

SPECIFICATION

This document specifies the training and assessment services required to be delivered for apprentices recruited in 2015 in the Offshore Region in the Mechanical 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 2015 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 2017.
- 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**Mechanical 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 Mechanical Maintenance and breakdown. Ideally operational plant |
| 3 | A full range of plain sliding and rolling element bearings |
| 4 | A full range of static and dynamic seals |
| 5 | Pumps with plain sliding and rolling element bearings for bearing removal/replacement |
| 6 | Centrifugal pumps for maintenance, inspection and overhaul. Plus pumps for removal, overhaul, re-installation, re-alignment and commissioning. Ideally these will be operational pumps. |
| 7 | Equipment for Rotating Machinery alignment (Reverse Periphery and Laser Alignment) |
| 8 | Hydraulic Equipment for overhaul and testing./ Hydraulic Test Rig for hydraulic circuits |
| 9 | Pipe Trainer with a variety of types, sizes and classes of flanges. |
| 10 | Different types of gaskets and joining methods |
| 11 | Equipment and tools for manufacture of steel threaded pipe systems, copper compression fittings and high pressure stainless steel twin ferule fittings and tubing |
| 12 | Bolt tensioning equipment for manual torque loading and tensioning & Bolt Tensioning equipment for Hydraulic tensioning |
| 13 | A variety of valve types for overhaul, repair and valve testing. Plus facilities to practice removal/replacement of valves. Ideally an Operational plant |
| 14 | Valve test rig for Testing of all types of valves and for re-certification of relief valves |
| 15 | Diesel engines for 1 st line servicing, component removal, overhaul and replacement and full overhaul and test run |
| 16 | Reciprocating and Rotary Air Compressors for overhaul, inspection, repair and re-assembly. |
| 17 | Shell & Tube and Plate Heat exchangers for overhaul and inspection |
| 18 | Centrifugal Gas Compressor for overhaul, inspection and re-assembly |
| 19 | Fully stocked workshop with comprehensive range of hand and power tools |
| 20 | Full and easily accessed system of maintenance manuals and diagrams for all Mechanical equipment and systems |

Table 2

| COMPONENT | AWARDING BODY / STANDARD SETTING BODY | REF |
|-----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|---------|
| National Certificate (NC) in Engineering Systems (Table 5) | SQA | G9CC 46 |
| Higher National Certificate (HNC) in Mechanical Engineering (Table 5) | SQA | G840 15 |
| Core Skills at SCQF Level 5 in Communication, Numeracy, Information & Communication Technology, Problem-Solving and Working with Others | SQA | N/A |
| SVQ Process Operations: Hydrocarbons Level 1 (8 week programme to be completed during final 12 weeks) | SQA / OPITO | G8LY 21 |
| SVQ 2 Performing Engineering Operations at SQCF Level 5 (Table 5) | EAL | GC9W 22 |
| Hydrocarbon Theory Training (Table 5) | ECITB | N/A |
| Discipline-specific skills training in accordance with ECITB specifications. (Table 5) | N/A | N/A |
| 12 week Additional Skills programme (Table 5) | 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

| Training Element | Start Date | Finish Date |
|-----------------------------------------------------------------------------------|----------------|---------------|
| NC Engineering Systems | September 2015 | July 2016 |
| SVQ 2 Performing Engineering Operations | September 2015 | July 2016 |
| Core Skills | September 2015 | July 2016 |
| HNC Mechanical Engineering | July 2016 | December 2016 |
| Hydrocarbon Theory | July 2016 | December 2016 |
| Discipline Skills plus BOSIET, CCNSG and MIST Training | August 2016 | February 2017 |
| 12 Week Skills Programme (including SVQ Process Operations: Hydrocarbons Level 1) | March 2016 | May 2017 |

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 \pm 6 months.

Table 4

| PATHWAY | COMPETENCE QUALIFICATION | AWARDING BODY | REF |
|------------------------|------------------------------------------------------------------------------------------------|---------------|---------|
| Mechanical Maintenance | Diploma in Maintaining Engineering Construction Plant and Systems - Mechanical at SCQF Level 7 | ECITB | R141 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 successfully 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

| G9CC 46 National Certificate (NC) in Engineering Systems | | |
|-----------------------------------------------------------------|--------------------|---------------------|
| Titles | Unit Number | Credit Value |
| Mandatory | | |
| Communications | F3GB 12 | 1 |
| Mathematics: Technician 1 | F3HX 12 | 1 |
| Engineering: Applying Information Technology | F5D4 12 | 1 |
| Restricted Core | | |
| 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 |
| Optional Units (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 |
| Additional Units | | |
| Mathematics: Technician 2 | F3HY 12 | 1 |
| Statics | F5K8 12 | 1 |

Table 5 continued

| GC9W 22 SVQ 2 Performing Engineering Operations at SQCF Level 5 | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------|--------------|
| Unit Titles | | SQCF Level | |
| Working Safely in an Engineering Environment | | 5 | |
| Working Efficiently and Effectively in Engineering | | 5 | |
| Using and Communicating Technical Information | | 5 | |
| Producing Components Using Hand Fitting Techniques | | 5 | |
| Forming and Assembling Pipework Systems | | 5 | |
| Maintaining Mechanical Devices and Equipment | | 5 | |
| Higher National Certificate - Mechanical Engineering: G840 15 | | | |
| Unit Titles | | Unit Number | Credit Value |
| Mandatory Units | | | |
| Communication: Practical Skills | | D77G 34 | 1 |
| Mathematics: for Engineering 1 : Mechanical and Manufacturing | | DT5X 33 | 1 |
| Quality Management: An Introduction | | DT8Y 34 | 1 |
| Engineering Principles | | DR3L 34 | 1 |
| Materials Selection | | DT46 34 | 1 |
| Statics and Strength of Materials | | DR1T 34 | 1 |
| Dynamics | | DT9T 34 | 1 |
| Thermofluids | | DT9P 34 | 1 |
| Pneumatics and Hydraulics | | DT9X 34 | 1 |
| Mechanical Engineering: Graded Unit 1 Examination | | DV11 34 | |
| Optional Units | | | |
| Fundamentals of Control Systems and Transducers | | DN3Y 34 | 1 |
| Industrial Systems | | DT5V 34 | 1 |
| The 12 Weeks (60 days) Skills Programme | | | |
| Training Element | | Duration | |
| 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 Mechanical 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
- H₂S
- 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 (H₂S, CO₂ 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 – MECHANICAL MAINTENANCE

TRAINING OBJECTIVES

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

- (a) Experience in the dismantling, diagnosis, repair, reassembly and testing of assorted items of plant.
- (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 |
| Discipline Specific Skills Training | 85 days |
| Hydrocarbon Theory | 28 days |
| Additional Skills Programme (including Processing of Hydrocarbons) | 55 days |
| CCNSG Safety Passport/BOSIET/MIST | 7 days |
| Holidays | 50 days |
| Total | 450 days (90 weeks) |

TRAINING CONTENT

1. Design, Operation, Assembly, Installation, Overhaul, Inspection, Repair and Test of Equipment to include;

- 1.1. Pipefitting Practice
- 1.2. Valves and Fittings
- 1.3. Pumps
- 1.4. Heat Exchangers
- 1.5. Turbo Machinery
- 1.6. Compressors
- 1.7. Diesel Engines

2. General Mechanical Fitting, to include;

- 2.1. Hydraulics
- 2.2. Lubrication
- 2.3. Lifting and Rigging

3. Maintenance Work Control

- 3.1. Maintenance organisation and responsibility
- 3.2. Planned correction and condition monitoring based maintenance
- 3.3. Typical documentation, work orders, timesheets, spares lists, bar charts, job reports etc.
- 3.4. Maintenance records – importance and use.
- 3.5. Computerised systems
- 3.6. Drawing office. Identification, selection and use of drawings
- 3.7. Source of information, makers manuals specifications, parts lists and maintenance schedules

TRAINING ACTIVITIES

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

1. DESIGN, OPERATION, ASSEMBLY, INSTALLATION, OVERHAUL, INSPECTION, REPAIR AND TEST OF EQUIPMENT

1.1. Pipe Fitting Practice (60)

Thorough proficiency in pipe fitting and associated fittings of all classes of pipe work and associated fittings

- 1.1.1 Pipes, flanges, bolting and gaskets – identification, selection and use of sizes/schedules/classes/materials
- 1.1.2 Pipe jointing procedures
- 1.1.3 Use of blind flanges and spades
- 1.1.4 Procedures for pressure testing of pipe work
- 1.1.5 Types, use and maintenance of pipe supports and hangers
- 1.1.6 Use and assembly of screwed pipe work and fittings
- 1.1.7 Use and assembly of tubing and compression fittings
- 1.1.8 P&ID drawings and Isometric drawings

1.2 Valves and Fittings (50)

- 1.2.1 Valves – types/sizes/classes/specifications from 25mm to + 300mm diameter, low and high pressure pipe work. Types include wedge gate, parallel slide, ball, plug needle, butterfly and diaphragm
- 1.2.2 Overhaul of valves – packing of stem, inspection, refurbishing, replacement of seals, testing of valves
- 1.2.3 Function, selection, overhaul and test of pressure relief valves. Appreciation of inspection procedures
- 1.2.4 Function, identification, selection, installation and overhaul of traps and associated fittings

Pumps (80)

Identification and overhaul of common process industry pumps

- 1.2.5 Common types of pump, duties and installation
- 1.2.6 Strip down, overhaul, reassembly and test of single stage overhung centrifugal/multistage vertical centrifugal/horizontal split casing etc. Clearances, floats, tolerances
- 1.2.7 Identification, selection and fitting of gland packing and rotating seals
- 1.2.8 Identification, selection and fitting of bearings, including plain journal, ball, roller, thrust etc.

- 1.2.9 Simulated field installation of pumps. Techniques of shaft alignment. Types and installation of shaft couplings. Acceptable tolerances, effects of bedplate distortion and pipework pull

1.3 Heat Exchangers

Identification, overhaul and test of process heat exchangers

- 1.3.1 Types of heat exchanger, duties and installation. Types include shell and tube, fixed tube sheet, floating head, 'U' tube and fin fan air cooled.
- 1.3.2 Preparation of heat exchangers for inspection. Procedures for pressure test of heat exchangers. Reassembly of heat exchangers, including fitting of gaskets and bottling up procedures. Torque values and controlled application of torque.
- 1.3.3 Heat exchanger repair – baffles/tie rods/bellows/tube plates/tube expansion/tube and welding/assembly procedures.

1.4 Turbo-machinery (40)

*Basic appreciation of turbo-machinery design and operation
Understanding of basic maintenance procedures*

- 1.4.1 Operation of gas and steam turbines and axial and centrifugal compressors. Principal components and function
- 1.4.2 Inspection and overhaul procedures – bearings (journal and thrust), seals, balance rings, clearances, cold and hot alignment, couplings, gearboxes, etc.
- 1.4.3 Lubrication system design and maintenance
- 1.4.4 Vibration analysis. Types of probe and use of results. Importance of dynamic balance. Balancing procedures

1.5 Compressors (80)

*Basic appreciation of compressors designs. Understanding of
Maintenance procedures*

- 1.5.1 Design and use of positive displacement and rotary compressors, including reciprocating, vane, screw, axial, centrifugal, gear. Principal components and function
- 1.5.2 Inspection and maintenance of valves, seals, pistons and rings, cylinders, cooling systems, lubrication systems. Installation procedure.

1.6 Diesel Engines (70)

Operation maintenance of diesel plant

- 1.6.1 Principles of IC engine. Compression ratios, thermodynamic cycle, spark or compression ignition. Torque and speed. Engine control, cooling systems, fuel systems, aspiration, turbo charging.
- 1.6.2 Routine maintenance of diesel plant – lubrication, cooling systems, filters, starter motor, fuel systems, injector calibration, timing. Fault diagnosis.
- 1.6.3 Inspection and overhaul procedures – strip down of principal components, including pistons and rings, cylinder lines, crankshaft, cylinder head, valves. Engine rebuild and test.

1.7 Boilers (20)

Basic appreciation of steam raising plant design and operation

Basic inspection and maintenance procedures

- 1.7.1 Principal components of steam raising plant and their function – steam drum, evaporator, super heater, economiser, firing, feed pumps, relief valves and boiler control, feed water quality.
- 1.7.2 Statutory inspection requirements of steam raising plant. Preparation of plant for inspection and test.

2. GENERAL MECHANICAL FITTING

2.1 Hydraulics (40)

Operation and maintenance of hydraulic systems

- 2.1.1 Routine maintenance of hydraulic systems – fluid quality, air in fluid, filters, seals, cylinder and valve performance, hydraulic pump. Fault diagnosis.
- 2.1.2 Typical applications – lifting equipment, jacks, hydro torque equipment, press

2.2 Lubrication (30)

Understanding of basic types of lubricant

- 2.2.1 Lubricating systems – free lubrication and forced lubrication. System components – splash rings, drip bottles, pump, filters, reservoirs, relief valves, coolers. Planned lubrication procedures.
- 2.2.2 Problems of grease application
- 2.2.3 E lubrication and forced lubrication. System components – splash rings, drip bottles, pump, filters, reservoirs, relief valves, coolers. Planned lubrication procedures.

2.3 Lifting and Rigging (20)

Appreciation of lifting and rigging practice

- 2.3.1 Basic lifting equipment – ropes, wires, webs, chain blocks, lifting beams, pulleys, trolleys, pneumatic/hydraulic equipment. Uses and abuses of lifting and handling equipment.
- 2.3.2 Cranes – types, basic design, use. Importance of reach, jib height and load. Multi sheave blocks.
- 2.3.3 Inspection, care and maintenance of lifting equipment and cranes, including statutory inspection, test and colour coding.

3. MAINTENANCE WORK CONTROL (20)

Application of maintenance work control procedures

- 3.1.1 Maintenance organisation and responsibilities
 - 3.1.2 Planned, corrective and condition monitoring based maintenance
 - 3.1.3 Typical documentation – works orders, timesheets, spares lists, bar charts, job reports etc.
 - 3.1.4 Maintenance Records – importance and use
 - 3.1.5 Computerised systems
 - 3.1.6 Drawing Office, identification, selection and use of drawings
- Sources of information – makers manuals, specifications, parts lists, maintenance schedules