



## **SPECIFICATION**

This document specifies the training and assessment services required to be delivered for apprentices recruited in 2019 in the Offshore Region in the Instrumentation & Control Maintenance discipline.

### **DELIVERY OF ECITB APPRENTICESHIPS**

The Engineering Construction Industry (ECI) demands that operatives working on site in the disciplines and occupations covered by ECITB apprenticeship pathways have been trained to a minimum SCQF level 7 (previously SVQ Level 3) standard. The safety-critical nature of the industry and the rigorously enforced health and safety rules and procedures dictate that any persons on-site must be able to work with a minimum of supervision.

ECITB apprentices must therefore be trained in all the fundamental and discipline-specific skills of their trade during the off-the-job period. They must experience the facilities, processes and equipment they are likely to encounter when they progress to their place of work, such that they can transfer their skills into a real working environment. With a period of supplementary coaching and experience on-the-job, applying their skills to a level 7 standard, then assessment of competence can follow.

For the avoidance of any doubt it is not sufficient to merely train ECITB apprentices to a SCQF level 5 (previously SVQ Level 2) standard in general engineering skills and then expect the additional training to occur on-the-job. This is untenable to employers working in the ECI.

The specification included in the following pages describes the qualifications to be attained off-the-job, but also the level of skill to be attained by the apprentices.



## CONTRACT SPECIFICATION

The ECITB's contractual requirement is for the training provider to deliver training and assessment services leading to the ECITB's Modern Apprenticeship in Engineering Construction qualification for apprentices in the employment of employers, in-scope to the ECITB and working in the upstream oil and gas sector.

For the avoidance of doubt, the proposed contract will not extend to the training and assessment of apprentices who are not in the employment of employers in-scope to the ECITB (and possibly other contractors).

This specification document describes the activities and processes required to be undertaken by the appointed provider (Training Provider) in order to ensure that all Apprentices achieve the requirements of the relevant discipline contained within the ECITB's Modern Apprenticeship in Engineering Construction (**attached as Appendix A**).

Please note that the final number of Apprentices, discipline and work based location will not be confirmed until the recruitment phase in the cohort commencement year has concluded.

## 1 STANDARDS

All training and assessment services will be delivered in accordance with Engineering Construction Industry Training Board (ECITB) specifications and standards as prescribed in the following documents and publications:

- 1.1 The relevant, current apprenticeship framework document (included as **Appendix A**), which shall be either;
  - 1.1.1 The Modern Apprenticeship in Engineering Construction Framework Document for Scotland
  - 1.1.2 The Level 3 Advanced Apprenticeship in Engineering Construction (England)
  - 1.1.3 The Level 3 Apprenticeship in Engineering Construction (Wales)
- 1.2 Procedure for Achieving Approved Centre Status
- 1.3 Quality Assurance Procedures Manual
- 1.4 ECITB Assessment Strategy for Craft and Technician Vocational Qualifications at levels 2 and 3 (revised to reference QCF and SCQF August 2010) (**Appendix B**)
- 1.5 Qualification Information Booklet for the relevant Competence Qualification

## 2 TERMS AND DEFINITIONS

The following definitions and rules of interpretation apply in this specification:

- 2.1 **Approved Centre**  
means an organisation having met all the regulatory authority's criteria approved by awarding bodies to offer assessment and verification of Competence Qualifications
- 2.2 **Awarding Body**  
this is the term used to describe an organisation approved by UK government appointed regulatory authorities to award qualifications, including Competence Qualifications. The ECITB is the UK's principal awarding body for engineering construction qualifications
- 2.3 **Competence Qualification**  
means the qualification a Modern Apprentice must complete and which attests his or her ability to do a job of work to a nationally recognised standard. A Modern Apprentice will complete the Competence Qualification in the workplace having been trained in the practical skills necessary to demonstrate competence in real work situations whilst off-the-job at the training provider or college. as opposed to a Knowledge Qualification, which will be achieved off-the-job, predominately in a classroom usually at a further education college.
- 2.4 **ECITB's Modern Apprenticeship Framework**  
means the requirements that must be met and the qualifications to be achieved by an apprentice in order for them to successfully complete the ECITB Modern Apprenticeship. All requirements and qualifications are specified and defined in the document, titled '*A Modern Apprenticeship in Engineering Construction Framework Document for Scotland*'.

**2.5 Funding Contract**

Means the contract between the Training Provider and the relevant governmental body, currently Skills Development Scotland under which public funding is provided in connection with the Training provided to the Apprentice

**2.6 Knowledge Qualification**

means the qualification a Modern Apprentice must complete that confirms their knowledge of the fundamental aspects of their discipline, underpinning the Competence Qualification. This qualification will be achieved off-the-job, predominately in a classroom and usually at a further education college.

**2.7 Pathway**

means the discipline or occupation that the apprenticeship is principally concerned with. All components of the apprenticeship, particularly the Competence and Knowledge Qualifications are relevant to the pathway and associated occupation

**2.8 Procedure for Achieving Approved Centre Status**

means the procedure an organization must follow to become an Approved Centre, approved to deliver ECITB Competence Qualifications. Details can be found on the following page of the ECITB website:

<http://www.ecitb.org.uk/Programmes/AwardsQualifications/HowToBecomeAnApprovedCentre/>

**2.9 Qualification Information Booklet**

these publications provide guidance to assessors and apprentices on how assessment of each Competence Qualification should be carried out

**2.10 Quality Assurance Procedures Manual**

issued to ECITB Approved Centres once approved to deliver ECITB Competence Qualifications, this manual contains the procedures the Approved Centre must follow in every aspect of assessment and internal verification activity.

**2.11 Scottish Credit and Qualifications Framework (SCQF)**

Is the framework that brings together all mainstream Scottish qualifications allocating them credit points, which show how much learning has been achieved, and a level which shows how demanding the learning is. It makes it possible to compare knowledge-based to competence-based qualifications.

### **3 APPRENTICE REGISTRATION REQUIREMENTS**

#### **3.1 External Funding**

The Training Provider will secure and maintain a contract with the relevant funding agency for the purposes of funding the delivery of the component parts of the ECITB's Modern Apprenticeship Framework carry out the necessary registration of all apprentices in adherence with funding agency requirements and timescales.

#### **3.2 Registration of Apprentices**

3.2.1 The Training Provider shall register apprentices on ECITB's Modern Apprenticeship Framework (using MA On-Line) within 4 weeks of commencement of training or other notified timescale.

3.2.2 The Training Provider shall register apprentices on the Competence Qualification, relevant to the pathway within 4 weeks of commencement of training or other notified timescale.

3.2.3 The Training Provider shall register apprentices on the Knowledge Qualification, relevant to the pathway within 4 weeks of commencement of training or other notified timescale.

### **4 PERSONAL PROTECTIVE EQUIPMENT (PPE)**

The Training Provider shall supply appropriate and adequate PPE for the respective pathways for the duration of the off-the-job training, other than overalls and safety boots.

### **5 INDUCTION OF APPRENTICES**

5.1 The Training Provider shall conduct a thorough induction onto the ECITB Modern Apprenticeship such that each apprentice is fully aware of what to expect and what is expected of them. There shall be particular emphasis on:

5.1.2 The Training Provider's policy on health, safety and welfare

5.1.3 The Training Provider's policy on equality of opportunity

5.1.4 The Training Provider's rules and regulations, disciplinary policy and procedure and attendance and punctuality standards

5.1.5 The relevant Competence Qualification

5.1.6 The relevant Knowledge Qualification

5.1.7 Core Skills

5.1.8 Employee rights and responsibilities

5.2 In addition to the above the Training Provider shall include other topics within the induction as required by the training provider, the funding agency and other regulatory bodies.

## 6 OFF-THE-JOB TRAINING REQUIREMENTS

- 6.1 The Training Provider shall have all arrangements in place to enable off-the- job training to commence on a date agreed with ECITB and the chosen Provider for the 2019 cohort.
- 6.2 The Training Provider shall be able to deliver off-the-job training services from a location within Scotland or Northern England, to take account of the localities where trainees will ultimately be employed.
- 6.3 The Training Provider shall possess, or be able to access through a partnering arrangement, the essential physical resources detailed in **Table 1** required to deliver the skills elements of off-the-job training.
- 6.4 The Training Provider shall ensure all aspects of the Modern Apprenticeship Framework are delivered in compliance with the *Modern Apprenticeship in Engineering Construction Framework Document for Scotland (June 2011)*
- 6.5 The Training Provider shall have all arrangements in place to ensure all elements of off-the-Job training described briefly in **Table 2** and specified fully in **Table 5**, are completed no later than the end of May 2021.
- 6.6 The Training Provider shall deliver the various elements of off-the-job training based on the indicative timescales as detailed in **Table 3**.
- 6.7 The Training Provider shall submit monthly reports to, and in a format prescribed by, ECITB on each apprentice's progress during the off-the-job period.

**Table 1 - Physical Resource Requirements**

**Instrumentation & Control Maintenance**

Item	Physical Resource Requirement
1	A suitable Permit to Work System which mirrors the type in use at all Oil and Gas Installations. Ideally a computer based ISSOW system
2	Facilities to provide training on instrumentation, process control systems with Emergency Shutdown Systems and Fire Gas Systems, ideally on a live working plant.
3	A full range of technologies in use on Oil and Gas installations, pneumatic analogue, Hart, Fieldbus and Wireless Hart.
4	A full range of portable test equipment for plant testing Digital Pressure Calibrators, Hart and Fieldbus Communicators, mA sources, multi-function calibrators, Wallace Tiernan Pneumatic calibrators, Digital Multi-meters, Decade resistance and mV sources.
5	A full range of pressure measurement instruments such as Pressure Gauges, Differential Pressure transmitters, Gauge and absolute pressure transmitters, pneumatic analogue, Hart, Fieldbus and Wireless Hart.
6	A full range of level measurement instruments such as Ultrasonic, Capacitance, Radar, Differential pressure for vented tanks and a wet leg for pressurized tanks, Displacer with torque tube, pneumatic, analogue, Hart , Fieldbus and Wireless Hart examples.
7	A full range of Temperature Measurement Instruments such as Temperature Transmitters for RTD's and thermocouples with analogue, Hart, Fieldbus and Wireless Hart examples.
8	A full range of Flow Measurement Instruments such as Magnetic Flow Meters, Coriolis Flow Meters, Vortex Flow Meters, Displacement Flow Meters, Fiscal Flow Metering, Variable Area Flow Meter with pneumatic, analogue, Hart, Fieldbus and Wireless Hart examples.
9	A well-equipped workshop with a full range of test equipment including equipment listed in item 4. Plus Dead Weight Testers, standard Test Pressure Gauges and Dry Block Temperature Calibrators.
10	Fire and Gas Sensors, Gas Detectors, Smoke Detectors, Heat Detectors and Flame Detectors.
11	Full and easily accessed system of Maintenance Manuals and Diagrams for all Instrumentation and Control systems.

**Table 2**

COMPONENT	AWARDING BODY / STANDARD SETTING BODY	REF
National Certificate (NC) in Engineering Systems <b>(Table 5)</b>	SQA	G9CC 46
Higher National Certificate (HNC) in Measurement and Control Engineering <b>(Table 5)</b>	SQA	G88N 15
<i>Core Skills at SCQF Level 5 in Communication, Numeracy, Information &amp; Communication Technology, Problem-Solving and Working with Others</i>	SQA	N/A
SVQ Process Operations: Hydrocarbons Level 1 <b>(8 week programme to be completed during final 12 weeks)</b>	SQA / OPITO	G8LY 21
SVQ 2 Performing Engineering Operations at SQCF Level 5 <b>(Table 5)</b>	EAL	GC9W 22
Hydrocarbon Theory Training <b>(Table 5)</b>	ECITB	N/A
Discipline-specific skills training in accordance with ECITB specifications. <b>(Table 5)</b>	N/A	N/A
12 week Additional Skills programme <b>(Table 5)</b>	ECITB	N/A
Employee Rights and Responsibilities	ECITB	N/A
Basic Offshore Safety Induction and Emergency Training (BOSIET)	OPITO	5700
Client/Contractor National Safety Group (CCNSG) Safety Passport	ECITB	N/A
Minimum Industry Safety Training (MIST)	OPITO	N/A

**Table 3**

**Off-the-job training indicative timescales**

<b>Training Element</b>	<b>Start Date</b>	<b>Finish Date</b>
NC Engineering Systems	September 2019	July 2020
SVQ 2 Performing Engineering Operations	September 2019	July 2020
Core Skills	September 2019	July 2020
HNC Measurement & Control Engineering	July 2020	December 2020
Hydrocarbon Theory	July 2020	December 2020
Discipline Skills plus BOSIET, CCNSG and MIST Training	August 2020	February 2021
12 Week Skills Programme (including SVQ Process Operations: Hydrocarbons Level 1)	March 2020	May 2021

**7 WORK-BASED ASSESSMENT**

*It is expected that a Modern Apprentice registered on a Competence Qualification at SCQF Level 7 will be deemed competent in the minimum number of units required to complete the full award 2 years after commencing the work-based part of their training. The nature of vocational qualifications, though, will mean that provision of opportunity is pivotal and consequently the qualification may be achieved in 2 years ± 6 months.*

**Table 4**

<b>PATHWAY</b>	<b>COMPETENCE QUALIFICATION</b>	<b>AWARDING BODY</b>	<b>REF</b>
Instrument & Control Maintenance	Diploma in Maintaining Engineering Construction Plant and Systems – Instrument & Control at SCQF Level 7	ECITB	R143 04

7.1 The Training Provider will be an ECITB Approved Centre (or have realistic plans in place to become one prior to the commencement of the apprentices' Modern Apprenticeship), approved to offer assessment and verification of ECITB Competence Qualifications, specifically the competence qualification described in Table 5, and with adequate number of registered Assessors and Internal Verifiers.

7.2 If not currently an ECITB Approved Centre the Training Provider will either;

7.2.2 Provide ECITB with sufficient confidence that it has adequate systems, processes and resources in place to become an ECITB Approved Centre, approved to offer assessment and verification of the competence qualification

described in Table 5, or,

7.2.3 Provide ECITB with details of the sub-contracting arrangements it intends to agree with a current ECITB Approved Centre, approved to offer assessment and verification of the competence qualification described in Table 5

7.3 Where 7.2.2 above is applicable the Training Provider will follow the ECITB's Procedure for Achieving Approved Centre Status as directed in 2.9 of this schedule

7.4 The Training Provider shall assess apprentices in the workplace as they progress their Competence Qualification (detailed in **Table 4** above)- at all times complying with ECITB Awarding Body procedures as detailed in:

7.4.2 ECITB Quality Assurance Procedures Manual (*issued to all Approved Centres upon attainment of ECITB Approved Centre status*)

7.4.3 ECITB Assessment Strategy for Craft and Technician Vocational Qualifications at levels 2 and 3 (revised to reference QCF and SCQF August 2010) (**Appendix B**)

7.4.4 The Competence Qualification's Assessment Guidance Booklet (can be found by following the link described in Table 4 )

7.5 The Training Provider shall regularly review the progress of apprentices throughout the apprentices' work-based element of their Modern Apprenticeship.

7.6 The Training Provider shall submit monthly reports to ECITB, in a format prescribed by ECITB, on each apprentice's progress during the work-based element of their Modern Apprenticeship.

7.7 The Training Provider shall liaise with ECITB to convene quarterly review meetings where all aspects of work-based assessment can be discussed and actions agreed.

7.8 The Training Provider shall ensure ECITB are informed at the earliest possible juncture of any barriers in the way of apprentices successful completing the SVQ Level 3 and, subsequently, the ECITB Modern Apprenticeship Framework.

## **8 PERSONNEL DEPLOYED**

The Training Provider shall ensure that all persons delivering training and assessing candidates in the workplace have the necessary qualifications, experience and have passed all necessary checks as required by the ECITB Awarding Body, funding agency and all other relevant, regulatory authorities.

## **9 THIRD PARTY AUDITING**

9.1 The Training Provider shall provide the ECITB with results of all quality and health and safety audits in relation to the training and/or assessment of ECITB apprentices.

9.2 The Training Provider shall work with ECITB in resolving any issues that arise as a result of quality and health and safety audits in relation to the training and/or assessment of ECITB apprentices.

## **10 BENCHMARKING**

The Training Provider shall endeavour to meet agreed targets - no more stringent than those agreed by the Training Provider with the relevant funding agency - with ECITB in relation to achievement, retention, etc. of ECITB apprentices

## **11 INSURANCE**

During the term of this Agreement and for a period of one year thereafter, the Training Provider shall maintain in force with reputable insurance company insurance for the sum of £10,000,000 per event, including the following risks:

- 11.1 employers' liability insurance in respect of all persons involved in delivery of the Training and performance of this Agreement;
- 11.2 public liability insurance to cover against any suit or action, claims or demands brought or made by any person injured or suffering loss or damage in connection with the carrying out of the Training and performance of this Agreement;
- 11.3 business interruption in the event that the Training Provider is unable to perform the Training.

**Table 5**

<b>G9CC 46 National Certificate (NC) in Engineering Systems</b>		
<b>Titles</b>	<b>Unit Number</b>	<b>Credit Value</b>
<b>Mandatory</b>		
Communications	F3GB 12	1
Mathematics: Technician 1	F3HX 12	1
Engineering: Applying Information Technology	F5D4 12	1
<b>Restricted Core</b>		
Mechanical Engineering Principles	F6X7 12	1
Electrical Principles	F5HL 12	1
Single Phase & 3 Phase Principles	F5JV 12	1
Process Chemistry: An Introduction	F6X9 12	1
Process Measurement & Control: An Introduction	F6X8 12	1
<b>Optional Units</b> (all to be completed)		
Engineering Dynamics: An Introduction	F5K6 12	1
Thermofluids	F5JE 12	1
Applications of PLCs	F5HD 12	1
Engineering: Distributed Control Systems	F5KM 12	1
Process Operations: Oil and Gas Separation	F6XA 11	1
Process Operations: Gas Processing Operations	F6XB 11	1
Process Operations: Utilities	F6XC 11	1
Engineering: Hazards, Protection Methods and Functional Safety	F5KP 12	1
<b>Additional Units</b>		
Mathematics: Technician 2	F3HY 12	1
Statics	F5K8 12	1

**Table 5 continued**

<b>GC9W 22 SVQ 2 Performing Engineering Operations at SQCF Level 5</b>		
<b>Unit Titles</b>	<b>SQCF Level</b>	
Working Safely in an Engineering Environment	5	
Working Efficiently and Effectively in Engineering	5	
Using and Communicating Technical Information	5	
Forming and Assembling Pipework Systems	5	
Maintaining and Testing Process Instrumentation and Control Devices	5	
Wiring and Testing Programme Controller based Systems	5	
<b>Higher National Certificate – Measurement &amp; Control Engineering: G88N 15</b>		
<b>Unit Titles</b>	<b>Unit Number</b>	<b>Credit Value</b>
<b>Mandatory Units</b>		
Communication: Analysing and Presenting Complex Communication	DE3N 34	1
Mathematics: for Engineering 1 : Electrical and Electronics	DG4H 33	1
Distributed Control Systems	DX48 34	1
Measurement Systems 1	DX4F 34	2
Measurement and Control Engineering - Graded Unit 1 Examination	FO13 34	1
<b>Optional Units</b>		
Process Control	DX4K 34	1
Complex Control Systems	DX45 34	1
Application of Programmable Logic Controllers	DG31 34	1
Instrumentation in Hazardous Areas	DX4D 34	1
Fire and Gas Detection	DX4A 34	1
<b>The 12 Weeks (60 days) Skills Programme</b>		
<b>Training Element</b>	<b>Duration</b>	
G8LY 21 Processing Operations: Hydrocarbons Level 1	40 days	
Diagrams used across all disciplines (an appreciation of P&IDs, loop diagrams, cause and effect, piping diagrams, schematic diagrams etc.)	2 days	
Gas Testing Awareness (Authorised Gas Tester Level 3)	0.5 days	
Task Based Risk Assessment	0.5 days	
ISSOW Level 1	1 day	
Small bore fittings (different types, make and break etc)	3 days	
An understanding of hydro-testing and leak testing basics (an awareness of hazards and dangers with practical elements covered during this session).	3 days	
Competence Test on Instrument Maintenance Skills – Report on each trainee to be developed by Training Provider	5 days	
Holidays	5 days	

## **Table 5 continued**

### **HYDROCARBON THEORY TRAINING**

(The figures in brackets represent a notional number of learning hours, for guidance only)

#### **1. INTRODUCTION TO OIL AND GAS INDUSTRY (10)**

##### **Objectives**

On completion of this training the learner shall demonstrate an understanding of:

- What is Oil and Gas?
- The history of Oil and Gas
- How Oil and Gas is formed
- Exploring for Oil and Gas
- Recovering Oil and Gas

#### **2. PROCESS PARAMETERS AND PROCESS HAZARDS (20)**

##### **Objective**

On completion of this training the learner shall demonstrate a high level of awareness of the major hazards encountered on a typical offshore and onshore installation, including but not limited to:

- Pressure
- Temperature
- Level
- Flow
- Radiation (LSA or NORM)
- Chemical Hazards (including COSHH)
- Hydrocarbon Flammability
- H<sub>2</sub>S
- Nitrogen, Halon replacement
- Mercury
- Corrosion (including under insulation)
- Erosion
- HP/LP Interfaces

### **3. PROCESS EQUIPMENT (35)**

#### **Objective**

On completion of this training the learner shall have an appreciation and understand the basic operating principles of all types of equipment including:

- Piping standards
- Valves
- Well Completions
- Wellheads and Christmas Trees
- Separators
- Heat exchangers
- Pumps
- Filter systems
- Compressors
- Hydrocarbons
- Turbo – expanders

### **4. PROCESS SYSTEMS (40)**

#### **Objective**

On completion of this training the learner shall demonstrate an understanding of all major process systems, how they work, reason for use and common failures.

- Oil/Water/Gas/Seperation
- Gas compression
- Produced Water Treatment
- Gas dehydration
- Sea Water Injection and Produced Water Re-Injection
- Gas Lift
- Subsea systems
- Metering and measurement
- Power Generation and Gas Turbine Drivers
- Distillation and Fractionation (NGL's)
- Impurity removal (H<sub>2</sub>S, CO<sub>2</sub> etc)

## **5. PROCESS UTILITIES (30)**

### **Objective**

On completion of this training the learner shall demonstrate an understanding of the use and requirements of utility systems including those associated with the accommodation and life support systems including:

- Instrument and Plant Air
- Fuel Gas
- Flare System
- Vent System
- Drains
- Heating Medium System
- Cooling Medium System
- Firewater System
- Plant Water System
- Diesel Systems
- Inerting Systems
- Portable Water System
- Heating, Ventilation and Air Conditioning (HVAC) System
- Platform Living Quarters

## **6. OIL AND GAS STRUCTURES AND INFRASTRUCTURE (15)**

### **Objective**

On completion of this training the learner shall demonstrate and understanding of the basic structures and infrastructures associated with the oil and gas extraction industry, including:

- Production Platforms
- Central Process Facilities
- FSPOs and Tanker Offloading
- Semi – Submersibles
- Gas Plants
- Pipeline Systems
- Transport and Supply Logistics

## **7. SAFETY SYSTEMS (20)**

### **Objectives**

On completion of this training the learner shall demonstrate a full understanding of:

- Health, Safety and Environment (HSE) Legislation
- Emergency Shutdown System (ESD)
- Emergency Depressurisation (EDP) or Blowdown
- Fire and Gas Systems
- Cause and Effect Diagrams
- Emergency Response Systems
- Process Isolations
- Permit – to – Work Systems
- Work briefing systems (e.g. toolbox talks)
- Risk Assessment

## **8. PRODUCTION OPERATIONS (20)**

### **Objectives**

On completion of this training the learner shall demonstrate an understanding of production operations, including:

- Job roles and responsibilities
- Typical work patterns (shift cycle, crew-change)
- Plant start up procedures
- Plant shutdown procedures
- Process Fault finding
- Critical Situation Response
- Control Room Operations
- Communication systems (radio, public address, telephone and satellite)
- Override systems and procedures
- Handovers
- Plant monitoring
- Isolations and de-isolations, integrity, leak testing etc

## **9. PROCESS OPERATIONS AND DOCUMENTATION (10)**

### **Objectives**

On completion of this training the learner shall demonstrate an understanding of the requirement, both legally and functionally, for specific documentation, their use and importance and method of maintaining same to a suitable standard including:

- Process Flow Diagrams (PFDs)/Process Flow Schemes (PFS)
- Piping and Instrument Diagrams (P&IDs)
- Process Engineering Flow Schematics (PEFS)
- Plot Plans
- Plant Logs
- Operating Procedure Manuals
- Operating Standards
- Plant Integrity (Maintenance systems, condition monitoring and planned shutdown)

## **10. SAFETY OF SELF AND OTHERS (10)**

### **Objectives**

On completion of this training the learner shall demonstrate a full understanding of:

- Implications of Health and Safety at Work Legislation
- Standard of behaviour in the workplace
- Safety Rules and Responsibilities
- Why Safety Meetings are important
- Why Audits are important

## Table 5 continued

### DISCIPLINE-SPECIFIC SKILLS TRAINING – INSTRUMENTATION & CONTROL TRAINING OBJECTIVES

The objectives of the discipline-specific skills training programme are to provide each apprentice with:

- (a) Experience in the calibration, adjustment, installation and commissioning of industrial instrumentation and control equipment.
- (b) Awareness of fault-finding techniques and development of diagnostic abilities

### TIMEFRAME

The training described in the following pages is to commence in July at the end of training year one and conclude in March, midway through training year two. It may be that some of the topics and the 'appreciation', theoretical aspects of the content will have been delivered as part of the HNC, or possibly in a few instances, the PEO programme.

In total the number of learning hours should **total 510 hours** (or 85 days)

### CONTEXT

The discipline-specific skills training is only one part of the overall UOGITTS off-the-job training programme, the other constituent parts are summarised in the table below.

Induction	5 days
PEO	60 days
National Certificate	90 days
Higher National Certificate	70 days
<b>Discipline Specific Skills Training</b>	<b>85 days</b>
Hydrocarbon Theory	28 days
Additional Skills Programme (including Processing of Hydrocarbons)	55 days
CCNSG Safety Passport/BOSIET/MIST	7 days
Holidays	50 days
<b>Total</b>	<b>450 days (90 weeks)</b>

## **TRAINING CONTENT – INSTRUMENTATION & CONTROL**

1. Pressure/Vacuum Measuring Devices
2. Level Measuring Devices
3. Flow Measuring Devices
4. Temperature Measuring Devices
5. Relays/Shut Down/Switches
6. Programmable Logic Controllers
7. Fire and Gas Detection Systems
8. Control Valves
9. Installation, Calibration & Commissioning of Control Loops

## TRAINING ACTIVITIES

(The figures in brackets represent a notional number of learning hours, for guidance only)

### 1. PRESSURE/VACUUM MEASURING DEVICES (50)

- a. **Calibration Standards:** Use and care of the following: pressure/vacuum test equipment:
  - i. Dead/weight testers
  - ii. Test Gauges
  - iii. Wallace and Tiernan Pressure Tester
  - iv. Druck I.S. Pressure Tester
- b. **Pressure and vacuum gauges:**
  - i. Bourdon tube pressure and vacuum gauges
  - ii. Calibrate against the appropriate calibration standard listed in 1a
  - iii. Plot graphs of results to show recognition of errors associated with bourdon gauges
  - iv. Correction adjustment and procedures to eliminate or reduce to an acceptable level the Errors in iii.
  - v. Installation practice, e.g. correction for head error, safety features, condensate seals, protection against corrosive processes
  - vi. Calibration of oxygen and acetylene gauges
- c. **Pneumatic Electronic Pressure/Differential Pressure Transmitters**
  - i. Calibrate against standard test equipment
  - ii. Apply static zero test to d/p transmitters
  - iii. Diagnose and rectify faults associated with transmitters
  - iv. Installation practice, e.g. piping to orifice plate, purge systems, elevation and suppression compensation. *Elevation and suppression of electronics only.*

### 2. LEVEL MEASURING DEVICES (50)

- a. **Installation of the following level measuring devices:**
  - i. Simple air-purge system showing the effect of partial blockage, and the use as a density meter.
  - ii. Electrical conductivity probes and associated circuitry for level alarm/control via a solenoid valve.
- b. **Familiarisation with the following level measuring devices:**
  - i. displacer – torque tube method
  - ii. Capacitance probes and dielectric properties of typical fluids
  - iii. D/P cell i.e. hydrostatic head

### 3. FLOW MEASURING DEVICES (50)

- a. **Installation and commissioning of the following:**
  - i. Orifice plate and d/p cell
  - ii. Positive displacement meter
- b. **Diagnosis and rectification of faults in flow metering instruments**

#### **4. TEMPERATURE MEASURING DEVICES (50)**

- a. Familiarisation with the following methods of temperature measurement**
  - i. Vapour pressure, gas filled
  - ii. Errors associated with the above methods
- b. Thermocouples and their uses:**
  - i. Construction of thermocouple circuits to measure average temperature and temperature difference. The use of mV/temperature tables and an emf source for calibration purposes.
- c. Resistance thermometers and their use:**
  - i. The temperature/resistance relationship of a resistance thermometer and the fundamental interval
  - ii. Determination of resistance of a platinum coil by means of Wheatstone bridge circuit.
  - iii. Use of two, three and four wire compensation
- d. Calibration of temperature measuring devices:**
  - i. Fixed points
  - ii. Oil and sand baths
- e. Optical thermometers and their use**

#### **5. RELAYS SHUT DOWN/SWITCHES (50)**

- a. The construction of simple relay logic circuits**
- b. The development of a simple relay shut down system using industrial type switches/sensors. e.g. pressure, temperature, level and flow switches, trip amplifiers, and key switches. Diode protection from back electro-magnetic fields.**

#### **6. PROGRAMMABLE LOGIC CONTROLLERS (50)**

- a. Basic programming of PLC's**
- b. Implementation of basic programmes using sensors and actuators**
- c. Implementation of relay shut down system developed in section 5 using a PLC**

## **7. FIRE AND GAS DETECTION SYSTEMS (90)**

### **a. Fixed gas detection systems**

- i. Read associated circuit and technical drawings
- ii. Fault find to component level and rectify any faults found
- iii. Calibrate a gas detection loop i.e. head voltage, loop operating or ambient, loop fault current and alarm settings using calibration gases
- iv. Check associated shut down systems, normally operated via main fire and gas panel.
- v. Principle of operation of various type of gas detection loops
- vi. Awareness of the types of gas to be detected and the methods of detection. Explosive levels of the various gases.

### **b. Alarm annunciation from gas to be detected and the methods of detection**

- i. Builds a typical 2 out of 3 voting system
- ii. Shut down capability

## **8. CONTROL VALVES (80)**

### **a. Use and calibration of control valves**

- i. Strip down, reassemble and calibrate control valves
- ii. Strip down, reassemble and calibrate a valve positioner
- iii. Use valve positioners for split range operation

## **9. INSTALLATION CALIBRATION AND COMMISSIONING OF CONTROL LOOPS (90)**

### **a. Use and calibration of controllers**

- i. Checks the operation of the controller in an open loop arrangement

### **b. Optimisation of control loops**

- i. Loop testing
- ii. Optimises the controller to the control loop

### **c. Control Systems**

- i. Monitoring systems
- ii. Overview of a Distributive Control System
- iii. Appreciation of PID control

### **d. Use of diagnostic test equipment**

### **e. Safety aspects when trouble shooting**