1714 / 1998 - Ultrasonic examination of welded joints.

A.4.2

Transco Engineering Standards

P9 - Specification for the welding of fittings to gas pipelines under pressure and having a wall thickness of not less than 5 mm

P11 - Procedures for inspection and repair of damaged steel pipelines designed to operate at pressures above 7 bar

A.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

A.5 MAGNETIC PARTICLE AND DYE PENETRANT

A.5.1

British Standards

BS 4069 - Specification for magnetic flaw detection inks and powders

BS 5044 - Specification for contrast aid paints used in magnetic particle flaw Detection

BS EN ISO 9934-1:2001 – Non-destructive testing - Magnetic particle testing

BS EN 1290:1998 – Non-destructive testing of welds – Magnetic particle examination of welds.

BS EN 571/1-1998 – Non-destructive testing – Penetrant testing. Part 1 General principles.

A.5.2 Transco Engineering Standards

P2 - Specification for field welding of steel pipelines and installations for high pressure gas transmission

P9 - Specification for the welding of fittings to gas pipelines under pressure and having a wall thickness of not less than 5 mm

IGE/SR/5 – Working in confined spaces.

A.6 - WRAPPING (AND BACKFILL)

A.6.1 Transco Engineering Standards

CW1 - Specification for external wrap operations for steel linepipe (using coal tar)

CW2 - Performance tests for the supply of cold applied wrapping tapes and tape systems

CW3 - -Specification for external wrap operations for steel linepipe (using hot applied bitumen)

CW4 - Specification for polyethylene cladding on steel pipe

CW5 - Code of practice for the selection and application of field applied external pipework coatings

IGE/SR/21 – Blast cleaning operations.

IGE/TD/6 – Handling transport and storage of steel pipes, bends, tees, valves and fittings

A.7 - COATINGS

A.7.1 Transco Engineering Standards

CW5 - Code of practice for the selection and application of field applied external pipework coatings

CW6 - Specification for the external protection of steel line pipe and fittings using resin and associated coating systems
Part 1 - Requirements for coating, materials and methods of test
Part 2 - Factory applied coatings

IGE/SR/21 – Blast cleaning operations.

IGE/TD/6 – Handling transport and storage of steel pipes, bends, tees, valves and fittings

P10 - General pipelining specification

PT2 - Procedure for pre-installation testing of pipes and fittings

A.8 PAINT/PAINTING

A.8.1 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)

A.8.2

Transco Engineering Standards

PA9 - Specification for paint properties and performance requirements

PA10 - Specification for new and maintenance painting at works and site for above ground pipeline and plant installations
Part 1 - Painting procedures
Part 2 - Notes for guidance
Supplements to PA10

A.8.3

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