CERTIFICATION SCHEME FOR PERSONNEL

DOCUMENT No. CSWIP- DIV-7-95 – Part 2

Requirements for the Certification of ROV Inspectors and Underwater Inspection Controllers

Categories of certification

ROV Inspector	-	Grade 3.3U
Underwater Inspection Controller	-	Grade 3.4U
Concrete Examination		

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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 0025

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 among others, Welding Inspectors, Welding Supervisors, Welding Instructors, Welding Examiners, Welding Quality Control Coordinators, Cathodic Inspection personnel, Plant Inspectors, Plastics Welders, Plastics Welding Inspectors 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. TWI Certification Ltd is accredited by UKAS to BS EN ISO/IEC 17024 for certification of personnel.

TWI Certification Ltd understands 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.

The CSWIP In-Service Inspection Management Committee is one such Management Committee and is representative of offshore operators, inspection contractors and classification societies.

The requirements governing Registration of ROV Inspectors and Underwater Inspection Controllers is detailed in a separate document CSWIP-WI-1-91, Part 2. Success in the appropriate CSWIP Certification examination is one of the prerequisites of Registration.

ACCESS TO CERTIFICATION

Access to certification schemes is not improperly restricted. The sole criteria for certification are given in this 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 describes the procedures by which personnel may be examined and if successful, certificated in relation to underwater inspection and non-destructive testing. The scheme is intended to meet the majority of users' requirements to provide industry with an assured minimum standard of proficiency. The specialist user may add specific tests or requirements related to their own needs. The examination procedure is designed to test the candidate's grasp of the methods and techniques, and their understanding of the operations they perform. The examination procedure involves written and practical tests, where appropriate.

The policy of the CSWIP In-Service Inspection Management Committee is to keep all technical requirements under regular review to ensure that current industrial needs and new technology are adequately covered. It is therefore important for users of the scheme to ensure that they are aware of any amendments to, or re-issue of, this document.

This document covers two grades of activity: These apply to topside personnel involved in underwater inspection, 3.3U and 3.4U. A concrete Examination is available for all holders of underwater inspection certification.

Certification categories are also available for divers who are involved in underwater structural inspection: 3.1U and 3.2U. A separate document (Reference CSWIP-DIV-7-95 Part 1) is available on these categories.

1.2. Vision requirements

All candidates must provide evidence of unaided or corrected near visual acuity in at least one eye, such that the candidate is capable of reading N5 Times Roman or Jaegar 1 fonts at a distance of not less than 30cm on a standard reading test chart. That evidence to have been provided within the two years preceding the examination.

1.3. Health requirements

Candidates need to be in satisfactory physical condition and the person completing the application form will be required to signify that the candidate's health and eyesight are adequate to enable them to carry out their duties.

1.4. Job responsibilities

Candidates will be expected to be able to apply appropriate inspection methods and techniques underwater. They should be capable of maintaining appropriate job records, of preparing written reports and of producing an adequate oral commentary on their work as and when required.

Grade 3.3U

The candidate will be expected to be able to demonstrate their ability to carry out inspection (planning through to completion) by means of ROV and autonomous technologies using visual and selected NDT techniques, to identify trends and anomalies as per the specification or scope of work. The candidate must have a knowledge of the inspection and testing methods included in the 3.1U syllabus; the capabilities of other relevant non-destructive testing methods in current use; the modes of failure, cracking and deterioration in steel and concrete structures (including the relevance of various inspection methods); and protection systems. They will have a knowledge of QA relevant to underwater inspection and an appreciation of the abilities and limitations of remotely applied inspection systems, ROV's and submersibles. They should be capable of maintaining appropriate job records, of preparing written reports and of producing an adequate oral commentary on their work as and when required.

Grade 3.4U

The candidate will be expected to have a knowledge of all aspects of the ROV Inspector (3.3U) Grade and of the inspection and testing methods included in the 3.2U examination. The candidate must have a knowledge of the capabilities and limitations of diving, ROV's and submersibles, and an understanding of inspection planning and briefing. They must have an appreciation of the roles and responsibilities of other personnel and organisations, including the Offshore Installation Manager, Master, Diving and ROV Supervisors, client's representatives, certifying authorities and government departments.

1.5. Evidence of experience - all candidates

Candidates should provide evidence of experience in Grades 3.1U or 3.2U satisfying the entry requirements using appropriate log book entries (the candidate's red IMCA underwater inspection log book or other official log book giving specific details of inspection work, each entry being signed by the candidate, diving supervisor and client representative).

Experience offshore, experience of application of NDT methods and subsea engineering related work can be provided by letter from the candidate's employing organisation or suitably endorsed authenticated CV. Photocopies of entries may be required as supporting evidence of experience when making application to CSWIP for examination. Any original log book, etc should be available for inspection by CSWIP if required.

2. GRADE 3.3U

2.1. Experience

To be eligible to attempt Grade 3.3U the candidate must:

i) Be a manned submersible pilot or observer, having completed a minimum of 15 operational dives.

or

ii) Be an ROV pilot or observer having completed a minimum of 720 logged hours of underwater inspection work experience as pilot or observer.

or

iii) Have a qualification in a relevant engineering or science subject which should not be less than HNC level or equivalent and a minimum of 60 days inspection related work at a Remote Operating Centre or offshore.

or

iv) Be a current or previously approved CSWIP 3.1U or 3.2U Diver Inspector who has held such certification for a minimum of three years, with a minimum of 100 logged hours of underwater inspection work.

or

v) Be a surface NDT Practitioner, certified under ISO 9712 in ultrasonic testing, magnetic particle or penetrant testing or equivalent approval accepted by the CSWIP In-Service Inspection Management Committee, who has a minimum of three years documented experience in the application of NDT methods related to offshore facilities and to have spent a minimum of 30 days at an offshore work site gaining familiarity with underwater inspection techniques.

2.2. Training course

All candidates will be required to have satisfactorily completed a CSWIP approved training course on the methods in which they are to be examined.

2.3. Dispensation of entry requirements

Personnel who satisfy most but not all of the other entry requirements specified and who may have alternative attributes which they consider should be taken into account, may have their individual cases assessed by the CSWIP In-Service Inspection Management Committee or its nominees. There is no dispensation from training requirements.

2.4. Approval Procedure

Candidates will be required to satisfy the examiners in all parts of the examination.

2.4.1 Theory examination

The written examination will consist of two parts, A and B, in one three hour paper:

Paper A 25 multiple choice questions

Paper B General inspection principles and applications divided into two sections.

Section A: One mandatory detailed written answer from two questions on Underwater Visual Inspection of a riser, pipeline or structure.

Section B: Six short written answer questions, that is one question to be attempted from two given in each of the following six sub-sections:

i) Underwater visual inspection
ii) Recording methods
iii) Corrosion protection systems
iv) Subsea applied inspection systems
v) Care and calibration of equipment

vi) Recording and reporting of data.

2.4.2 Practical examination

The test will consist of the following parts:

i) Data recording
ii) Commentating on a recording of an inspection task
iii) Written reports
iv) Description (written)

2.4.3 Concrete examination

For those seeking qualification in the inspection of concrete, the examination may be taken at the same time as the initial examination. The concrete qualification will also be renewable at the five year renewal point of the 3.3U.

The examination will consist of a 20 multiple choice question paper and assessment and reporting on eight photographs of typical concrete blemishes and reporting the possible cause, type and classification.

Please note there is no retest for this examination. Further attempts are all treated as an Initial concrete examination.

3. Grade 3.4U

3.1. Experience

To be eligible to attempt Grade 3.4U the candidate must:

i) Have a qualification in a relevant engineering or science subject which should not be less than HNC level or equivalent and a minimum of 12 months subsea engineering related work, including a minimum of 60 days spent at an offshore site.

or

ii) Have a qualification in a relevant engineering or science subject which should not be less than HNC level, or equivalent, including a minimum of 60 days inspection related work at a Remote Operations Centre

or

iii) Be a current or previously approved CSWIP 3.3U ROV Inspector who has held such certification for a minimum of one year, with a minimum of 300 logged hours of underwater inspection work.

or

iv) Be a current or previously approved CSWIP 3.1U or 3.2U Diver Inspector who has held such certification for a minimum of three years, with a minimum of 100 logged hours of underwater inspection work.

or

v) Be a surface NDT Practitioner, certified under ISO 9712 in ultrasonic testing, magnetic particle or penetrant testing or equivalent approval accepted by the CSWIP In-Service Inspection Management Committee, who has a minimum of three years documented experience in the application of NDT methods related to offshore facilities and to have spent a minimum of 30 days at an offshore work site gaining familiarity with underwater inspection techniques.

3.2. Training course

All candidates must have successfully completed a CSWIP 3.4U approved training course.

3.3. Dispensation of entry requirements

Personnel who satisfy most but not all of the other entry requirements specified and who may have alternative attributes which they consider should be taken into account, may have their individual cases assessed by the CSWIP In-Service Inspection Management Committee or its nominees. There is no dispensation from training requirements.

3.4. Approval procedure

Candidates will be required to satisfy the examiners in all parts of the examination.

3.4.1 Theory examination

The written examination will consist of three parts, A, B and C. Parts A and B will be one three hour long paper and part C will consist of one paper for which 3 hours will be allowed.

Part A 50 multi-choice questions

Part B General inspection principles and applications - six written answer questions, that is one question to be attempted from the two given in each of the following five sections, plus one question from any section in part B:

i) Magnetic particle inspection
ii) Ultrasonic inspection
iii) Corrosion protection systems
iv) Underwater visual inspection
v) Non-destructive testing (general knowledge).

Part C Application aspects - eight written answer questions, that is one question to be attempted from two given in each of the following seven sections, plus one question from any section in part C:

vi) Subsea applied inspection systems
vii) Recording and processing of data
viii) Quality Assurance
ix) Inspection planning and briefing
x) Capabilities and limitations of divers
xi) Capabilities and limitations of ROV's and submersibles
xii) Care and deployment of equipment.

3.4.2 Practical examination

The test will consist of the following parts:

i) Data recording.
ii) Commentating on a recording of an inspection task.
iii) Written reports.
iv) Written description of a component.
v) Technical drawing evaluation.
vi) Telex précis.
vii) Work scheduling.

3.4.3 Concrete examination

For those seeking qualification in the inspection of concrete, the examination may be taken at the same time as the initial examination. The concrete qualification will also be renewable at the five year renewal point of the 3.4U.

The examination will consist of a 20 multiple choice question paper and assessment and reporting on eight photographs of typical concrete blemishes and reporting the possible cause, type and classification.

Please note there is no retest for this examination. Further attempts are all treated as an Initial concrete examination.

4. GENERAL INFORMATION

4.1 Examination equipment, specimens and test centres

3.3U and 3.4U examinations do not involve practical underwater examination parts and all necessary video equipment/tapes, audio equipment/tapes and photographs will be provided at the Test Centre.

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

4.2 Application for examinations and fees

Applications must be made on the appropriate application form to the examining organisation, details of which are given at the end of this document. Application forms ask for specific details of experience, training and health and must be signed, confirming that these details are correct and supported by such other documents as may be necessary to confirm that the candidate is eligible for examination. No applications can be confirmed until receipt of a correctly completed application form and the full fee.

In the event of a false statement being discovered any certificate awarded as a result of the test will be 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 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.

4.3 Certification

4.3.1 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.

4.3.2 Successful candidates

Two copies of a certificate of proficiency will be issued to the organisation or person that pays the examination fees.

Duplicate certificates to replace those lost or destroyed will be issued only after extensive enquiries, and a fee will be charged.

4.3.3 Unsuccessful candidates

Initial 3.3U or 3.4U examination

Brief details of the reasons for failure will be given in the results notice sent to the candidate and the organisation paying the fees.

Candidates who fail part(s) of the initial examination may attempt one retest of the failed part(s) provided said retest is completed within 12 months of the initial examination. Candidates who do not complete the retest within the specified time or those who are again unsuccessful, will be treated thereafter as initial candidates, i.e. they must attend the full training course again and then take the full initial examination.

4.3.4 Validity of certificates

Certificates will be valid for five years from the date of completion of the original test. The renewal procedure after five years is described in section 4.4.

Certificates which are issued as a result of previously failed parts of the examination will be valid from the date of completion of the original test as described above.

Certificates are only valid provided:

a) They are within certification period.
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.
e) All fees have been paid.

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

4.3.5 Complaints and appeals

Any `party' which considers itself to have reasonable grounds for questioning the competency of a CSWIP qualified person may petition the CSWIP In-Service Inspection Management Committee for withdrawal of that person's certificate. Such a petition must be accompanied by all relevant facts and if, in the opinion of the Committee, an adequate prima facie 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 Committee, the person's certificate will be withdrawn and a further test will be required.

Appeals against failure to be certified, or eligibility to attempt an examination or against non-renewal of a certificate may be made by the person concerned or the employer upon application in writing to the CSWIP In-Service Inspection Management Committee.

4.4 Renewal

4.4.1 Five year renewal examination

To ensure continuity, it is desirable for five year retests to be carried out up to six months prior to the final expiry of the original certificate. If successful, the certificate shall be dated five years from the original expiry date.

Candidates who fail the five year renewal test will be given the opportunity of one retest for any failed part. Failure of the retest means a return to Initial Status.

All retests must be attempted within six months of the date of the results notice - this is not extendable under any circumstances

If for any reason it is not possible for the candidate to complete the renewal test before expiry of the original certificate, then the period during which the renewal test can be taken may be extended.

Requests for extra time should be made in the first instance to the CSWIP Secretariat, TWI Certification Ltd. It should be noted that this extra time does not change the expiry date on the certificate and work carried out beyond the expiry date has no certificate cover.

4.4.2 Five year renewal procedure for 3.3U and 3.4U

The five year renewal examination for 3.3U will consist of:

- 25 multiple-choice questions.
- One question from Section A of Paper B and a choice of three from six short written answer questions from Section B of Paper B.
- The Data Recording and Commentary elements of the practical examination.

The five year renewal examination for 3.4U will consist of:

- 50 multiple-choice questions.
- Three from a choice of six written answer questions from Part B and four from a choice of eight written answer questions from Part C.
- The Data Recording and Commentary elements of the practical examination.

Certificate holders must demonstrate that they have maintained their competence by providing evidence of continuous work activity in relevant underwater inspection work within the previous five years by letter from their employers, or for self-employed personnel by letters from those companies they have been contracted to over the previous five years.

4.4.3 Structured Credit

A structured credit system for CSWIP 3.4U certificate holders is available on an Appeal basis for recertification of personnel for whom the Appeals Panel accepts that an examination is not an appropriate route. Such personnel include CSWIP 3.4U certificate holders who are approved examiners, CSWIP In-Service Inspection Management Committee (CISIMC) members or members of the Certification Management Board (CMB) or Senior Managers in the subsea inspection sector who are expected to hold a CSWIP 3.4U but are acting in the capacity of Superintendents, Project Managers, Client Representatives, Regulator or Government Departments, and who have had access to examination material as part of their delivery or operational management of the scheme. This system will not be offered as a standard recertification option, and certificate holders whose appeals are declined will be required to fully comply with Clause 4.4.2 above.

The evidence of credit will span the five year period preceding recertification and will comprise a combination of the following:

Item	Activity	Points for each event or measure of activity	Maximum points per year	Maximum points permitted per five year period
1	Contribution to CISIMC, CMB or other relevant standards activity related to CSWIP 3.4U	5	15	75
2	CSWIP 3.4U examination marking, moderation, writing	1	10	50
3	Auditing for CSWIP 3.4U course approval, training centre audit, appeals & complaints	1	3	15
4	Statutory compliance or quality assurance audits of underwater inspection programmes controlled by CSWIP 3.4U personnel	2	6	30
5	Development, authorisation and implementation of underwater inspection	5	50	150

	programmes controlled by CSWIP 3.4U personnel			
6	Reviewing, authorising and acting upon subsea inspection reports produced under the control of CSWIP 3.4U personnel	2	50	150
7	Development, design and evaluation of equipment and inspection methods to be used under the control of CSWIP 3.4U personnel	2	50	150
8	Assessment and authorisation of CSWIP 3.4U personnel	1	20	50

The required minimum points total for recertification in lieu of examination is 200. All other recertification requirements set out in Clause 4.4.2 shall be satisfied

4.4.3 Renewal of concrete qualification

Candidates holding a certificate with a concrete examination awarded prior to the introduction of the five year renewal of that endorsement will also have to renew at the five year renewal point of their 3.3UC or 3.4UC.

The five year renewal examination will consist of a 20 multiple-choice question paper and assessment and reporting on eight photographs of typical concrete blemishes and reporting the possible cause, type and classification.

5. RECORDS

Records of all successful and unsuccessful candidates are maintained. These records are accessible to the In-Service Inspection Management Committee or its nominee's at all reasonable times.

At all times the rules of CSWIP current at the time of the examination apply. The CSWIP In-Service Inspection Management Committee will not be responsible for failure of candidates or their sponsors to inform themselves of these rules.

6. ADDRESSES

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For examination enquiries:

For all examinations:
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Phone: 01642 210512 Email: twinorth@twi.co.uk

For 3.3U, 3.4U and all written retests only
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Requirements for the Certification of ROV Inspectors and Underwater Inspection Controllers

Appendix 1: Examination Syllabus

APPENDIX 1: EXAMINATION SYLLABUS

Any aspect of the syllabus may be included in the written and oral examination. Items which will be specifically included in the practical examination have the suffix **`P.'**

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.

DEFINITIONS

OUTLINE KNOWLEDGE: The candidate must be familiar with the subject in outline terms. They should know that the topic exists and what it is applied to. In the context of inspection methods/techniques the candidate would be expected to know the "what it is, what it does" but would not be expected to know the finer points of application of the technique.

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

DETAILED KNOWLEDGE: The candidate must have a depth of knowledge sufficient to enable them to exercise judgement.

3.3U ROV INSPECTOR

INTRODUCTION

The candidates will be required to demonstrate their knowledge in the following general areas:

- The need for inspection in relation to the safety and integrity of offshore structures and pipelines.
- Basic terminology of subsea structures (steel and concrete), including jackets, semi-submersible and jack-up drilling rigs, FPSOs (Floating Production and Storage and Offloading units), single point moorings, seabed production manifolds, wellhead and valve protection frames.
- Basic terminology of subsea pipelines, including rigid and flexible pipelines and risers, umbilical's and J-tubes.
- The modes of failure and deterioration experienced in steel/concrete structures, risers and pipelines.
- An appreciation of how an Operator's inspection programme attempts to detect and assess such failure and deterioration by the use of various ROV inspection techniques.
- The importance of good communications, planning and briefing.
- The importance of documentation and record keeping. An appreciation of manual and computer based data recording and reporting.
- An appreciation of the abilities and limitations of commonly used vehicles including autonomous vehicles.
- The need for written procedures for all activities.
- An appreciation of current health, safety and environmental issues as they affect subsea operations. This includes Permit to Work systems, the requirements for hazard identification and Risk Assessments, the use of ROV Dive Plans, current legislation and industry guidelines (e.g. IMCA guidelines).
- Interpretation of the scope of work as well as tracking the scope.

1 ROV SYSTEMS

A KNOWLEDGE OF:

The capabilities and limitations of vehicles, including:

Types of vehicles as defined in the IMCA specification (Class 1 to Class 6).

- Typical thruster configurations, vehicle power, speed, manoeuvrability and operating limits in current.
- Launch and recovery methods and tether management systems.
- Types of sensors and manipulators.

Operational Considerations - General:

- Endurance, hazards to ROVs, manning levels, real-time data acquisition over recorded data, spatial awareness, human contact, dexterity, risk of snagging, umbilical handling, access, operating radius and the simultaneous operation of ROVs and Divers.

ROV's

:

- The capabilities and limitations of underwater vehicles. Operational considerations when operating ROV's from DP vessels, drill rigs or fixed structures.

2 **UNDERWATER VISUAL INSPECTION**

A KNOWLEDGE OF:

- Cleaning for the purpose of inspection by ROV (LP air, water jet, grit entrainment, etc.) and safety aspects. Standards of surface finish.
- General Visual Inspection (GVI), and Close Visual Inspection (CVI) of components on structures/pipelines by ROV.
- The most common steel structures, methods of installation, and the main types of defects, repairs and maintenance, welds and steel structure terminology.
- Structures associated with renewable energy.
- Mooring systems.
- Floating Production Facilities.
- Subsea Infrastructure
- Wells, Manifold, etc
- Concrete structure terminology: An appreciation of the basic types of concrete structures, methods of installation, and the main types of defects, repairs and maintenance
- Pipeline component terminology: Traditional rigid risers, tie-in spool pieces, tees, valves, flanges and mechanical connectors, basic pipeline components/items of interest such as riser clamps/guides, sacrificial anodes, (bracelet and retro-fit) field joints and freespans, flexible pipelines and risers, (including buoyant risers with their associated buoyancy components/arches and gravity bases etc. pipe in pipe and pipeline nubdles).
- Pipeline / umbilical's / cables technology: A basic appreciation of the main methods of rigid and flexible pipeline and umbilical / cables installation, tie-in and repair. The main methods of trenching, burying and stabilizing pipelines/umbilical's, and the construction of pipeline/umbilical crossings. (this includes stabilisation and anti-scour mattresses, grouted supports and rock dumps). Flexible risers used with semi-submersible production facilities and FPSO's. An awareness of diverless pipeline tie-in systems.
- Marine growth species identification, percentage coverage (estimates of each type) growth thickness measurement techniques, the effects of marine growth and reason for removal.

A DETAILED KNOWLEDGE OF:

- Types of visual defects and their likely location in steel/concrete structures and risers.
-
- Types of defects and areas of concern for structures/pipelines. Dimensional checking of welds and measurements underwater using ROV methods e.g., photogrammetry.

3 **CORROSION PROTECTION SYSTEMS**

AN OUTLINE KNOWLEDGE OF:

- The general principles of corrosion and how corrosion protection is effected by protective coatings and cathodic protection systems.

A KNOWLEDGE OF:

- Modes of deterioration, types of corrosion and the typical inspection requirements for sacrificial anode and impressed current systems and retrofit CP systems
- The effects of external factors such as debris and seabed material on Cathodic Protection systems.
- Field gradient technology.

A DETAILED KNOWLEDGE OF:

- The visual inspection of protective coatings including Monel and other cladding.
- Cathodic potential measurement methods, the typical values obtained, common anomaly criteria applicable to cathodic potential levels, and the calibration procedures of equipment/instruments.
- The constraints in using the contact technique (e.g. problems associated with establishing good contact through paint and/or marine growth), the factors affecting the proximity technique (e.g. problems associated with the positioning of the electrode and establishing good electrical continuity to the structure) and the use of current density and/or field strength measurements (e.g. the influence of positioning and orientation on accuracy).

4 SUBSEAAPPLIED INSPECTION SYSTEMS

A KNOWLEDGE OF:

- The methods, capabilities and limitations of, Ultrasonic Inspection (UT), Electromagnetic detection and Flooded Member Detection (FMD) techniques.

5 CARE AND CALIBRATION OF EQUIPMENT

A DETAILED KNOWLEDGE OF:

- The care and set-up of video and digital imaging systems.
- The care, calibration and set-up of CP Measuring equipment.
- The care, calibration and set-up of digital ultrasonic wall thickness meters.
- The safe use of electrical equipment as required by current codes of practice and legislation.
- Pre- and post-dive calibration records.
- The care of equipment after recovery.

6 RECORDING AND REPORTING OF DATA

A DETAILED KNOWLEDGE OF:

Data gathering, including:

- The ability to use, understand and compile workbooks, data sheets, and logs.
- The use of digital video for recording visual inspection data.

- Video recording: The need for accurate video introductions, (text and verbal), and text headers. The use of pipe-tracker, cross profiler, sonar and navigation displays overlaid onto the video recording. The appropriate use of lighting and cameras. The set up and correct colour balancing of cameras and DVRs.

- Video commentaries: Video introductions, (text and verbal). The need to adequately explain the subject of the NDT/inspection. The requirement to explain any changes in orientation or position or component layout that may cause confusion. The need to comment on any NDT or inspection or operational factors that affect the NDT/inspection task. The need to adequately report the findings of the NDT/inspection, and any other points of likely interest.

- Video editing and dubbing skills.

- The usage and methods for setting-up video overlay units.

- The skill and ability necessary to direct inspections.

- Understanding of and recognition of the need for fixed repeatable location/orientation references.

The principles of reporting, including:

- The ability to develop report formats, manually or with the aid of a computer, including logs, and demonstrate an ability to use visual aids such as digital images and tabulated data.

- Report Types:
  - Daily
  - Anomaly
  - Field
  - Detailed
  - Final

- Typical methods of reporting routine data and anomalies.

- The ability to prepare a report from inspection data.

- The importance of using standard terminology and the necessity for good communication.

- The need for accuracy, consistency, simplicity, clarity and a methodical approach in all recording and data processing including report writing, daily report preparation and the completion of logs.

- The importance of using the correct component identification and location reference systems when inspecting and reporting on structures and pipelines.

- An understanding and ability to read engineering drawings and produce inspection drawings and sketches.

- Completion status/scope of work progress.

7 QUALITY ASSURANCE, RELEVANT TO UNDERWATER INSPECTION

AN OUTLINE KNOWLEDGE OF:

- The application of QA/QC systems.

A KNOWLEDGE OF:

- The need for personnel competence (certification/qualification) and the need for sufficient and adequate equipment certification.
- Written inspection procedures and documentation. The importance of adhering to approved procedures. The need for procedures to be simple and unambiguous.
- The need for technical equipment and system audits.
- The need for clear communications and lines of responsibility
- The quality requirements of design, fabrication, installation and commissioning through to in-service inspection, repair and maintenance, and decommissioning.
- The requirement for documentation and data control.
- The value of general quality assurance principles as applied to the collection and recording of inspection data (whether in the form of drawings, sketches, photographs, video or other media). Quality assurance and quality control as applied to collection and reporting of anomaly data.

8 HOW TO RECOGNISE TYPICAL ANOMALIES, AND AN UNDERSTANDING OF "CRITERIA OF NON-CONFORMANCE".

- Types of anomalies.
- Client specific anomalies/criteria of non-conformance.
- Typical anomaly limits.
- Criticality assessments.
- Hierarchy of reporting.
- Follow up, upon discovery of anomaly.
- Data collection.

3.4U UNDERWATER INSPECTION CONTROLLER

INTRODUCTION

The candidate**s** will be required to demonstrate their knowledge in the following general areas:

The need for inspection in relation to the safety and integrity of offshore structures and pipelines.

Basic terminology of subsea pipelines (steel and concrete), including jackets, semi-submersible and jack-up drilling rigs, FPSOs (Floating Production and Storage and Offloading units), single point moorings, seabed production manifolds, wellhead and valve protection frames.

Basic terminology of subsea pipelines, including rigid and flexible pipelines and risers, umbilical's and J-tubes.

The modes of failure and deterioration experienced in steel/concrete structures, risers and pipelines.

An appreciation of how an Operator's inspection program attempts to detect and assess such failure and deterioration by the use of various Diver or ROV or AUV inspection techniques, including NDT.

The importance of good communications, planning and briefing.

The importance of documentation and record keeping. An appreciation of manual and computer based data recording and reporting.

An appreciation of the abilities and limitations of commonly used ROVs and divers for the collection of data.

The need for appropriate levels of personnel competence (certification / qualification) and equipment certification of conformity.

The need for written procedures for all activities.

An appreciation of current health, safety and environmental issues as they affect subsea operations. This includes Permit to Work systems, the requirements for hazard identification and Risk Assessments, the use of Dive Plans, current legislation and industry guidelines (e.g. IMCA guidelines)

An appreciation of the roles and responsibilities of others, such as: the Diving Supervisor, the ROV Supervisor, the Superintendent/Offshore Project Manager, the Offshore Installation Manager, or the vessel/barge Master, the Client's Representative, government departments, or other agencies.

1 UNDERWATER VISUAL INSPECTION

A KNOWLEDGE OF:

- Cleaning for the purpose of inspection by Diver and ROV (LP air, water jet, grit entrainment etc.) and safety aspects. Standards of surface finish.
- General Visual Inspection (GVI), and Close Visual Inspection (CVI) of components on structures/pipelines by Diver and ROV.
- Welds and steel structure terminology: This includes an appreciation of the most common steel structures, and the main types of defects, repairs and maintenance.
- Structures associated with renewable energy.
- Mooring systems
- Concrete structure terminology: An appreciation of the basic types of concrete structures, methods of installation, and the main types of defects, repairs and maintenance

- Pipeline component terminology: This includes traditional rigid risers, tie-in spool pieces, tees, valves, flanges and mechanical connectors, basic pipeline components/items of interest such as riser clamps/guides, sacrificial anodes, (bracelet and retro-fit) field joints and freespans, flexible pipelines and risers, including buoyant risers with their associated buoyancy components/arches and gravity bases etc., pipe in pipe, and pipeline bundles.

- Pipeline technology: A basic appreciation of the main methods of rigid and flexible pipeline and umbilical installation, tie-in and repair. The main methods of trenching, burying and stabilizing pipelines/umbilical's, and the construction of pipeline/umbilical crossings (this includes stabilisation and anti-scour mattresses, grouted supports and rock dumps). Flexible risers used with semi-submersible production facilities and FPSO's. An awareness of recent developments in diverless pipeline tie-in systems.

- Marine growth species identification, percentage coverage (estimates of each type) growth thickness measurement techniques, the effects of marine growth and the reason for removal and various methods of prevention.

A DETAILED KNOWLEDGE OF:

- Types of visual defects and their likely location in steel/concrete structures and risers, areas of concern for structures/pipelines. Dimensional checking of welds and measurements underwater.

2 **RECORDING METHODS**

AN OUTLINE KNOWLEDGE OF:

- The principles of photogrammetry, the care in use, and the deployment of recording equipment.

A KNOWLEDGE OF:

- The use of digital video recording equipment.

- Types of video and digital imaging equipment.

A DETAILED KNOWLEDGE OF:

- Optimum light placement and intensity requirements

- The correct use of, video and digital imaging equipment to give optimum results.

3 **CORROSION PROTECTION SYSTEMS**

***AN OUTLINE KNOWLEDGE OF*:**

- The general principles of corrosion and how corrosion protection is effected by protective coatings and cathodic protection systems.

A KNOWLEDGE OF:

- Modes of deterioration, types of corrosion and the typical inspection requirements for sacrificial anode and impressed current systems. An awareness of the safety requirements involved in diving adjacent to impressed current systems.

- The effects of external factors such as debris and seabed material on CP systems. Understanding of retrofit systems.

A DETAILED KNOWLEDGE OF:

- Contact and proximity potential measurement methods, the typical values obtained, common anomaly criteria applicable to cathodic potential levels, and the calibration procedures of equipment/instruments.
- The visual inspection of protective coatings, including Monel and other cladding.
- Next generation inspection technique.
- Field gradient technology.

4 **NON-DESTRUCTIVE TESTING TECHNIQUES**

A KNOWLEDGE OF:

- The methods, capabilities and limitations of Magnetic Particle Inspection (MPI), Ultrasonic Inspection (UT), Radiographic Inspection (RT), Electromagnetic techniques, Alternating Current Potential Drop (ACPD) and Flooded Member Detection (FMD) techniques.

A DETAILED KNOWLEDGE OF:

- The NDT techniques particularly applicable underwater.
- The practical application underwater of Magnetic Particle Inspection.
- The practical application underwater of Ultrasonic Wall Thickness measurement.
- The practical application of electromagnetic inspection techniques.
- The practical application of FMD.

5 MAGNETIC PARTICLE INSPECTION (MPI):

AN OUTLINE KNOWLEDGE OF:

- The principles and terms/definitions specific to magnetism such as magnetic poles, magnetic field, lines of force, longitudinal magnetisation, horseshoe magnet, vector field, consequent field, consequent poles, distorted field, permeability, reluctance, flux density, residual magnetism, ferromagnetic materials and leakage field.
- The generation of circumferential and longitudinal flux.
- Hysteresis loops and their relevance to demagnetisation/magnetisation methods.
- Inspection equipment including: portable installations, ancillary equipment, lighting such as UV-A illumination, viewing aids, marking devices, demagnetisation equipment, contrast aids and consumables.
- Familiarity with topside inspection equipment.

A KNOWLEDGE OF:

- The correct choice of a magnetic technique.

- The problems associated with component geometry and shape.
- Surface preparation.
- The reasons and the methods used for demagnetisation.
- The methods used to assess the sensitivity of the MPI technique used.
- Methods for recording defect indications.
- Testing for demagnetisation.

A DETAILED KNOWLEDGE OF:

- Functional and performance checks, calibration equipment and appropriate test pieces.
- Magnetic ink (fluorescent and non-fluorescent), concentrates, wetting agents, contrast paints, cleaning agents and inhibitors and the preparation and testing of inks and other consumables.
- The types and causes of surface breaking and near-surface discontinuities and their indications.
- The types, causes and visible features of non-relevant and false indications.
- The advantages and limitations of applying magnetisation using permanent magnets, electromagnets, coils, parallel conductors, flexible cables and prods.

6 ULTRASONIC TESTING

AN OUTLINE KNOWLEDGE OF:

- The physical principles of sound, the relationship between ultrasonic frequency/wavelength velocity, the propagation mode of compressional and shear waves.
- The types and properties of transducers. The piezoelectric effect, near/far fields, dead zones and their effect on both frequency and sound velocity.
- Compressional wave probes, single/twin crystal probes and their construction.
- Digital Thickness Meters (DTM).
- A basic outline of ultrasonic wall thickness mapping systems.
- The types and uses of calibration blocks.
- Non-contact Ultrasonic Testing.
- Ultrasonic Flooded Member Detection (FMD).

A DETAILED KNOWLEDGE OF:

- Surface condition requirements of materials and weldments prior to scanning.
- Methods to determine wall thickness, material quality and determination of the presence of internal corrosion and laminations.
- Application and the limitations/advantages of digital instruments for wall thickness measurements.

7 RADIOGRAPHY

AN OUTLINE KNOWLEDGE OF:

- The principles and techniques for industrial radiography, including its advantages and limitations.
- Safety precautions and requirements when using ionizing radiations (as per local regulations) and the roles and responsibilities of Radiation Protection Supervisors/Officer.

8 SURFACE GRINDING, SURFACE STRESS RELIEF

A KNOWLEDGE OF:

- An appreciation of the reasoning behind, and the limitations of, remedial grinding of MPI indications, and the drilling of “crack arrestor” holes in cracks in steel structures.
- Typical basic procedures for remedial grinding, with particular regard to material removal limits per grinding pass and maximum overall grinding limits, as well as the need for final profiling to reduce stress levels. Typical client’s concerns with regard to remedial grinding or the use of crack arrestor holes.
- The practical application of the grinding of weld toes/parent plate material to a required profile and methods of recording/measuring the process undertaken.

9 CARE AND CALIBRATION OF EQUIPMENT

A DETAILED KNOWLEDGE OF:

- The care and calibration of digital media imaging systems.
- The care, calibration and set up of all relevant equipment, such as, CP measurement equipment, digital ultrasonic wall thickness meters, MPI equipment, etc.
- The safe use of electrical equipment as required by current codes of practice and legislation.
- The care of equipment after recovery.
- Maintenance and curation of calibrated equipment documentation

10 RECORDING AND PROCESSING OF DATA

A DETAILED KNOWLEDGE OF:

Data gathering, including:

- The ability to use, understand and compile workbooks, data sheets, and logs.
- The use of the video, digital and photographic media for recording inspection data.
- Video tape recording: The need for accurate video introductions, (text and verbal), and text headers. The use of pipe tracker, cross profiler, sonar and navigation displays overlaid onto the video recording. The appropriate use of lighting and cameras. The set up and correct colour balancing of cameras and DVRs.
- Video tape commentaries: Video introductions, (text and verbal).The need to adequately explain the subject of the NDT/inspection. The requirement to explain any changes in orientation or position or component layout that may cause confusion. The need to comment on any NDT or inspection or operational factors that affect the NDT/inspection

task. The need to adequately report the findings of the NDT/inspection, and any other points of likely interest.

- Video editing and dubbing skills.
- The usage and methods for setting-up video overlay units.
- The skills and ability necessary to direct inspections.
- Understanding of and recognition of the need for fixed repeatable location/orientation references.

The principles of reporting, including:

- The ability to develop report formats, manually or with the aid of a computer, including logs, and demonstrate an ability to use visual aids such as digital images and tabulated data.
- Report Types:
  - Daily
  - Anomaly
  - Field
  - Detailed
  - Final
- Typical methods of reporting routine data and anomalies.
- The ability to prepare a report from inspection data.
- The importance of using standard terminology and the necessity for good communication.
- The need for accuracy, consistency, simplicity, clarity and a methodical approach in all recording and data processing including report writing, daily report preparation and the completion of logs.
- The importance of using the correct component identification and location reference systems when inspecting and reporting on structures and pipelines.
- An understanding and ability to read engineering drawings and produce inspection drawings and sketches.

11 COMMUNICATION SKILLS:

- ***A KNOWLEDGE OF:*** Communication discipline, standard phrases, the phonetic alphabet.
- The information that should be shared, with whom, and when, when providing status reports.

12 SUBSEA INSPECTION SYSTEMS

AN OUTLINE KNOWLEDGE OF:

- The methods, limitations and capabilities of weld inspection techniques.
- The principles of FMD techniques (ultrasonic, gamma radiation) when applied remotely.
- Formats and media available for visual acquisition, and how to acquaint yourself with the equipment.

- Changes in technology, support of visual acquisition by data acquisition, e.g. the use of 3D models.

A KNOWLEDGE OF:

- Pipeline inspection/survey methods and equipment.
- The factors affecting performance of video and images.
- The influence of access, positioning, stand-off and set-up constraints.
- The importance of selecting systems and settings suitable to the task and the location.
- Deployment method constraints.
- Cleaning, location, environmental and referencing limitations.

A DETAILED KNOWLEDGE OF:

- The measurement of wall thickness using digital wall thickness meters, the necessity and standard of surface preparation, alignment, calibration and the effects of surface coatings and corrosion.

13 DIVING SYSTEMS

AN OUTLINE KNOWLEDGE OF:

The capabilities and limitations of divers, including:

- Human physiology with particular emphasis on the effects of pressure on the lungs and hearts, nitrogen narcosis, air/gas mixtures.
- Types of diving: the techniques and equipment for air diving and mixed gas saturation diving. Current legislation and guidance for commercial diving.
- The effects on divers by currents, tides, wind, waves and water turbulence.

The capabilities and limitations of ROV's, including:

- Types of vehicles as defined in the IMCA specification
- Types of vehicles as defined in the IMCA specification (Class 1 to Class 6).
- Typical thruster configurations, vehicle power, speed, manoeuvrability and operating limits in current.
- Launch and recovery methods and tether management systems.
- Types of ROV sensors and manipulators.

The capabilities and limitations of miscellaneous vehicles, including:

- Towed vehicles
- AUVs

Operational considerations - General:

- Endurance, hazards to divers and ROVs, manning levels, real-time data acquisition over recorded data, spatial awareness, tactility, (human presence) dexterity, umbilical and/or tether management, access, operating radius and the simultaneous operation of ROVs and Divers.

A KNOWLEDGE OF:

Divers:

- The deployment of divers.
- Operational considerations when using divers from vessels, drill rigs or fixed structures.
- The limitations of diving inside a structure or around obstructions
- The deployment of equipment to the diver.

ROV's:

- The capabilities and limitations of underwater vehicles.
- Operational considerations when operating ROV's from vessels, drill rigs or fixed structures.

14 INSPECTION PLANNING AND BRIEFING

A KNOWLEDGE OF:

- Different safety and limitation of using equipment on a dive support vessel compared to fixed structures.
- Inspection philosophies behind inspection programs for offshore structures and pipelines.
- Local statutory regulations governing the safety of offshore structures and pipelines, and the professional relationships between the client, inspection contractor and any applicable government or other agency.
- The roles and responsibilities of Client's Representatives, Inspection Controllers, the inspection contractor's Superintendent or Offshore Project Manager, and the inspection contractor's ROV and Diving Supervisors and personnel.
- The different forms of contract under which the work can be undertaken, i.e. day rate, lump sum, etc. This should include an appreciation of the different constraints faced by the Inspection Controller depending on who they are employed by i.e. client or inspection contractor.

A DETAILED KNOWLEDGE OF:

- Equipment maintenance, calibrations and certifications.
- Documenting and reporting damaged equipment.
- Consumable inventories
- Operational restrictions which may affect the planning of works such as vessel movements, platform priorities, diver and ROV limitations and capabilities.

15 QUALITY ASSURANCE, RELEVANT TO UNDERWATER INSPECTION

AN OUTLINE KNOWLEDGE OF:

- The application of QA/QC systems.

A KNOWLEDGE OF:

- The need for personnel competence (certification/qualification) and the need for sufficient and adequate equipment certification.
- Written inspection procedures and documentation. The importance of adhering to approved procedures. The need for procedures to be simple and unambiguous.
- The need for technical equipment and system audits.
- The need for clear communications and lines of responsibility.
- The quality requirements of design, fabrication, installation and commissioning through to in-service inspection, repair and maintenance.
- The value of documentation and data control and indexing systems.
- The value of general quality assurance principles as applied to the collection and recording of inspection data (whether in the form of drawings, sketches, photographs, video or other media) Quality assurance and quality control as applied to collection and reporting of anomaly data.

16 HOW TO RECOGNISE TYPICAL ANOMALIES, AND AN UNDERSTANDING OF "CRITERIA OF NON-CONFORMANCE"

- Types of anomalies.
- Client specific anomalies/criteria of non-conformance.
- Typical anomaly limits.
- Criticality assessments.
- Hierarchy of reporting.
- Follow up, upon discovery of anomaly.
- Data collection.

17 UNDERWATER INSPECTION IN LIEU OF DRY DOCKING (UWILD)

AN OUTLINE KNOWLEDGE OF:

- Hull/Superstructure
- Types of Mooring
- Mooring Lines
- Other considerations