

Level 3 NVQ in Installation and commissioning (1684)

National occupational standards and assessment
requirements

www.cityandguilds.com
June 2004



Publications and enquiries

The publications listed below are available free of charge from

Publications Sales
City & Guilds
1 Giltspur Street
London EC1A 9DD

Telephone 020 7294 2850

Facsimile 020 7294 2400

Answering your questions
Ensuring a brighter future
Helping you achieve your targets
Helping you reach your goals
Helping you succeed
Publications list

General information about City & Guilds may be obtained from the Customer Relations Unit at the above address, or on 020 7294 2800.

Equal opportunities

City & Guilds fully supports the principle of equal opportunities and we are committed to satisfying these principles in all our activities and in all our published material.

For a copy of our equal opportunities policy statement please contact the Customer Services Enquiries Unit.

Every effort has been made to ensure that the information contained in this publication is true and correct at the time of going to press. However, City & Guilds' products and services are subject to continuous development and improvement and the right is reserved to change products and services from time to time. City & Guilds cannot accept liability for loss or damage arising from the use of information contained in this publication.

©2004 The City & Guilds of London Institute. All rights reserved.
City & Guilds is a trademark of the City and Guilds of London Institute.

1 Giltspur Street
London EC1A 9DD
Telephone 020 7294 2468
Facsimile 020 7294 2400
Web site <http://www.cityandguilds.com>.

Contents

Foreword	5
The Award	6
Qualification Structure – Level 3 Installation and commissioning	7
Assessment Requirements	9
Engineering progression routes	16
National Occupational Standards and Evidence Recording Sheets	17
Key Skills Signposting	329
Further Information	333

[This page is intentionally blank]

Foreword

This document provides details of the requirements specific to this N/SVQ qualification which includes:

- the requirements for occupational competence for all those involved in assessing performance
- specific assessment requirements and
- the National Occupational Standards.

It is designed to be used in conjunction with the following documents

the *N/SVQ Candidate Guide and Logbook*
and
the *N/SVQ Centre Guide*.

Both documents are available from the City & Guilds website or from Sales.

The guide does not contain details of centre and scheme approval - these may be found in the document: 'Providing City and Guilds qualifications' (stock code EN-00-1111) available free of charge from the Sales Department or your regional/national City & Guilds office (see *Further information* section of this document).

Details of general regulations, registration and certification procedures, including fees, appear on City & Guilds web site <http://www.cityandguilds.com.uk>

The following documents also include information on policy and guidance on quality assurance within NVQs and assessors and verifiers should be aware of the contents.

- City & Guilds policy document '*Ensuring Quality*' – aimed at those involved in the assessment and verification of City & Guilds awards. Issued 3-4 times a year (available from Sales Department) NB Edition 12 – December 2001 summarises policy from all previous editions)
- *Joint Awarding Body Guidance on Internal Verification of NVQs*, issued November 2001, published by the DfES, also available on City & Guilds web site.

General NVQ information

Centres should refer to the City & Guilds *Centre Guide for NVQs* for information on NVQs, the people involved, the assessment process and model recording forms.

Level 3 NVQ in Installation and commissioning

Scheme information

Scope of the award

NVQs for the engineering sector are work-based qualifications designed to reflect the roles and responsibilities of personnel within the sector.

This level 3 award is based on a mandatory and optional unit structure. The mandatory units cover those areas which have a common approach such as safety, engineering communications and team working. The optional units are combined in to 'pathways' which offer a choice to meet the needs of the main occupational patterns within typical installation and commissioning organisations.

National Occupational Standards and Key Skills

The full National Occupational Standards and Key Skills mapping are enclosed within this document. Centres may access whichever units are appropriate to their requirements.

Restrictions on entry

There are no restrictions on entry to this award, however candidates should not register for this award if they hold or are registered with City & Guilds or another awarding body for a similar award at the same level.

The Award

The Level 3 NVQ in Installation and commissioning consists of 45 units. All candidates must take the **four** core units plus a specified number of optional units from one of the **five** occupational pathways to achieve the award. Additional units may be taken, for which the candidate will receive a Certificate of Unit Credit.

The certificates referred to in this guide are as follows

Level 3 NVQ in Installation and commissioning (Equipment Installation)

Level 3 NVQ in Installation and commissioning (Commissioning)

Level 3 NVQ in Installation and commissioning (Traction Lift Installation)

Level 3 NVQ in Installation and commissioning (Hydraulic Lift Installation)

Level 3 NVQ in Installation and commissioning (Escalator Installation and Commissioning)

The Units have been contextualised by *SEMTA* from the National Engineering Competency Standards (ECS).

Qualification Structure

Level 3 Installation and commissioning Mandatory units for all pathways

Unit 1: Complying with Statutory Regulations and Organisational Safety Requirements

Unit 2: Using Engineering Drawings and Documents in Installation and Commissioning Activities

Unit 3: Working Efficiently and Effectively in Engineering

Unit 4: Handing Over and Confirming Completion of Installation or Commissioning Activities

Pathways

Equipment Installation

Must complete ONE of the following units:

Unit 5: Installing Mechanical Equipment

Unit 6: Installing Electrical/Electronic Equipment

Unit 7: Installing Equipment to Produce an Engineered System

Unit 8: Installing Instrumentation and Control Equipment

Unit 9: Installing Fluid Power Equipment

Unit 10: Installing Process Controller Equipment

Unit 11: Installing Emergency Electrical Power Generation Equipment

Unit 12: Installing Environmental Pollution Control Equipment

Unit 13: Installing Workplace Environmental Control Equipment

Unit 14: Installing Heating and Ventilation Equipment

Unit 15: Installing Air Conditioning and Ventilation Equipment

Unit 16: Installing Compressed Air Equipment

Unit 17: Installing Waste/Foul Water Distribution Equipment

Unit 18: Installing Fresh Water Distribution Equipment

Unit 19: Installing Refrigeration Equipment

Commissioning

Must complete ONE of the following units:

Unit 20: Commissioning Mechanical Equipment and Systems

Unit 21: Commissioning Electrical/Electronic Equipment and Systems

Unit 22: Commissioning Engineered Systems

Unit 23: Commissioning Process Controller Equipment and Systems

Unit 24: Commissioning Instrumentation and Control Equipment and Systems

Unit 25: Commissioning Fluid Power Equipment and Systems

Unit 26: Commissioning Emergency Electrical Power Generation Equipment and Systems

Unit 27: Commissioning Environmental Pollution Control Equipment and Systems

Unit 28: Commissioning Workplace Environmental Control Equipment and Systems

Unit 29: Commissioning Heating and Ventilation Equipment and Systems

Unit 30: Commissioning Air Conditioning and Ventilation Equipment and Systems

Unit 31: Commissioning Compressed Air Equipment and Systems

Unit 32: Commissioning Waste/Foul Water Distribution Equipment and Systems

Unit 33: Commissioning Fresh Water Distribution Equipment and Systems

Unit 34: Commissioning Refrigeration Equipment and Systems

Traction Lift Installation

Must complete ALL of the following units:

- Unit 35: Carrying Out Fault Diagnosis on Lift Installations
- Unit 36: Measuring and Setting Out Lift Installations
- Unit 37: Installing Lift Well and Ancillary Equipment
- Unit 38: Installing Traction Lift Equipment
- Unit 39: Installing Lift Ropes and Chains
- Unit 40: Installing Lift Doors, Frames and Ancillary Components
- Unit 41: Checking and Setting Lift Installations

Hydraulic Lift Installation

Must complete ALL of the following units:

- Unit 35: Carrying Out Fault Diagnosis on Lift Installations
- Unit 36: Measuring and Setting Out Lift Installations
- Unit 37: Installing Lift Well and Ancillary Equipment
- Unit 39: Installing Lift Ropes and Chains
- Unit 40: Installing Lift Doors, Frames and Ancillary Components
- Unit 41: Checking and Setting Lift Installations
- Unit 42: Installing Hydraulic Lift Equipment

Escalator Installation and Commissioning

Must complete ALL of the following units:

- Unit 43: Carrying Out Fault Diagnosis on Escalator Installations
- Unit 44: Installing Escalator Equipment
- Unit 45: Commissioning Escalator Installations

Assessment Requirements for Awards within the Engineering Sector

Introduction

The purpose of the assessment strategy is to

- assist assessors, internal verifiers and external verifiers
- encourage and promote consistent assessment of the qualification
- promote cost effective assessment strategies
- promote the use of external quality control of assessment methods

The assessment strategy also specifies

- the qualifications and experience required for assessors and verifiers
- the assessment environment and standard of equipment that should be used
- access to the qualification
- the evidence required to support competent performance against the standards
- carrying out assessments
- assessing knowledge and understanding

Section A General Requirements

The assessment strategy for City and Guilds awards based on *SEMTA* units is detailed below. It applies throughout the standards and must be used as the basis for all individual assessments. In the implementation of all *SEMTA* standards, reference should be made back to this strategy when specifying the assessment requirements for each unit or element of competence. The internal and external verifier will seek evidence that the requirements have been fulfilled by candidates and assessors at all times.

Scope of the Award

Evidence of competence must be assessed against the requirements of the relevant National Occupational Standards. For this award, the relevant standards are contextualised versions of the Engineering Competence Standards (ECS).

Qualification Structure

The qualification structure for this award requires candidates to complete common mandatory units, followed by a choice of pathways. Candidates may then be required to complete further mandatory units within their chosen pathway, followed by a number of optional units from a provided selection. The range of optional units allows for any variations in the occupation in different organisations and across the sector.

Assessor Requirements

Assessment must be carried out by competent assessors who hold, or are working towards, the nationally recognised Assessor units (A1/A2) (formerly D32/D33).

Assessors must be able to demonstrate that they have sufficient technical competence to evaluate and judge evidence for this award. This will be demonstrated either by holding a relevant technical qualification or by proven suitable experience of the technical areas to be assessed. The assessor's competence must, at the very least, be at the same level as that required of the candidate(s) in the units being assessed.

Specific technical requirements for assessors of this qualification are outlined on page 12.

Assessors must also know:

- the content and meaning of the National Occupational Standards against which assessments are to be carried out
- the appropriate Regulatory Body's system of vocational qualifications
- the relevant Awarding Body's documentation and system of vocational qualifications within which the assessment is taking place.

Verifier Requirements

Internal Verifiers must hold, or be working towards, the nationally recognised Internal Verifier unit (V1) (formerly D34), and would be expected to be familiar with, and preferably hold, the nationally recognised Assessor units.

External Verifiers must hold, or be working towards, the nationally recognised External Verifier unit (V2) (formerly D35), and would be expected to be familiar with, and preferably hold, the nationally recognised Assessor units, and possibly even the nationally recognised Internal Verifier unit.

Verifiers, both internal and external, will also be expected to be fully conversant with the standards against which the assessments and verification are to be carried out, the appropriate Regulatory Body's system of vocational qualifications, and the relevant Awarding Body's documentation and system of vocational qualifications within which the assessment and verification is taking place.

Additionally verifiers, both internal and external, should be technically familiar with the skill area being verified.

Specific technical requirements for verifiers of this qualification are outlined on page 12.

Witness testimony

Where observation of process is used to obtain the performance evidence, this observation must be carried out against the standards. Best practice would require that such observation is carried out by a qualified assessor. If this is not practicable then alternative sources of evidence may be used.

For example, the observation may be carried out against the standards by someone else in close contact with the candidate. This could be a supervisor, colleague, mentor or manager, who may be regarded as a suitable witness to the candidate's competency. However, the witness must be technically competent in the process or skills that they are providing testimony for to at least the same level of expertise as that required of the candidate. It will be the responsibility of the assessor to make sure that any witness testimonies accepted as evidence of a candidate's competency are reliable and technically valid.

Assessment Environment

Evidence for this award should be obtained from the working environment where the work activities or work outcomes to be assessed are clearly attributable to the candidate. However, in certain circumstances, replication of work activities may be acceptable.

Where replication is considered necessary, assessors must be confident that the environment replicates the workplace to such an extent that competencies gained will be fully transferable to the workplace. In this case assessors must clearly identify those aspects of the workplace that are critical to performance, and make sure that they have been replicated satisfactorily. Where replication is involved, assessors must obtain agreement with internal and external verifiers before assessing any candidates.

Examples of critical aspects could be:

- environmental conditions such as, noise levels, lighting conditions and the presence of hazards
- the use of industrial equipment and procedures
- pressure of work such as time constraints and repetitive activities
- carrying out work on actual work pieces and the consequences of making mistakes
- customer/supplier/departmental relationships

Access to Assessment

There are no entry qualifications or age limits required for these qualifications unless this is a legal requirement of the process or the environment. Assessment is open to any candidate who has the potential to reach the standards laid down for this qualification. However centres should refer to the statement on access to assessment in the City & Guilds *Centre Guide for NVQs* on not entering for similar awards at the same level.

Aids or appliances which are designed to alleviate disability may be used during assessment providing they do not compromise the standard required.

Carrying Out Assessments

SEMTA strongly recommends that the majority of assessment evidence for the mandatory units is gathered during the performance of the optional units. Evidence should be obtained as a whole, where practically possible, since competent performance in the optional units is often dependent on competence in the mandatory units. Although it is possible to achieve this qualification with the minimum number of optional units, organisations may wish their candidates to be assessed for more than this.

Where key skills are required, these may be included as additional units and assessed in conjunction with the mandatory and optional units, where this is appropriate.

The standards were developed to cover a range of activities. The evidence produced for this award will, therefore, depend on the candidate's choice of 'scope' items in the standard, which are intended to help the candidate to seek the appropriate information and to acquire the necessary skills, techniques and knowledge before being able to demonstrate competent performance.

Where the scope section gives a choice (for example 'any three from five'), assessors should note that candidates do not need to cover the other (in this example, two) items, particularly where these additional items may relate to other activities or methods which are not part of the candidate's normal workplace activity or area of expertise.

Performance Evidence Requirements

Performance evidence must be the main form of evidence gathered.

In order to demonstrate consistent, competent performance for a unit, a minimum of **three** different evidence examples of performance evidence will be required, to show that the tasks reflected by the unit title have been carried out to the stated standards. The number of items required in each of the scope statements specified for a unit (eg four from a choice of six) must all be covered. It is possible that some of the scope items may be covered more than once. If, however, the three examples of performance evidence are not sufficient to cover all the specified scope items, then further examples of performance evidence will be required to ensure this coverage is achieved.

Assessors must make sure that the evidence provided reflects the candidate's competence and not just the achievement of the training programme.

Items of performance evidence often contain features that apply to more than one unit, and can be used as evidence in any unit where appropriate.

Performance evidence may be either:

- products of the candidate's work, such as items that have been produced or worked on, documents produced as part of a work activity, records or photographs of the product
- or**
- evidence of the way the candidates carried out the activities such as witness testimonies, assessor observations or authenticated candidate reports of the activity undertaken

Competent performance is more than just carrying out a series of individual set tasks. Many of the units contain statements that require the candidate to provide evidence that proves they are capable of combining the various features and techniques. Where this is the case, separate fragments of evidence would not provide this combination of features and techniques and will not, therefore, be acceptable as demonstrating competent performance.

If there is any doubt as to what constitutes suitable evidence, the external verifier should be consulted.

Assessing Knowledge and Understanding

Knowledge and understanding are key components of competent performance, but it is unlikely that performance evidence alone will provide enough evidence in this area. Where the candidate's knowledge and understanding (and the handling of contingency situations) is not apparent from performance evidence, it must be assessed by other means and be supported by suitable evidence.

Knowledge and understanding can be demonstrated in a number of different ways, but it is suggested that the most appropriate methods for this qualification are oral questioning and practical demonstrations. Assessors should ask enough questions to be able to determine that the candidate has an appropriate level of knowledge and understanding as required by the unit.

Where oral questioning is used the assessor must retain a record of the questions asked, together with the candidate's answers.

Section B Qualification-Specific Requirements for the Level 3 N/SVQ in Installation and commissioning

Scope of the Award

This qualification is for people who are occupied in installation and commissioning activities in an engineering environment, and who have a high level of technical skill and knowledge in those activities. They will be expected to demonstrate safe working practices and procedures at all times and work with minimum supervision, taking personal responsibility for the quality and accuracy of the work they carry out.

Candidates for this qualification will have gained a high level of skill ability and acquired sound knowledge and understanding of the relevant techniques, materials, tools and equipment used, in order to enable them to carry out the installation and commissioning activities, solve related problems, correct any faults and ensure the work output meets the required specification standard.

In order to complete a installation and commissioning activity, it may be necessary for a candidate to carry out additional tasks, such as machining, welding or electrical wiring. Where this is the case, the candidate will not be expected to be fully conversant with all aspects of the skills and knowledge required in this additional area. However, he/she will be expected to carry out and complete the additional operation or task to the same quality standard expected of a competent person, and must comply with the appropriate safety instructions and operational procedures.

Specific Technical Requirements for Assessors

Assessors of this qualification should have a minimum of three years' relevant skills experience, and should have a thorough working knowledge of the processes, techniques and procedures that are used within installation and commissioning.

Competence in the specific areas covered by the pathway being assessed is essential.

Specific Technical Requirements for Verifiers

Verifiers should have some relevant skills experience, and should have held a position of engineering responsibility. They should have sufficient technical knowledge to enable them to verify that assessments have been carried out to the technical and safety standards required, and to be able to ask relevant questions of assessors or candidates, if deemed necessary.

Specific Evidence Requirements

Candidates must carry out at least **three** separate assessment tasks. The unit guidance and scope for each unit indicate in detail what evidence is required. There is a specific Unit Checklist provided for **each** unit in this guide.

Completing the Unit checklists

The candidate must carry out **at least three separate assessment tasks**. The location of all items of evidence, that must cover **all** of the criteria given in the standards, should be entered on the checklist provided after each unit under the 'Performance Evidence' columns. These locations must be identified in a way that allows the verifiers (internal and external) to easily trace and audit the evidence eg. *Page 6* – could refer to the position in the portfolio of the inspection sheet covering a task. *Drawing 1* could provide the specification for the same task. Also *Job 1234* could refer to an actual product.

Note that it may not be possible to cover all of the required criteria by completing three tasks. In such cases supplementary work may be needed to cover this shortfall, this will be referenced in the fourth column.

In addition to the unit checklist, the required evidence must also contain

- Actual product evidence where practical – eg. taking into account its weight, size and or if it is an actual production item for customer use. Photographs or videos may be used in lieu provided they show the skill areas in sufficient detail for the verifiers (internal and external) to make a decision regarding the practical standards achieved
- A work sheet (company or centre devised) that clearly lays down the required product specification in terms of materials, tolerances and any time restrictions plus a drawing.
Note
 - i) it is not necessary for the candidate to personally reproduce drawings, method descriptors etc. unless these items do not exist.
 - ii) in cases of industrial confidentiality or sensitivity then it may be permissible to exclude certain items from the evidence, but a description of the general nature of the work/activity must be provided. In cases of doubt the EV should be consulted about the validity of a proposed assessment before the candidate commences any such work.
- An inspection sheet or report that clearly identifies that the product has been reliably tested against the specification. If there are any discrepancies of a non-critical nature then the assessment may be deemed acceptable provided that there is a statement to this effect signed by a duly appointed and responsible person.
- A **brief** report, prepared by the candidate, that identifies any hazards or difficulties associated with the work and how these were dealt with. It should also highlight any specific requirements or special skill areas that were involved eg. non standard tools, tool and work holding methods (use of jigs and fixtures etc.) Note that where relevant some aspects of this could also form part of the required knowledge evidence.

Knowledge evidence

Where the required knowledge and understanding cannot be obviously and positively inferred from an assessor or expert witness observing the practical tasks, then the candidate must be formally questioned using either short written answer or oral types of questions.

The questions should only relate to the specific areas defined by the criteria for this unit. eg. if only AC equipment is used then the questions should not ask for setting details etc. of DC equipment. (Note that this knowledge may well form part of an all round **underpinning knowledge** programme but in such cases it would be assessed separately.

Evidence of knowledge and understanding will **not** be required for those scope items that have not been selected by the candidate.

Assessors must carefully plan all types of questioning procedures beforehand. The actual questions (oral and written) must be kept under secure conditions and only made available to the candidates during the assessment process. The candidates will retain a copy of their results, including comments made by the assessor during oral questioning. (See the separate information section regarding the use of oral questioning techniques).

Assessors must make the questions available to verifiers so that the latter can compare them against the results sheets held by the candidates.

The knowledge evidence should be referenced in a similar fashion to that used for performance evidence.

Note that it is not necessary to assess the knowledge criteria on three separate occasions

Level 3 NVQ in Installation and commissioning Knowledge evidence recording sheet

(this should be copied for each unit)

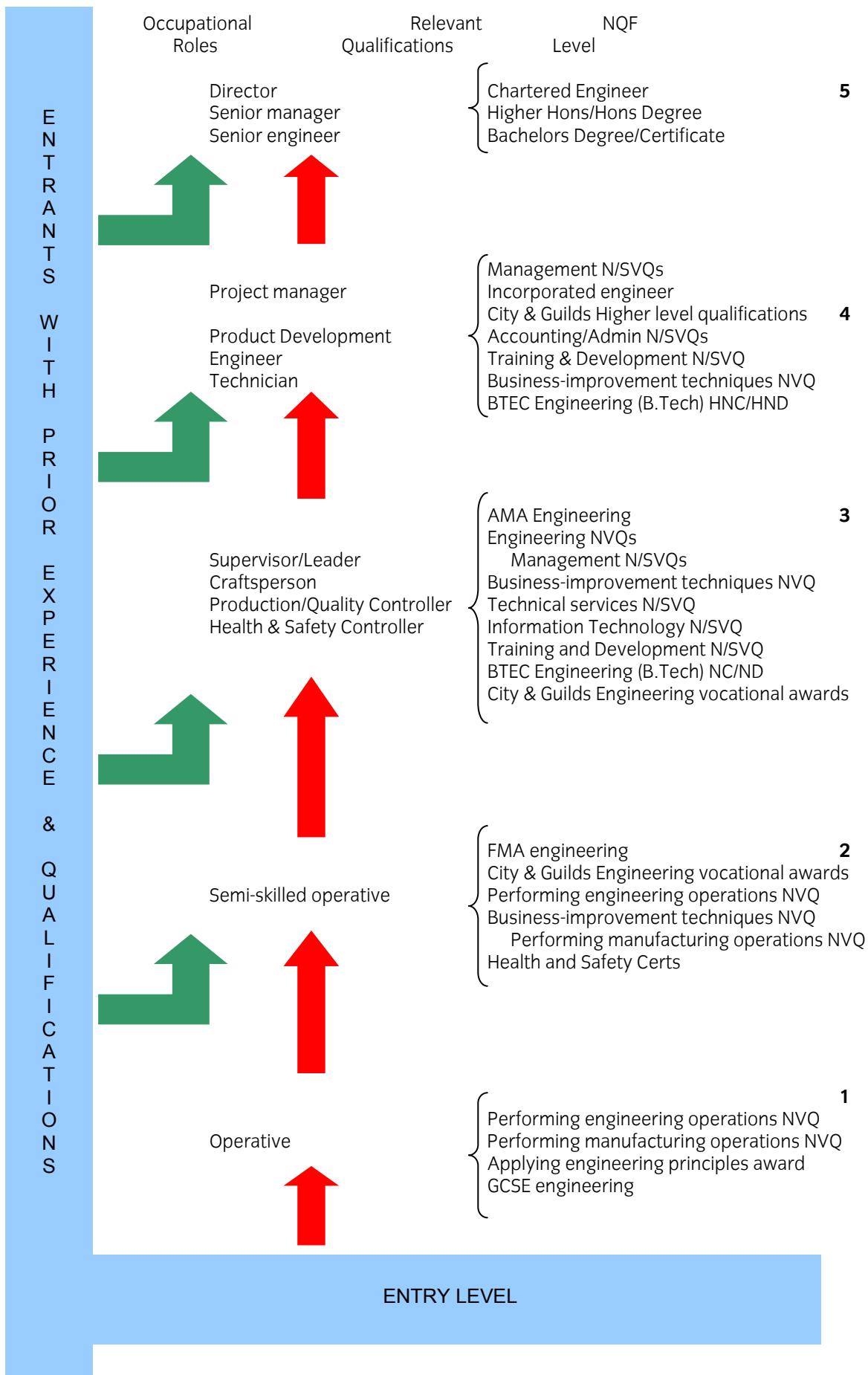
Knowledge reference	Method(s) used			Candidate's Evidence location	Assessor Reference	Result	Date assessed
	Written	Oral	Inferred				
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							

Name

Signature

Candidate:			Date:
Assessor:			Date:
Internal Verifier			Date:
External Verifier			Date:

Engineering Sector Progression Routes



National Occupation Standards and assessment record sheets– Level 3 Installation and commissioning

Standards supplied by SEMTA

[This page is intentionally blank]

Unit 1 Complying With Statutory Regulations and Organisational Safety Requirements

Unit Summary

This unit identifies the competencies you need to deal with statutory and organisational safety requirements in accordance with approved regulations, codes of practice and procedures. You will be required to comply with all relevant regulations that apply to your area of work as well as your general responsibilities as defined in the Health and Safety at Work Act. You will also need to be able to identify the relevant qualified first aiders or appointed person and know the location of the first aid facilities. You will have an understanding of the procedures to be adopted in the case of accidents involving injury and in situations where there are dangerous occurrences or hazardous malfunctions of equipment, processes or machinery. You will also need to be fully conversant with the organisation's procedures for fire alerts and the evacuation of premises.

You will also be required to identify the hazards and risks that are associated with your job. Typically these will focus on your working environment, the tools and equipment that you use, materials and substances that you use and working practices that do not follow laid down procedures, and manual lifting and carrying techniques.

Your responsibilities will require you to comply with organisational policy and procedures for the Statutory Regulations and organisational safety activities undertaken and to report any problems with the safety activities that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with minimum supervision, taking personal responsibility for your own actions and the way in which you carry out the required engineering activities.

Your underpinning knowledge will provide a good understanding of your work, and provide an informed approach to applying Statutory Regulations and organisational safety requirements and procedures. You will understand the safety requirements and their application, and will know about the safety requirements in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

Unit 1 Complying With Statutory Regulations and Organisational Safety Requirements

Performance statements:

You must:

- a. Comply with your duties and obligations as defined in the Health and Safety at Work Act
- b. Present yourself in the workplace suitably prepared for the activities to be undertaken
- c. Follow organisational accident and emergency procedures
- d. Recognise and control hazards in the workplace
- e. Use correct manual lifting and carrying techniques
- f. Apply safe working practices and procedures

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Demonstrate your understanding of your duties and obligations to health and safety by carrying out **all** of the following:
 - apply in principle your duties and responsibilities as an individual under the Health and Safety at Work Act and relevant current legislation
 - identifying within your organisation, appropriate sources of information and guidance on health and safety issues, to include:
 - Eye protection and personal protective equipment
 - COSHH regulations
 - Risk assessments
 - identifying the warning signs and labels of the main groups of hazardous or dangerous substances
 - complying with the appropriate Statutory Regulations at all times
2. Comply with **all** emergency requirements to include:
 - identifying the appropriate qualified first aiders or appointed person and the location of first aid facilities
 - identifying the procedures to be followed in the event of injury to self or others
 - following organisational procedures in the event of fire and the evacuation of premises
 - identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions
3. Identify the hazards and risks that are associated with **all** of the following:
 - your working environment
 - the tools and equipment that you use
 - materials and substances that you use
 - using working practices that do not follow laid down procedures
4. Demonstrate **two** methods of manual lifting and carrying techniques:
 - lifting alone
 - with assistance of others
 - with mechanical assistance
5. Apply safe working practices in an industrial environment to include **all** of the following:
 - maintaining a tidy workplace with exits and gangways free from obstructions
 - using tools and equipment safely and only for the purpose intended
 - observing organisational safety rules, signs and hazard warnings
 - taking measures to protect others from harm by any work you are carrying out

Unit 1 Complying With Statutory Regulations and Organisational Safety Requirements

Knowledge statements:

You must have knowledge and understanding of :

1. The roles and responsibilities of yourself and others under the Health and Safety at Work Act 1974 and current legislation (eg. The Management of Health and Safety at Work Regulations; Workplace Health and Safety and Welfare Regulations; Personal Protective Equipment at Work Regulations; Manual Handling Operations Regulations; Provision and use of Work Equipment Regulations; Display Screen at Work Regulations)
2. The specific regulations and safe working practices and procedures that apply to your work activities
3. The warning signs for the seven main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations
4. How to locate relevant health and safety information for your tasks and the sources of expert assistance when help is needed
5. What constitutes a hazard in the workplace (such as moving parts of machinery, electricity, slippery and uneven surfaces, dust and fumes, handling and transporting, contaminants and irritants, material ejection, fire, working at height, environment, pressure/stored energy systems, volatile or toxic materials, unshielded processes)
6. What are your responsibilities for dealing with hazards and reducing risks in the workplace (such as hazard spotting and safety inspections; the use of hazard check lists, carrying out risk assessments, COSHH assessments and safe systems of working)
7. What are the risks associated with your working environment, the tools, materials and equipment that you use, spillages of oil and chemicals, not reporting accidental breakages of tools or equipment and not following laid down working practices and procedures
8. What first aid facilities exist within your work area and within the organisation in general and the procedures to be followed in the case of accidents involving injury
9. What constitutes dangerous occurrences and hazardous malfunctions and why these must be reported even when no one was injured
10. The procedures for sounding the emergency alarms, evacuation procedures and escape routes to be used and the need to report your presence at the appropriate assembly point
11. What the organisational policy is with regard to fire fighting procedures, the common causes of fire and what you can do to help prevent them
12. What protective clothing and equipment is available for your areas of activity
13. How to safely lift and carry loads and the manual and mechanical aids available
14. How to prepare and maintain safe working areas, standards and procedures to ensure good housekeeping
15. The importance of safe storage of tools, equipment, materials and products
16. The extent of your own authority and whom you should report to, in the event of problems that you cannot resolve

Unit 1 Complying With Statutory Regulations and Organisational Safety Requirements

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Demonstrate your understanding of your duties and obligations to health and safety by carrying out all of the following (ALL)				
understand Health & Safety at Work Act				
identify appropriate information for PPE COSHH risk assessments				
identify warning signs				
comply with statutory regulations				
Comply with all emergency requirements to include (ALL)				
identify first aider/facilities				
identify injury procedures				
follow fire procedures				
identify danger/hazard procedures				
Identify the hazards and risks that are associated with all of the following (ALL)				
working environment				
tools and equipment				
materials and substances				
bad working practices				
Demonstrate two methods of manual lifting and carrying techniques (TWO)				
lifting alone				
with assistance of others				
with mechanical assistance				
Apply safe working practices in an industrial environment to include all of the following (ALL)				
tidy workplace				
tools and equipment				
safety/hazard warnings				
protect others				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit 2 Using Engineering Drawings and Documents in Installation and Commissioning Activities

Unit Summary

This unit identifies the competences you need in order to read and extract information from drawings and specifications relating to the installation and commissioning of engineering equipment. In this unit, you will be required to make effective use of text, numerical and graphical information, by interpreting and using technical information extracted from engineering drawings, technical manuals, specifications and charts, technical data sheets and manufacturers' manuals, in accordance with approved procedures. You will be required to extract the necessary information from the various drawings and related documents, in order to establish and carry out the installation or commissioning requirements, and to make valid decisions about the quality and performance of the equipment being worked on.

Your responsibilities will require you to comply with organisational policy and procedures for the care and control of the drawings and related specifications. You will be expected to report any problems with the use and interpretation of the drawings, specifications and documentation that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of the different types of drawings and documents used for installation or commissioning, and will provide an informed approach to applying instructions and procedures. You will be able to read and interpret the drawings and documents used, and will know about the symbols, notations, conventions, and abbreviations used, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

Unit 2 Using Engineering Drawings and Documents in Maintenance Activities

Performance statements:

You must:

- a. Use the approved source to obtain the required drawings and specifications
- b. Correctly interpret the drawings and specifications
- c. Identify, extract and interpret the required information
- d. Use the information obtained to ensure that work output meets the specification
- e. Deal promptly and effectively with any problems within your control and report those which cannot be solved
- f. Report any inaccuracies or discrepancies in drawings and specifications

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Use approved sources to obtain the necessary drawings and related specifications, and carry out **all** of the following:
 - check the currency and validity of the drawings and documents used
 - exercise care and control over the documents at all times
 - correctly extract all necessary data in order to carry out the required tasks
 - seek out additional information where there are gaps or deficiencies in the information obtained
 - report any problems found with the drawings/specifications
 - make valid decisions based on the data extracted from the documents
 - return all drawings and related documents to the approved location on completion of the work
 - complete all necessary installation or commissioning documentation
2. Use information extracted from engineering drawings and related documentation, to include **three** of the following:
 - approved sketches
 - installation drawings/layouts
 - gas supply, distribution and installation
 - fuel oil supply, distribution and installation
 - routing diagrams (such as piping, cables)
 - operation manuals
 - test schedules
 - manufacturer/supplier/contractor data
 - electrical supply, distribution and installation
 - water supply, distribution and installation
 - compressed air supply, distribution and installation
 - layout diagrams (such as schematic, block, physical, system)
 - commissioning documentation
 - steam supply, distribution and installation general assembly drawings
 - national, international and organisational standards
 - health and safety standards relating to the activity (such as COSHH or environmental requirements)
3. Use information extracted from related documentation to include **three** from the following:
 - installation requirements
 - material or components required
 - dimensions
 - location/orientation
 - utility supply details (such as electricity, water, gas, air)
 - locations of services, including standby and emergency backup systems
 - electrical data
 - fluid data
 - protective arrangements and equipment (such as containment, pressure relief valves, environmental controls, warning and evacuation systems and equipment)

Unit 2 Using Engineering Drawings and Documents in Maintenance Activities

Knowledge statements:

You must have knowledge and understanding of:

1. The sources of the drawings and specifications that you use in your work activities
2. How drawings and documents are obtained, and how to check that they are current and valid
3. How to use other sources of information to support the drawings (such as organisational standards, national and international standards, health and safety documentation)
4. The procedures for reporting discrepancies in the drawings or documents, and for reporting lost or damaged drawings/documents
5. Care and control procedures for the drawings and documents, and the importance of returning the drawings and documents to the designated location on completion of the work activities
6. The basic drawing conventions, colour coding of services, symbols and notations used, and why there needs to be different types of drawings
7. The types of drawings used, and how they interrelate (such as general layout drawings; piping and cable route diagrams; flow, block, schematic and system diagrams)
8. Imperial and metric systems of measurement; dimensions and tolerances; scales and reference points
9. The meaning of the different symbols, notations and abbreviations found on the drawings used for services (such as electricity, water, gas, fuel oil, compressed air, steam, pressure and flow characteristics)
10. How damage and contaminants on drawings can lead to delays in carrying out work
11. The extent of your own responsibility, when to act on your own initiative to find, clarify and evaluate information, and whom you should report to if you have problems that you cannot resolve

Unit 2 Using Engineering Drawings and Documents in Maintenance Activities

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Use approved sources to obtain the necessary drawings and related specifications, and carry out all of the following (ALL)				
check currency/validity of drawings and documents				
exercise care and control over documents				
correctly extract all necessary data				
seek out additional information where there are gaps or deficiencies				
report any problems in drawings/specifications				
make valid decisions based on data extracted from the documents				
return drawings/documents to the approved location				
complete all necessary documentation				
Use information extracted from engineering drawings and related documentation, to include three of the following (THREE)				
approved sketches				
installation drawings/layouts				
gas supply, distribution and installation				
fuel oil supply, distribution and installation				
routing diagrams				
operation manuals				
test schedules				
manufacturer, supplier, contractor data				
electrical supply, distribution and installation				
water supply, distribution and installation				
compressed air supply, distribution and installation				
layout diagrams				
commissioning documentation				
steam supply, distribution and installation general assembly drawings				
national, international and organisational standards				
health and safety standards				
Use information extracted from related documentation to include three from the following (THREE)				
installation requirements				
material/components required				
dimensions				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
location/orientation				
utility supply details				
locations of services, including standby and emergency backup				
electrical data				
fluid data				
protective arrangements and equipment				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit 3 Working Efficiently & Effectively in Engineering

Unit Summary

This unit identifies the competencies you need to work efficiently and effectively in the workplace, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, you will be required to carry out all necessary preparations within the scope of your responsibility. This may include preparing the work area and ensuring that it is in a safe condition to carry out the intended activities, ensuring you have the appropriate job specifications and instructions and that any tools, equipment, materials and other resources required are available and in a safe and usable condition.

On completion of the engineering activity, you will be required to return your immediate work area to an acceptable condition before recommencing further work requirements. This may involve placing completed work in the correct location, returning and/or storing any tools and equipment in the correct area, identifying any waste and / or scrapped materials and arranging for their disposal, and reporting any defects or damage to tools and equipment used.

In order to be efficient and effective in the workplace, you will also be required to demonstrate that you can create and maintain effective working relationships with colleagues and line management. You will be expected to review objectives and targets for your personal development and contribute to, and communicate any opportunities for, improvements that could be made to working practices and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the engineering activities undertaken, and to report any problems with the activities, tools or equipment that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to take personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to working efficiently and effectively in an engineering environment. You will understand the need to work efficiently and effectively, and will know about the things you need to consider when preparing and tidying up the work area, how to contribute to improvements, deal with problems, maintain effective working relationships, and agree your development objectives and targets, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

You will understand the safety precautions required when carrying out engineering activities. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace.

Unit 3 Working Efficiently & Effectively in Engineering

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Prepare the work area to carry out the engineering activity
- c. Check there are sufficient supplies of materials and/or consumables and that they meet work requirements
- d. Ensure completed products or resources are stored in the appropriate location on completion of the activities
- e. Tidy up the work area on completion of the engineering activity
- f. Deal promptly and effectively with problems within you control and report those that cannot be resolved
- g. Contribute and communicate opportunities for improvement to working practices and procedures
- h. Maintain effective working relationships with colleagues
- i. Review personal training and development as is appropriate to the job role

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Prepare for the engineering activity, by carrying out **all** of the following, as applicable to the type of work to be undertaken:

- ensure the work area is free from hazards and is suitably prepared for the activities to be undertaken
- check that any required safety procedures are implemented
- obtain any necessary personal protection equipment, and ensure that it is in a usable condition
- obtain the required tools and equipment, and check that they are in a safe and useable condition
- obtain all necessary drawings, specifications and associated documentation
- obtain the job instructions and make sure you understand them
- obtain the correct materials or components for the work in hand
- ensure that storage arrangements for work are appropriate
- obtain appropriate authorisation to carry out the work

2. Complete work activities to include **all** of the following:

- completing all necessary documentation accurately and legibly
- returning tools and equipment
- returning drawings and work instructions
- identifying where appropriate any unusable tools, equipment and components
- arranging for disposal of waste materials

3. Contribute to organisational procedures for identifying opportunities for improvement to **one** of the following:

- working practices
- working methods
- quality
- safety
- tools and equipment
- suppliers
- internal communication
- customer service
- training and development
- teamwork
- other

4. Deal with problems affecting the engineering process to include **two** of the following:

- materials
- tools and equipment
- drawings
- job specification
- quality
- people
- timescales
- safety
- activities or procedures

5. Maintain effective working relationships to include **two** of the following:

Level 3 NVQ in Installation and commissioning

- colleagues within own working group
 - colleagues outside normal working group
 - line management
 - external contacts
6. Review personal development objectives and targets to include **one** of the following:
- dual or multi skilling
 - training on new equipment/technology
 - increased responsibility
 - understanding of company working practices, procedures, plans and policies
 - other specific requirements

Unit 3 Working Efficiently & Effectively in Engineering

Knowledge statements:

You must have a knowledge and understanding of:

1. The safe working practices and procedures to be followed whilst preparing and tidying up your work environment
2. The correct use of any equipment used to protect the health and safety of you and your colleagues
3. The procedure for ensuring that all documentation relating to the work being carried out is available and current prior to starting the activity
4. The action that should be taken if documentation received is incomplete and / or incorrect
5. The procedure for ensuring all tools and equipment are available prior to undertaking the activity
6. The checks to be carried out to ensure tools and equipment are in full working order prior to undertaking the activity
7. The action that should be taken if tools and equipment are not in full working
8. The checks to be carried out to ensure all materials required are correct and complete prior to undertaking the activity
9. The action that should be taken if materials do not meet the requirements of the activity
10. Who to inform when the work activity has been completed
11. The information and / or documentation they require to confirm the activity has been completed
12. What materials, equipment and tools can be re-used
13. How any waste materials and / or products are transferred, stored and disposed of
14. Where tools and equipment should be stored and located
15. The importance of making a contribution to improving working practices
16. The procedure and format for making suggestions for improvements
17. What the benefits are to you and the organisation if improvements can be identified
18. The importance of maintaining effective working relationships within the workplace
19. The procedures to deal with and report any problems that can affect working relationships
20. The type of difficulties that can occur in working relationships
21. The regulations that affect how you should be treated at work (such as Equal Opportunities Act, Race and Sex Discrimination, Working Time Directive)
22. The benefits of continuous personal development
23. The training opportunities that are available in the workplace
24. The importance of why your training and development should be reviewed
25. Who to discuss training and development issues with
26. The extent of your own responsibility and whom you should report to if you have any problems that you cannot resolve

Unit 3 Working Efficiently & Effectively in Engineering

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Prepare for the engineering activity, by carrying out all of the following, as applicable to the type of work to be undertaken (ALL)				
ensure work area free from hazards and suitably prepared				
check any required safety procedures are implemented				
obtain personal protection equipment and ensure it is in a usable condition				
obtain tools and equipment and check they are safe and useable				
obtain all necessary drawings, specifications and documentation				
obtain job instructions and understand them				
obtain correct materials or components				
ensure storage arrangements appropriate				
obtain authorisation to carry out the work				
Complete work activities to include all of the following (ALL)				
necessary documents				
return tools/equipment				
return drawings				
unusable tools/components				
dispose of waste materials				
Contribute to organisations procedures for identifying opportunities for improvement to one of the following (ONE)				
working practices				
working methods				
quality				
safety				
tools/equipment				
suppliers				
internal communication				
customer service				
training/development				
teamwork				
other				
Deal with problems affecting the engineering process to include two of the following (two)				
materials				
tools/equipment				
drawings				
job specification				
quality				
people				
timescales				
safety				
activities/procedures				
Maintain effective working relationships to include two of the following (TWO)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
own working group				
outside own working group				
line management				
external contacts				
Review personal development objectives and targets to include one of the following (ONE)				
dual or multi-skilling				
new equipment/technology				
responsibility				
company working policies				
other				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 4: Handing Over and Confirming Completion of Installation or Commissioning Activities

Unit Summary

This unit identifies the competences you need to hand over equipment that has been installed or commissioned, to the appropriate person, prior to it entering service. Following the installation activity, you will be required to either set up the equipment and hand it over to another person to complete the required commissioning activities, or to complete the commissioning operation yourself. In either of these cases, this will involve checking that all the equipment and safety devices are operable and correctly set and/or calibrated, and that the equipment functions, safely and correctly, to the required specification. Following commissioning, and in addition to the above, checks for full operational requirements and production specifications, including run rate, are to be carried out before final handover to the appropriate person.

On handing over the equipment, you will be expected to highlight any unusual or changed operating features of the equipment, and to inform the appropriate person of any possible future maintenance requirements. You must also ensure that you receive documented confirmation that everyone involved in the handover accepts that the equipment is in a satisfactory condition to be put into service.

Your responsibilities will require you to comply with organisational policy and procedures for the handover activities undertaken, and to report any problems with the handover procedure that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying handover procedures following installation and commissioning. You will understand the equipment being handed over, and its application, and will know about the operating procedures and potential problems, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

You will understand the safety precautions required when carrying out the final commissioning and handover activities, especially those for isolating the equipment. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Unit No 4: Handing Over and Confirming Completion of Installation or Commissioning Activities

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Confirm that everyone involved accepts the product or asset is in a satisfactory condition for handover to take place
- c. Clearly identify any unusual features of the condition of the product or asset
- d. Make the handover and obtain agreement between everyone involved on the precise moment of transfer of responsibility
- e. Deal promptly and effectively with problems within your control and report those that you cannot solve
- f. Make sure that clear, accurate and complete records of the handover are made

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Confirm that the equipment is ready for handover, by carrying out **all** of the following checks, as applicable to the equipment being handed over:
 - the installation and/or commissioning activity has been completed and the equipment functions to specification
 - all safety systems are functioning correctly
 - any waste materials, safety barriers and warning signs used specifically for installation/commissioning activities have been removed
 - any auxiliary systems or equipment involved are connected and operable
 - environmental controls are operable
 - others involved in using the equipment are aware of impending start-up/handover
2. Carry out the correct handover procedures for **one** type of equipment/service from the following:
 - manual
 - semi-automatic
 - fully automatic
 - process/control
 - computer controlled
 - engineering services
 - other specific equipment
3. Carry out **all** of the following during the handover procedures:
 - run the installed and/or commissioned equipment through a complete cycle, in the presence of the appropriate person
 - confirm that the other person accepts that the equipment functions satisfactorily, to specification
 - highlight to the appropriate person any modifications or unusual features in the operating procedure
 - hand over all documentation relating to operating instructions, service/maintenance requirements
 - obtain agreement from the other person that they now accept responsibility for the equipment being handed over
 - complete any necessary handover documentation
 - confirm that the other person knows who to contact, and how, for future maintenance requirements
4. Carry out handover procedures to **one** of the following:
 - commissioning engineer
 - production/process supervisor
 - maintenance supervisor
 - other specific person
5. Complete **all** relevant paperwork from the following, and pass it to the appropriate people:
 - job card
 - installation report
 - commissioning report
 - other handover paperwork

Unit No 4: Handing Over and Confirming Completion of Installation or Commissioning Activities

Knowledge statements:

You must have knowledge and understanding of:

1. The health and safety requirements of the area in which the handover is to take place, and the responsibility they place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies to the equipment being installed/commissioned
3. The specific health and safety precautions to be applied during the handover procedure, and their effects on others
4. The importance of wearing protective clothing and other appropriate safety equipment during the handover, and where it may be obtained
5. The checking process to be followed before handing over the equipment (eg, are the safety and quality systems operable, does the equipment function to specification, run rate)
6. The appropriate handover procedure, depending on the activity carried out (installation, commissioning)
7. The procedure for involving the appropriate people when starting up the equipment during the handover
8. The need to highlight any unusual or changed operating features of the equipment
9. The importance of informing the appropriate person of any future maintenance requirements
10. The need to confirm that the other person understands the equipment operating procedures
11. The need to ensure that the person you are handing over the equipment to accepts that it is functioning correctly
12. The organisational documentation procedures applicable to the handover
13. How to create and maintain effective working relationships with appropriate people (encouraging, helping, politeness, open discussions both ways)
14. The problems that can occur during handover, and how they can be overcome
15. The extent of your own authority, and whom you should report to if you have problems that you cannot resolve

Unit No 4: Handing Over and Confirming Completion of Installation or Commissioning Activities

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Confirm that the equipment is ready for handover, by carrying out all of the following checks, as applicable to the equipment being handed over (ALL)				
installation/commissioning activity completed and equipment functions to specification				
all safety systems are functioning correctly				
waste materials, safety barriers, warning signs removed				
auxiliary systems or equipment connected and operable				
environmental controls are operable				
others involved in using equipment aware of start-up/handover				
Carry out the correct handover procedures for one type of equipment/service from the following (ONE)				
manual				
semi-automatic				
fully automatic				
process/control				
computer controlled				
engineering services				
other specific equipment				
Carry out all of the following during the handover procedures (ALL)				
run installed and/or commissioned equipment through complete cycle with appropriate person				
confirm appropriate person accepts equipment functions satisfactorily, to specification				
highlight to appropriate person any modifications or unusual features in the operating procedure				
hand over all documentation				
obtain agreement from appropriate person that they accept responsibility				
complete any necessary handover documentation				
confirm that appropriate person knows contact details for future maintenance requirements				
Carry out handover procedures to one of the following people (ONE)				
commissioning engineer				
production/process supervisor				
maintenance supervisor				
other specific person				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Complete all relevant paperwork from the following, and pass it to the appropriate people (ALL)				
job card				
installation report				
commissioning report				
other handover paperwork				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 5: Installing Mechanical Equipment

Unit Summary

This unit identifies the competences you need to install mechanical equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of mechanical equipment, such as machine tools, process control equipment, rotating mechanical equipment, engines and turbines, conveyors and elevators, lifting and handling equipment, processing plant, and structures like hoppers and large storage vessels.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment, or the installation of simple, self-contained items that require minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment, such as power supplies, belt and chain drives, clutches and brakes, services and fluid power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment being installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate tension or working clearances, are tightened to the correct torque, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must also be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying mechanical installation procedures. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities safely and effectively, to identify and correct any faults, and to ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Unit No 5: Installing Mechanical Equipment

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as drawings, layouts, instructions, manufacturers' data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure safe isolation of services during the installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install **one** of the following types of mechanical equipment:
 - machine tools
 - industrial compressors
 - conveyors
 - turbines
 - elevators
 - processing plant
 - hoppers or large storage vessels
 - lifting and handling equipment
 - other equipment (specify)
 - engines
 - process control equipment (such as large valves and actuating mechanisms, pumps)
4. Apply installation methods and techniques, to include **five** of the following:
 - marking out of locating and securing positions
 - drilling and hole preparation
 - fitting inserts (such as rag or expanding bolts)
 - positioning equipment
 - aligning equipment
 - levelling equipment
 - shimming and packing
 - fitting anti-vibration mountings
 - securing using mechanical fixings
 - applying screw fastening locking devices
5. Move and position equipment, using **two** of the following:

- slings
 - cranes
 - fork lift
 - portable lifting devices
 - block and tackle
 - rollers/skates
 - hoists
 - jacks
 - manual handling and moving loads
6. Use **three** of the following instruments during the installation activities:
- straight edges and feeler gauges
 - engineer's levels
 - dial test indicators
 - measuring instruments (such as electrical, mechanical, fluid power)
 - plumb lines and taut wires
 - alignment telescopes
 - laser equipment
 - self-diagnosis equipment
7. Make **two** of the following connections to the installed equipment:
- mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - fluid power connections
 - utility service connections (such as gas, air, water, oil)
8. Carry out checks and adjustments, appropriate to the equipment being installed, to include:
- testing that the equipment operates to the installation specification
- Plus **six** more of the following:
- setting working clearance
 - tensioning
 - topping up fluid/oil reservoirs
 - making 'off-load' checks
 - checking level and alignment
 - pressurising the system
 - making visual checks for completeness and freedom from damage
 - making sensory checks (sight, sound, smell, touch)
 - ensuring that moving parts are guarded and clear of obstruction
 - checking torque settings of fasteners
 - ensuring locking devices are fitted to fasteners (where appropriate)
9. Deal with **two** of the following conditions during the installation process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
10. Use **two** of the following fault finding techniques during the checking and testing activities:
- six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution
11. Produce installations which comply with **two** or more of the following standards:
- equipment manufacturer's operation specification/range
 - BS and/or ISO standards
 - customer (contractual) standards and requirements
 - company standards and procedures

Unit No 5: Installing Mechanical Equipment

12. Complete the relevant paperwork, to include **one** of the following, and pass to the appropriate people:
- installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing mechanical equipment, (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing mechanical equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks of the specifications you are working with
8. The equipment to be installed, its operating procedures and function
9. Methods of marking out the site for positioning of the equipment, and the tools and equipment used for this
10. Methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)
11. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
12. The torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
13. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
14. The types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, crow bars, torque wrenches, engineer's levels, alignment telescopes and laser devices)
15. The techniques used to position, align, level and adjust the equipment
16. Methods of lifting, handling and supporting the equipment during the installation activities
17. Methods of connecting to mechanical power transmission devices (such as belt and chain drives, couplings, clutches and brakes)
18. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
19. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
20. The procedure for the safe disposal of waste materials
21. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy, and quality of the installation (including the fitting of guards to all moving parts, and covers on electrical connections)
22. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
23. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
24. The calibration/care and control procedures for tools and equipment
25. The problems that can occur with the installation operations, and how these can be overcome
26. The fault-finding techniques to be used when the equipment fails to operate correctly
27. The recording documentation to be completed for the activities undertaken
28. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 5: Installing Mechanical Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install one of the following types of mechanical equipment (ONE)				
machine tools				
industrial compressors				
conveyors				
turbines				
elevators				
processing plant				
hoppers/storage vessels				
lifting and handling equipment				
other equipment				
engines				
process control equipment				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out				
drilling and hole preparation				
fitting inserts				
positioning equipment				
aligning equipment				
levelling equipment				
shimming and packing				
fitting anti-vibration mountings				
using mechanical fixings				
using screw fasteners				
Move and position equipment using two of the following (TWO)				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
rollers/skates				
hoists				
jacks				
manual handling				
Use three of the following instruments during the installation activities (THREE)				
straight edges and feeler				
gauges				
engineers levels				
dial test indicators				
measuring instruments				
plumb lines and taut wires				
alignment telescopes				
laser equipment				
self-diagnosis equipment				
Make two of the following connections to the installed equipment (TWO)				
mechanical connections				
electrical wired connections				
fluid power connections				
utility service connections				
Carry out checks and adjustments appropriate to the equipment being installed to include				
testing that the equipment operates to specification				
PLUS six more of the following (SIX)				
setting working clearance				
tensioning				
topping up fluid/oil reservoirs				
making 'off-load' checks				
checking level and alignment				
pressurising the system				
making visual checks				
ensuring moving parts are guarded				
checking torque settings				
ensuring locking devices are fitted				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 6: Installing Electrical/Electronic Equipment

Unit Summary

This unit identifies the competences you need to install electrical/electronic equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available so that the installation can be carried out safely and efficiently. You will be required to make installations involving various electrical power supplies, such as single phase, three-phase, direct current and low voltage. The installation will also include fitting and connecting a range of electrical components, such as switchgear, distribution panels and wiring enclosures, motors and starters, control systems, safety devices, and luminaires.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the connection to external units/equipment, such as sensors and actuators, services and power supplies.

You will be required to select the appropriate tools, materials and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques for the installation of the various electrical components, wires, cables, enclosures and connectors that make up the electrical system/circuit. In addition, you will be expected to make all necessary electrical connections to sensors/actuators and other devices, as appropriate to the equipment installed, which could include mechanical, fluid power, water or fuel supplies. The installation activities will include making all necessary checks and adjustments to the installation,, including protective insulation and resistance values, load current, voltage levels and power ratings, and ensuring that the equipment functions to the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying electrical installation procedures. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, to identify and correct any faults, and to ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
 - apply procedures and precautions to eliminate electrostatic discharge hazards
3. Connect equipment to **two** of the following types of electrical supplies:
 - single phase
 - combination power circuits
 - three phase
 - direct current
 - low voltage (up to 115V)
4. Install **ten** of the following electrical module/components:
 - switchgear
 - alarm devices
 - programmable controllers
 - power factor correction devices
 - motors and starters
 - luminaires
 - panels or sub-assemblies
 - control devices
 - communication equipment
 - cable connectors
 - encoders or resolvers
 - conduit
 - bus bars
 - safety devices
 - emergency/standby batteries
 - overload protection devices
 - sensors and actuators
 - electronic modules/units
 - trunking
 - tray work

- other electrical equipment (specify)
5. Apply installation methods and techniques to include **four** of the following:
- marking out of location positions for components/modules
 - positioning and securing of equipment and components
 - securing by using mechanical fixings
 - securing by using masonry fixings
 - drilling and hole preparation
 - levelling and alignment
6. Install **three** of the following types of cables:
- mineral
 - armoured
 - data/communication
 - fibre optics
 - PVC
 - screened
 - wiring loom/harness
7. Carry out **six** of the following cable termination activities:
- terminating armoured cables
 - terminating mineral cables
 - sealing and protecting cable connections
 - making mechanical/screwed/clamped connections
 - soldering and de-soldering
 - attaching suitable cable identification
 - route and secure wires and cables
 - heat shrinking (devices and boots)
 - crimping (such as tags and pins)
 - stripping cable insulation/protection
 - adding cable end fittings
8. Use **two** of the following test instruments during the installation activities:
- multimeter
 - watt meter
 - voltmeter
 - ammeter
 - insulation resistance tester
 - light meter
 - earth-loop impedance tester
 - other specific test equipment
9. Carry out checks and adjustments, appropriate to the equipment being installed, to include:
- testing that the equipment operates to the installation specification
- Plus **six** more from the following:
- protective resistance values
 - insulation resistance values
 - voltage levels
 - load current
 - power rating
 - resistance
 - capacitance
 - frequency values
 - continuity
 - inductance
 - safety device trip speed
 - polarity
- making visual checks for completeness and freedom from damage

- making sensory checks (sight, sound, smell)
 - specialised tests (such as speed, sound, light, temperature)
10. Deal with **two** of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
 11. Use **two** of the following fault finding techniques during the checking and testing activities:
 - six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution
 12. Produce installations which comply with **two** or more of the following standards:
 - equipment manufacturer's operation range
 - IEE wiring regulations
 - BS and/or ISO standards
 - customer (contractual) standards and requirements
 - company standards and procedures
 13. Complete the relevant paperwork, to include **one** of the following, and pass to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing electrical equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing electrical equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, IEE regulations, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The basic principles of operation of the equipment/circuits being installed, and the purpose of individual modules/components
9. The different types of cabling and their application (such as multicore cables, single core cables, steel wire armoured (SWA), mineral insulated (MI), screened cables, data/communications cables, fibre optics)
10. The different types of electric motors and motor starters
11. The different types of control systems and their various components
12. The application and use of a range of electrical components (such as plugs, switches, sockets, lighting and fittings, junction boxes, consumer units)
13. The various lighting systems used (including tungsten, sodium, mercury vapour and fluorescent)
14. The different types of wiring enclosures that are used (to include conduit, trunking and traywork systems)
15. The care, handling and application of ohmmeters, multimeters and other electrical measuring instruments
16. Methods of lifting, handling and supporting the equipment during the installation activities
17. How to check that components meet the required specification/operating conditions (values, tolerance, current carrying capacity, voltage rating, power rating, working temperature range)
18. The techniques used to terminate electrical equipment (plugs, soldering, screwed, clamped and crimped connections)

19. The use of IEE wiring, and other, regulations when selecting wires and cables and when carrying out tests on systems
20. Methods of attaching markers/labels to components or cables to assist with identification
21. The tools and equipment used in the installation activities (including the use of cable stripping tools, crimping tools, soldering irons and torches, gland connecting tools)
22. How to make adjustments to components/assemblies to ensure that they function correctly
23. How to check that tools and equipment are free from damage or defects, and are in a safe and usable condition
24. The importance of making 'off-load' checks before proving the equipment with the electrical supply on
25. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
26. The calibration/care and control procedures for tools and equipment
27. The problems that can occur with the installation operations, and how these can be overcome
28. The fault-finding techniques to be used when the equipment fails to operate correctly
29. The recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
30. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 6: Installing Electrical/Electronic Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
-----------------------	------------------------	------------------------	------------------------	---

evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
apply procedures and precautions to eliminate electrostatic discharge				
Connect equipment to two of the following types of electrical supplies (TWO)				
single phase				
combination power circuits				
three phase				
direct current				
low voltage				
Install ten of the following electrical module/components (TEN)				
switchgear				
alarm devices				
programmable controllers				
power factor correction devices				
motors and starters				
luminaries				
panels/sub-assemblies				
control devices				
communication equipment				
cable connectors				
encoders or resolvers				
conduit				
bus bars				
safety devices				
emergency/standby batteries				
overload protection devices				
sensors and actuators				
electronic modules/units				
trunking				
tray work				
other electrical equipment				
Apply installation methods and techniques to include four of the following (FOUR)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
marking out				
positioning equipment				
use mechanical fixings				
use masonry fixings				
drilling and hole preparation				
levelling and alignment				
Install three of the following types of cable (THREE)				
mineral				
armoured				
data/communication				
fibre optic				
PVC				
screened				
wiring loom/harness				
Carry out six of the following cable termination activities (SIX)				
terminate armoured cables				
terminate mineral cables				
seal and protect cable connections				
make mechanical, screwed, clamped connections				
soldering/de-soldering				
attach cable identification				
routeing and securing				
heat shrinking				
crimping				
stripping				
adding cable end fittings				
Use two of the following test instruments during the installation activities (TWO)				
multimeter				
watt meter				
voltmeter				
ammeter				
insulation resistance				
light meter				
earth-loop impedance				
other test equipment				
Carry out checks and adjustments appropriate to the equipment being installed to include				
testing that the equipment operates to specification				
PLUS six more of the following (SIX)				
protective resistance values				
insulation resistance values				
voltage levels				
load current				
power rating				
resistance				
capacitance				
frequency values				
continuity				
inductance				
safety device trip speed				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
polarity				
visual checks				
sensory checks				
specialised tests				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 7: Installing Equipment to Produce an Engineered System

Unit Summary

This unit identifies the competences you need to carry out the installation of equipment to produce an engineered system, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of equipment, all of which encompass an integrated system, involving two or more of the following interactive technologies: mechanical, electrical, fluid power or process controller. Typical systems will include automated equipment such as robots, pick-and-place devices, stacking devices, automated systems, transfer equipment, processing plant and material handling devices, such as jigs and fixtures, with fluid power and electrical mechanisms attached.

This unit does not involve maintenance/repair type activities such as removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to equipment, which could include mechanical, electrical, fluid power, components and services (such as water or fuel supplies), as appropriate to the equipment being installed. Where appropriate, you will also work with personal computers (PCs) or programmable logic controllers (PLCs), making the necessary connections, installing hardware, and loading and editing software. The installation activities will include making all necessary checks and adjustments to ensure that the system and components are correctly positioned, aligned, secure and function to the required specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the installation of an engineered system. You will know about the equipment being installed, its installation requirements, the correct function of all components within the system and any associated problems, in adequate depth to provide a sound basis for carrying out the installation process, correcting faults and ensuring that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Carry out the installation of an engineered system, which includes installing and configuring equipment for **two** of the following interactive technologies (from A, B, C, D or E):

A - Installing mechanical equipment/components:

To include **all** of the following:

- installing mechanical equipment (such as machine tools, processing plant, turbines engines transfer equipment)
- connecting, levelling, aligning and securing sub-assemblies and units
- installing structures (such as guards and fences, safety equipment, overhead supports)
- setting and adjusting drive mechanisms (such as shafts and couplings, belt and chain drives)
- setting and adjusting operating mechanisms (such as levers, linkages, cams and followers)
- setting and adjusting control mechanisms (such as clutches and brakes)

B - Installing electrical and electronic equipment/components:

To include **all** of the following:

- installing electrical equipment (such as switchgear and distribution panels, motors and starters, luminaires)
- installing wiring enclosures/cable protection systems (such as conduit, trunking and tray work)
- installing, routeing and securing wires and cables (such as PVC, mineral and armoured cables)
- installing electrical/electronic components (such as relays, sensing devices, limit switches, electronic modules)
- installing circuit protectors and safety devices
- terminating cables to electrical components and main distribution centre (such as screwed connections, crimped and soldered)
- attaching suitable cable identification (such as colour coding, numbering systems or write-on labels)

C - Installing fluid power components:

To include **all** of the following:

- installing fluid power equipment (such as compressors, pumps, accumulators, storage reservoirs and receivers)
- installing rigid and flexible pipework and hoses
- installing fluid power components (such as cylinders, valves, sensors, actuators, filters and regulators)
- connecting components to pipework using appropriate fittings
- dressing and securing piping and hoses

D - Installing process controller components:

To include **all** of the following:

- installing process controllers or sequential controllers (such as PLCs, data communication links)
- installing and connecting wires and cables to components
- installing input/output interfacing
- installing program logic peripherals (such as modems, PC peripheral devices)
- checking and confirming that signal measurement and transmission are satisfactory

E - Installing instrumentation and control components:

To include **all** of the following:

- installing instrumentation and control equipment (such as pressure, flow, temperature, speed, weight, vibration)
- installing and connecting process pipe work
- installing and connecting peripherals (such as sensors, actuators, relays, switches)
- connecting electrical/pneumatic supply to instruments/sensors
- connecting signal transmission components to instruments/sensors
- checking and confirming that signal measurement and transmission are satisfactory

4. Apply installation methods and techniques, to include **five** of the following:

- marking out positions of all equipment
- drilling and preparing holes
- moving and positioning equipment, using appropriate lifting and handling equipment
- aligning and levelling equipment
- shimming and packing
- fitting anti-vibration mountings
- securing using mechanical fixings (nuts and bolts)
- securing using masonry fixings (such as rag or expanding bolts)
- securing using adhesives
- applying screw fastening locking devices

5. Use **four** of the following test instruments during the installation activities:

- alignment devices (such as plumb lines, spirit levels, inclinometers, laser equipment)
- linear measuring devices (such as tapes, dial test indicators, micrometers, verniers, feeler gauges)
- electrical measuring equipment (such as multimeter, continuity checker, insulation resistance tester, earth loop impedance tester)
- fluid/power testing equipment (such as pressure and flow testing devices, speed measurement devices)
- instrumentation test equipment (such as dead weight testers, temperature baths, manometers, pressure gauges)
- PLC/PC test equipment (such as logic probes, signal sources, analogue and digital meters)

6. Carry out **all** of the following checks and adjustments, as applicable to the installed system:

- making visual checks of the installation for completeness and freedom from damage
- topping up fluid/oil reservoirs
- ensuring that all bolts are correctly torqued and locking devices are fitted to fasteners
- ensuring that all electrical connections are correctly made, earth bonding is secure and connections covered
- ensuring that all pipe connections are correctly made, secure and leak free
- ensuring that all moving parts are guarded and clear of obstruction
- checking that the system operates to the installation specification
- making sensory checks of the system (sight, sound, smell, touch)

7. Deal with **two** of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

8. Use **two** of the following fault finding techniques during the checking and testing activities:
 - six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution

9. Produce installations to comply with **two** or more of the following standards:
 - equipment manufacturer's operation spec/range
 - BS and/or ISO standards
 - IEE wiring regulations
 - customer (contractual) standards and requirements
 - company standards and procedures

10. Complete the relevant paperwork, to include **one** of the following, and pass to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing systems equipment within an engineered system (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing the system equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, IEE Regulations, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The basic principles of how the system functions, its operating sequence, the working purpose of individual units/components, and how they interact
9. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. Methods of drilling holes in masonry for rag and expanding bolts (including the use of grouting and adhesives)
11. The various mechanical fasteners that will be used, and their method of installation
12. The torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
13. Methods of lifting, handling and supporting the equipment during the installation activities
14. Methods of levelling and aligning the equipment, and the types of tools, instruments and techniques used for this
15. Methods of connecting to mechanical power transmission devices (such as shafts, couplings belt and chain drives)
16. The different types of cabling used in the installation activities, and their method of termination
17. The different types of wiring enclosures that are used (to include conduit, trunking and traywork systems)
18. The installation and termination of a range of electrical components (such as plugs, switches, sockets, lighting and fittings, junction boxes, consumer units)
19. Why electrical bonding is critical, and why it must be both mechanically and electrically secure

20. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
21. The care, handling and application of ohmmeters, multimeters and other electrical measuring instruments
22. Methods of assembling and installing pipework, hoses and fittings
23. The installation and connection of a range of fluid power components (such as pumps, valves, cylinders, actuators, switches and relays)
24. Recognition of contaminants and the problems they can create; the effects and likely symptoms of contamination in the system
25. The installation of process instrumentation and associated peripherals (such as pressure, flow, temperature devices)
26. The installation of PLC systems and associated peripheral devices (such as I/O devices)
27. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
28. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage)
29. The tools and equipment used in the installation activities, and their calibration/care and control procedures
30. The problems that can occur with the installation operations, and how these can be overcome
31. The fault-finding techniques to be used when the equipment fails to operate correctly
32. The recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
33. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 6: Installing Equipment to Produce an Engineered System

58 Level 3 NVQ in Installation and commissioning

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
apply procedures and precautions to eliminate electrostatic discharge				
Carry out the installation of an engineered system which includes installing and configuring equipment for two of the following interactive technologies from A, B, C, D or E (TWO)				
A - Installing mechanical equipment/components to include all of the following (ALL)				
installing mechanical equipment				
connecting, levelling, aligning and securing				
installing structures				
setting and adjusting drive mechanisms				
setting and adjusting operating mechanisms				
setting and adjusting control mechanisms				
B - Installing electrical and electronic equipment/components to include all of the following (ALL)				
installing electrical equipment				
installing wiring enclosures, cable protection systems				
installing, routing and securing wires and cables				
installing electrical, electronic components				
installing circuit protectors and safety devices				
terminating cables				
attaching cable identification				
C - Installing fluid power components to include all of the following (ALL)				
installing fluid power equipment				
installing rigid and flexible				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
pipework and hoses				
installing fluid power components				
connecting components to pipework				
dressing and securing piping and hoses				
D – Installing process controller components to include all of the following (ALL)				
installing process or sequential controllers				
installing and connecting wires and cables				
installing input/output interfacing				
installing program logic peripherals				
checking and confirming signal measurement				
E – Installing instrumentation and control components to include all of the following (ALL)				
installing instrumentation and control equipment				
installing and connecting process pipework				
installing and connecting peripherals				
connecting electrical, pneumatic supply to sensors				
checking and confirming signal measurement				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out				
drilling and hole preparation				
positioning equipment				
levelling and alignment				
shimming and packing				
fitting anti-vibration mountings				
using mechanical fixings				
using masonry fixings				
using adhesives				
using screw fasteners				
Use four of the following test instruments during the installation activities (FOUR)				
alignment devices				
linear measuring devices				
electrical measuring equipment				
fluid power test equipment				
Instrumentation test equipment				
PLC/PC test equipment				
Carry out all of the following checks and adjustments as applicable to the installed system (ALL)				
making visual checks				
topping up fluid/oil reservoirs				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
ensuring correct torque on bolts, locking devices fitted				
ensuring correct electrical connections and earth bonding				
ensuring correct pipe connections and leak free				
ensuring all moving parts are guarded				
checking system operates to the specification				
making sensory checks				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
IEE Wiring Regulations				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 8: Installing Instrumentation and Control Equipment

Unit Summary

This unit identifies the competences you need to install instrumentation and control equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of instrumentation and control equipment, such as pressure, flow and temperature monitoring and control equipment, fiscal monitoring equipment (gas/electricity meters, etc), fire and gas detection and alarm equipment, industrial weighing equipment, speed measurement and control equipment, vibration monitoring equipment, nucleonics and radiation measurement, analysers, recorders and indicators, telemetry equipment and emergency shutdown equipment.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment, such as power supplies, electrical/electronic devices, services and fluid power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, connect, set and calibrate the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly located, correctly calibrated, tightened to the correct torque (if relevant), and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying instrumentation and control installation procedures. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install **one** of the following types of instrumentation and control equipment:
 - pressure monitoring/control
 - flow monitoring/control
 - temperature monitoring/control
 - weight monitoring/control
 - fiscal (gas/electricity, etc) metering
 - fire detection and alarm
 - gas detection and alarm
 - emergency shutdown
 - speed measurement
 - speed control
 - vibration monitoring/control
 - nucleonic and radiation analysers
 - recorders and indicators
 - telemetry equipment
 - control equipment (such as indexing, positioning, sequencing)
4. Apply installation methods and techniques, to include **all** of the following, as appropriate to the instruments being installed:
 - positioning and securing equipment/components
 - making mechanical connections
 - installing electrical/electronic components
 - installing and connecting process pipe work
 - tightening fastenings to the required torque
 - proof marking/labelling of wires or components
 - installing and connecting peripherals (such as sensors, actuators, relays, switches, back-up batteries)
 - taking electrostatic precautions when handling components and circuit boards
 - setting, calibrating and adjusting instruments

- connecting electrical/pneumatic supply to instrument/sensor
 - connecting signal transmission components to instrument/sensor
5. Use **two** of the following types of test and calibration equipment during the installation activities:
- signal sources
 - standard test gauges
 - analogue and digital meters
 - digital pressure indicators
 - calibrated flow meters
 - special purpose test equipment
 - pressure sources
 - comparators
 - manometers
 - current injection devices
 - calibrated weights
 - logic probes
 - temperature baths
 - workshop potentiometers
 - dead weight testers
 - insulation testers
6. Make **two** of the following connections to the installed equipment:
- mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - fluid power connections
 - process supply connections (such as water, gas, oil, chemical, waste)
7. Carry out checks and adjustments, appropriate to the equipment being installed, to include:
- testing that the equipment operates to the installation specification
- Plus **five** more from the following:
- making visual checks for completeness and freedom from damage
 - making sensory checks (sight, sound, smell, touch)
 - checking the system for leaks
 - checking the security of connections/terminations
 - checking signal transmission (electrical, electronic, pneumatic, mechanical)
 - confirming that signal measurement and transmission are satisfactory
 - carrying out final start-up of the system, and removing any trip defeats
8. Deal with **two** of the following conditions during the installation process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
9. Use **two** of the following fault finding techniques during the checking and testing activities:
- six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution
10. Produce installations which comply with **two** or more of the following standards:
- equipment manufacturer's operation spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - customer (contractual) standards and requirements
 - company standards and procedures

11. Complete the relevant paperwork, to include **one** of the following, and pass to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing instrumentation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing instrumentation equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be installed, and its operating procedures and function
9. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. The basic principles of operation of the instrumentation being installed, how the system functions, its operating sequence, the working purpose of individual units/components and how they interact
11. The reasons for making sure that control systems are isolated or put into manual control, and appropriate trip locks or keys are inserted, before removing any sensors or instruments from the system
12. The identification and selection of instrument sensors (including how to identify their markings, calibration information, component values, operating parameters and working range)
13. Methods of checking and calibrating instruments, and the type and range of equipment that can be used for this
14. The correct way of fitting instruments to avoid faulty readings (caused by head correction, poor flow past sensor, blockages, incorrect wiring, poor insulation or incorrect materials)
15. How to avoid electronic interference or mechanical damage caused by unsuitable positioning of external wiring and components
16. How to carry out visual checks of the instruments (checking for leaks, security of joints and physical damage)
17. The techniques used to install integrated equipment (build up of pressures/force, connection of pipe/component, dealing with soldered joints, screwed, clamped and crimped connections)
18. Methods of attaching identification marks/labels to components or cables
19. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
20. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
21. The procedure for the safe disposal of waste materials
22. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
23. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
24. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
25. The tools and equipment used in the installation activities, and their calibration/care and control procedures
26. The problems that can occur with the installation operations, and how these can be overcome
27. The fault-finding techniques to be used when the equipment fails to operate correctly
28. The recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
29. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 8: Installing Instrumentation and Control Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install one of the following types of instrumentation and control equipment (ONE)				
pressure monitoring/control				
flow monitoring/control				
temperature monitoring/control				
weight monitoring/control				
fiscal metering				
fire detection and alarm				
gas detection and alarm				
emergency shutdown				
speed measurement				
speed control				
vibration monitoring/control				
nucleonic and radiation analysers				
recorders and indicators				
telemetry equipment				
control equipment				
Apply installation methods and techniques to include all of the following as appropriate (ALL)				
positioning equipment				
making mechanical connections				
installing electrical, electronic components				
installing process pipework				
tightening fastenings				
proof marking/labelling				
installing/connecting peripherals				
taking electrostatic precautions				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
setting, calibrating and adjusting instruments				
connecting electrical, pneumatic supply				
connecting signal transmission components				
Use two of the following types of test and calibration equipment during the installation activities (TWO)				
signal sources				
standard test gauges				
analogue and digital meters				
digital pressure indicators				
calibrated flow meters				
special purpose test equipment				
pressure sources				
comparators				
manometers				
current injection devices				
calibrated weights				
logic probes				
temperatures baths				
workshop potentiometers				
dead weight testers				
insulation testers				
Make two of the following connections to the installed equipment (TWO)				
mechanical connections				
electrical wired connections				
fluid power connections				
process supply connections				
Carry out checks and adjustments appropriate to the equipment being installed to include				
testing that the equipment operates to specification				
PLUS five more of the following (FIVE)				
making visual checks				
making sensory checks				
checking system for leaks				
checking security of connections/terminations				
checking signal transmission				
confirming signal measurement satisfactory				
carrying out final start-up and removing trip defects				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 9: Installing Fluid Power Equipment

Unit Summary

This unit identifies the competences you need to install fluid power equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of fluid power equipment, including hydraulic, pneumatic and vacuum. This will involve the installation of components and units such as pumps, valves, actuators, sensors, intensifiers, regulators, compressors, pipes and hoses, and other specific fluid power equipment.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment, such as electrical connections, power supplies, sensors, services and fluid power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, align and connect the various fluid power components, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, operate at the correct pressure and flow rate, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying fluid power installation procedures. You will know about the equipment being installed, its installation requirements, its correct function, and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install equipment for **one** of the following types of fluid power systems:
 - pneumatic
 - hydraulic
 - vacuum
4. Carry out installations which include **all** of the following:
 - rigid pipework
 - hoses
 - valvesPlus **twelve** more from the following:
 - pumps
 - compressors
 - reservoirs/storage
 - gaskets and seals
 - lubricators
 - accumulators
 - pressure intensifiers
 - filters
 - cylinders
 - switches
 - receivers
 - regulators
 - actuators
 - sensors
 - other (specify)

5. Apply installation methods and techniques to include **six** of the following:
 - marking out of locating and securing positions
 - drilling and hole preparation
 - positioning equipment/components
 - aligning pipework and connections
 - dressing and securing pipes and hoses
 - connecting wires and cables
 - securing using mechanical fixings
 - securing using masonry fixings
 - applying screw fastening locking devices
 - applying hose/cable clips and fasteners

6. Use **three** of the following instruments during the installation activities:
 - pressure testing devices
 - flow testing devices
 - mechanical measuring devices
 - bleeding devices
 - alignment devices
 - electrical measuring devices

7. Make **two** of the following connections to the installed equipment:
 - mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - utility service connections

8. Carry out checks and adjustments, as appropriate to the equipment being installed, to include:
 - ensuring that the equipment operates to the installation specifications
 Plus **six** more from the following:
 - leak checks
 - making 'off-load' checks
 - levelling and alignment
 - system pressure checks
 - line pressure checks
 - flow checks
 - checking the sequencing of the system
 - checking for completeness and freedom from damage
 - making sensory checks (sight, sound, smell, touch)
 - ensuring that moving parts are guarded and clear of obstruction
 - ensuring that locking devices are fitted to fasteners (where appropriate)

9. Deal with **two** of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

10. Use **two** of the following fault finding techniques during the checking and testing activities:
 - six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution

11. Produce installations which comply with **two or more** of the following standards:
 - equipment manufacturer's operation specification/range
 - BS and/or ISO standards
 - customer (contractual) standards and requirements
 - company standards and procedures

12. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing fluid power equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing fluid power equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be installed, its operating procedures and function
9. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. Methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)
11. The various mechanical fasteners that will be used and their method of installation (including, threaded fasteners, dowels, special securing devices, masonry fixing devices)
12. The basic principles of operation of the system being installed, and the function of individual modules/components
13. The different types of pipework, fittings and manifolds, and their application
14. The identification and application of different types of valves (such as poppet, spool, piston, disc)
15. The identification and application of different types of sensors and actuators (such as rotary, linear, mechanical, electrical)
16. The identification and application of different types of cylinders (such as single acting, double acting)
17. The identification and application of different types of pumps (such as positive and non-positive displacement)
18. The application and fitting of static and dynamic seals
19. Recognition of contaminants and the problems they can create; the effects and likely symptoms of contamination in the system
20. The techniques used during installation of fluid power equipment (release of pressures/force, cylinder/valve movement, sequencing)
21. The procedures for ensuring that you have correct tools, equipment, and consumables for installation
22. The types of tools and instruments used to position, secure and connect the equipment (such as spanners, pipe benders, torque wrenches, alignment devices, pressure testing devices)
23. Methods of lifting, handling and supporting the equipment during the installation activities
24. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and any fuel supplies)
25. The procedure for the safe disposal of waste materials
26. How to conduct any necessary checks to ensure equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
27. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
28. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
29. The calibration/care and control procedures for tools and equipment
30. The fault-finding techniques to be used when the equipment fails to operate correctly
31. The recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
32. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 9: Installing Fluid Power Equipment

72 Level 3 NVQ in Installation and commissioning

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install equipment for one of the following types of fluid power systems (ONE)				
pneumatic				
hydraulic				
vacuum				
Carry out installations which include all of the following (ALL)				
rigid pipework				
hoses				
valves				
PLUS twelve more from the following (TWELVE)				
pumps				
compressors				
reservoirs/storage				
gaskets and seals				
lubricators				
accumulators				
pressure intensifiers				
filters				
cylinders				
switches				
receivers				
regulators				
actuators				
sensors				
others				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out				
drilling and hole preparation				
positioning equipment				
aligning pipework				
dressing and securing pipes and hoses				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
connecting wires, cables				
using mechanical fixings				
using masonry fixings				
applying screw fasteners				
applying hose/cable clips				
Use three of the following instruments during the installation activities (THREE)				
pressure testing devices				
flow testing devices				
mechanical measuring devices				
bleeding devices				
alignment devices				
electrical measuring devices				
Make two of the following connections to the installed equipment (TWO)				
mechanical connections				
electrical wired connections				
utility service connections				
Carry out checks and adjustments appropriate to the equipment being installed to include				
testing that the equipment operates to specification				
PLUS six more of the following (SIX)				
leak checks				
making 'off-load' checks				
levelling and alignment				
system pressure checks				
line pressure checks				
flow checks				
checking sequencing				
checking completeness and freedom from damage				
making sensory checks				
ensuring moving parts are guarded				
ensuring locking devices are fitted				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 10: Installing Process Controller Equipment

Unit Summary

This unit identifies the competences you need to install process controller equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of process controller equipment, that typically includes process controllers or sequential controllers (such as programmable logic controllers (PLCs), or equipment controlled by personal computers (PCs) which are working in an integrated system, involving two or more interactive technologies, such as mechanical, electrical or fluid power. You will also install peripheral components and communication links, and will load/download process controller programs, check them for errors, and create back-up copies of completed programs.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. The unit does, however, include the connection to external units/equipment such as motors, control devices, safety devices, services and power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required sensors and actuators, which could be electrical, fluid power, water or fuel supply, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate settings or working clearances, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures to process controllers. You will know about the equipment being installed, its installation requirements, its correct function, and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
 - apply procedures and precautions to eliminate electrostatic discharge hazards
3. Install equipment for **one** of the following types of process controller systems:
 - monitoring system
 - safety system
 - diagnostic system
 - combination system
 - process/product control system
 - business management system
4. Install **one** of the following types of process controller equipment/components during installation
 - fixed input/output (I/O) units
 - rack mounted controller units
 - modular controller unitsPlus **five** more from the following:
 - sensors
 - actuators
 - switches
 - motor starters
 - modems
 - printers
 - PC peripheral devices
 - panels and sub-assemblies
 - electrical wires and cables
 - signal transmission components/cables
 - overload protection devices
 - conduit
 - trunking and tray work
5. Apply installation methods and techniques, to include **five** of the following:

- marking out of locating and securing positions
 - drilling and hole preparation
 - fitting inserts (such as rag or expanding bolts)
 - positioning equipment
 - connecting wires and cables
 - securing using mechanical fixings
 - securing using masonry fixings
 - levelling and alignment of equipment
6. Carry out **six** of the following cable termination activities:
- terminating armoured cables
 - terminating mineral cables
 - sealing and protecting cable connections
 - making mechanical/screwed/clamped connections
 - soldering and de-soldering
 - attaching suitable cable identification
 - route and secure wires and cables
 - heat shrinking (devices and boots)
 - crimping (tags and pins)
 - stripping cable insulation/protection
 - adding cable end fittings
7. Use **three** of the following test instruments during the installation activities:
- multimeter
 - watt meter
 - voltmeter
 - ammeter
 - insulation resistance tester
 - earth-loop impedance tester
 - other specific test equipment
8. Carry out **all** of the following checks on the installation:
- testing that the equipment operates to the installation specification
 - making visual checks for completeness and freedom from damage
 - making sensory checks (sight, sound, smell)
 - checking the security of connections/terminations
 - checking signal transmission
 - confirming that the correct software has been installed
 - carrying out a final start-up of the system, and removing of any trip defeats
9. Deal with **two** of the following conditions during the installation process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
10. Use **two** of the following fault finding techniques during the checking and testing activities:
- six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution
11. Produce installations which comply with **two** or more of the following standards:
- equipment manufacturer's operation spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - company standards and procedures

- customer (contractual) standards and requirements
12. Complete relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing process control equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements for the work area where you are carrying out the installation activities (such as when working at heights), and the responsibility these requirements place on you
4. The hazards associated with installing process control equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks of the specifications you are working with
8. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. Methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)
10. The various mechanical fasteners that will be used, and their method of installation
11. The procedures for ensuring that you have the correct tools, equipment and fasteners for the installation activities
12. The types of tools, instruments and techniques used to position, align, level, secure and adjust the equipment
13. Methods of lifting, handling and supporting the equipment during the installation activities
14. The basic principles of how the system functions, its operating sequence, the working purpose of individual units/components
15. The techniques used to connect PLC equipment (plugs, soldering, screwed, clamped and crimped connections)
16. The use of IEE wiring, and other, regulations when selecting wires and cables, and when carrying out tests on systems
17. The devices and systems for storing programmes
18. The procedures to be applied to storage, location and methods of backing up programmes
19. The different types of interface cards, and their application
20. The procedures for the application of computer-based authoring software for design and development
21. The numbering system and codes used for the identification inputs and outputs
22. How to search a programme within the process controller for specific elements
23. How to make adjustments to components to ensure they function correctly
24. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
25. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
26. How to recognise installation defects (such as dry connections, communication difficulties, ineffective fasteners, foreign object damage or contamination)
27. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components are correctly covered/protected
28. The calibration/care and control procedures for tools and equipment
29. The problems that can occur with the installation operations, and how these can be overcome
30. The fault-finding techniques to be used when the equipment fails to operate correctly
31. The recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
32. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 10: Installing Process Controller Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
apply procedures and precautions to eliminate electrostatic discharge				
Install equipment for one of the following types of process controller systems (ONE)				
monitoring				
safety				
diagnostic				
combination				
process/product control				
business management				
Install one of the following types of process controller equipment/components during installation (ONE)				
fixed input/output (I/O) units				
rack mounted controllers				
modular controller units				
PLUS five more from the following (FIVE)				
sensors				
actuators				
switches				
motor starters				
modems				
printers				
PC peripheral devices				
panels/sub-assemblies				
electrical wires and cables				
signal transmission components/cables				
overload protection devices				
conduit				
trunking and tray work				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out				
drilling and hole preparation				
fitting inserts				
positioning equipment				
connecting wires, cables				
using mechanical fixings				
Using masonry fixings				
levelling and alignment				
Carry out six of the following cable termination activities (SIX)				
terminate armoured cables				
terminate mineral cables				
seal and protect cable connections				
make mechanical, screwed, clamped connections				
soldering/de-soldering				
attach cable identification				
routeing and securing				
heat shrinking				
crimping				
stripping				
adding cable end fittings				
Use three of the following test instruments during the installation activities (THREE)				
multimeter				
watt meter				
voltmeter				
ammeter				
insulation resistance				
earth-loop impedance				
other test equipment				
Carry out all of the following checks on the installation				
testing that the equipment operates to specification				
visual checks				
sensory checks				
checking security of connections/terminations				
signal transmission				
confirming use of correct software				
carrying out start up and removal of trip defects				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 11: Installing Emergency Electrical Power Generation Equipment

Unit Summary

This unit identifies the competences you need to install emergency electrical power generation equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of emergency electrical power generation equipment, such as turbine alternator sets, piston engine sets, and generators.

This unit does not involve maintenance/repair type activities, such as the removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements, such as portable generators or alternator sets. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment, such as power supplies, belt and chain drives, clutches and brakes, services and fluid power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate settings or working clearances, are tightened to the correct torque, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying emergency power generation installation procedures. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install **one** of the following types of emergency power generation equipment:
 - turbine alternator sets
 - piston engine alternator sets
 - generators
4. Apply installation methods and techniques to include **five** of the following:
 - marking out of locating and securing positions
 - drilling and hole preparation
 - fitting inserts (such as rag or expanding bolts)
 - positioning of equipment
 - aligning of equipment
 - levelling of equipment
 - shimming and packing
 - fitting anti-vibration mountings
 - securing using mechanical fixings
 - applying screw fastening locking devices
5. Move and position equipment using **two** of the following:
 - slings
 - cranes
 - fork lift
 - portable lifting devices
 - block and tackle
 - rollers/skates
 - hoists
 - jacks
 - manual handling and moving of loads
6. Use **three** of the following instruments during the installation activities:

- straight edges and feeler gauges
 - engineer's levels
 - dial test indicators
 - electrical meters
 - plumb lines and taut wires
 - alignment telescopes
 - laser equipment
 - mechanical measuring devices
7. Make **all** of the following connections to the installed equipment:
- mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - services supplies (such as water, fuel)
8. Carry out checks and adjustments, as appropriate to the equipment being installed, to include:
- ensuring that the equipment operates to the installation specification
- Plus **six** more from the following:
- checking the operation of all safety devices
 - checking settings and working clearance
 - checking consumables (oil, water, fuel)
 - making 'off-load' checks
 - checking level and alignment
 - testing the system for leaks
 - checking electrical integrity
 - making visual checks for completeness and freedom from damage
 - checking security of connections (mechanical, electrical, service supplies)
 - making sensory checks (sight, sound, smell, touch)
 - ensuring that moving parts are guarded and clear of obstruction
 - checking the torque setting of fasteners
 - ensuring that locking devices are fitted to fasteners (where appropriate)
 - checking the correct operation of the automatic/power failure switching system
9. Deal with **two** of the following conditions during the installation process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
10. Use **two** of the following fault finding techniques during the checking and testing activities:
- six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution
11. Produce installations which comply with **two** or more of the following standards:
- equipment manufacturer's operating specification/range
 - BS and/or ISO standards
 - customer (contractual) standards and requirements
 - company standards and procedures
12. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing emergency power generation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing the equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. Methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)
10. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, dowels, special securing devices, masonry fixing devices)
11. The torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
12. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation
13. The types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, crow bars, torque wrenches, engineer's levels, alignment telescopes and laser devices)
14. The techniques used to position, align, level and adjust the equipment
15. Methods of lifting, handling and supporting the equipment during the installation activities
16. Methods of connecting to mechanical power transmission devices
17. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
18. The equipment to be installed, its operating procedures and function (to include principles of power generator sets, the function of the stator, rotor and excitation system, principles of AC power generation, electrical losses, synchronizing and loading, output voltage control)
19. The use of generator and prime-mover tripping and protection devices
20. The use of generator and bus terminal connections
21. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
22. The procedure for the safe disposal of waste materials
23. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
24. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
25. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
26. The calibration/care and control procedures for tools and equipment
27. The problems that can occur with the installation operations, and how these can be overcome
28. The fault-finding techniques to be used when the equipment fails to operate correctly
29. The recording documentation to be completed for the activities undertaken
30. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 11: Installing Emergency Electrical Power Generation Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install one of the following types of emergency power generation equipment (ONE)				
turbine alternator sets				
piston engine alternator				
generators				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out				
drilling and hole preparation				
fitting inserts				
positioning equipment				
aligning equipment				
levelling equipment				
shimming and packing				
fitting anti-vibration mountings				
using mechanical fixings				
using screw fasteners				
Move and position equipment using two of the following (TWO)				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers/skates				
hoists				
jacks				
manual handling				
Use three of the following instruments during the installation activities (THREE)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
straight edges and feeler gauges				
engineers levels				
dial test indicators				
electrical meters				
plumb lines and taut wires				
alignment telescopes				
laser equipment				
mechanical measuring devices				
Make all of the following connections to the installed equipment (ALL)				
mechanical connections				
electrical wired connections				
service supplies				
Carry out checks and adjustments appropriate to the equipment being installed to include				
ensuring that the equipment operates to specification				
PLUS six more of the following (SIX)				
checking safety devices				
checking settings and working clearance				
checking consumables				
making 'off-load' checks				
checking level and alignment				
testing for leaks				
checking electrical integrity				
making visual checks				
checking security of connections				
making sensory checks				
ensuring moving parts are guarded				
checking torque settings				
ensuring locking devices are fitted				
checking operation of automatic/power failure switching system				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 12: Installing Environmental Pollution Control Equipment

Unit Summary

This unit identifies the competences you need to install environmental pollution control equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently.

You will be required to install equipment for an environmental pollution control system, which could be air pollution control equipment, such as decarbonisation (CO₂ reduction), de-nitrification, deodorising, desulphurisation, dust collectors, smoke filters, scrubbers, and removal of refrigerant gases; effluent treatment equipment, such as aerobic and anaerobic biochemical treatment, filter screens and presses, liquid separators, waste oil treatment, sewage treatment, industrial waste water treatment; noise and vibration equipment, such as vibration prevention and isolation, noise attenuation and acoustic enclosures; waste and used product handling, storing and recycling equipment, such as appliance recycling, battery recycling, incinerators, ash handling, heat recovery, shredders and crushers, conveyors and sorters, and compaction.

This unit does not involve maintenance/repair type activities, such as the removal and replacement of existing equipment or the installation of self-contained mobile and portable items of equipment, or simple fixed units. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate tension or working clearances, are tightened to the correct torque, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures for environmental pollution control equipment. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards (such as COMAH, CDM)
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install **one** of the following types of environmental pollution control equipment:
 - air pollution control equipment (such as decarbonisation (CO₂ reduction), de-nitrification, deodorising, desulphurisation, dust collectors, smoke filters, scrubbers, and removal of refrigerant gases)
 - effluent treatment equipment (such as aerobic and anaerobic biochemical treatment, filter screens and presses, liquid separators, waste oil treatment, sewage treatment, industrial waste water treatment)
 - noise and vibration equipment (such as vibration prevention and isolation, noise attenuation and acoustic enclosures)
 - waste and used product handling, storing and recycling equipment (such as appliance recycling, battery recycling, incinerators, ash handling, heat recovery, shredders and crushers, conveyors and sorters, compaction)
4. Install **six** of the following mechanical equipment items:
 - actuators
 - mechanical drives
 - burners
 - containment booms
 - floor base plates
 - enclosures
 - guards
 - instrumentation
 - ducting
 - linkages
 - pipework and hoses
 - pumps
 - gear boxes
 - couplings
 - safety devices
 - seals and gaskets
 - motors

- filters
5. Install **six** of the following electrical equipment items:
 - annunciator
 - building management device
 - distribution board
 - switchgear
 - control panel or system
 - safety device
 - sensor
 - relay
 - solenoid
 - monitoring device
 - switch
 - instrumentation
 - cable and cores
 - motor and starter
 6. Apply installation methods and techniques to include **five** of the following:
 - marking out of locating and securing positions
 - drilling and hole preparation
 - fitting inserts (such as rag or expanding bolts)
 - positioning of equipment
 - aligning of equipment
 - levelling of equipment
 - shimming and packing
 - fitting anti-vibration mountings
 - securing using mechanical fixings
 - applying screw fastening locking devices
 7. Use **three** of the following instruments during the installation activities:
 - straight edges and feeler gauges
 - engineer's levels
 - dial test indicators
 - mechanical measuring instruments (such as rule, tape)
 - electrical measuring instruments (such as multimeter)
 - fluid power measuring equipment (such as pressure, flow)
 - vibration transducer
 - plumb lines and taut wires
 - alignment telescopes
 - laser equipment
 - self-diagnosis equipment
 - theodolite
 8. Move and position equipment using **two** of the following
 - slings
 - cranes
 - fork lift
 - portable lifting devices
 - block and tackle
 - rollers/skates
 - hoists
 - jacks
 - manual handling
 9. Make **two** of the following connections to external supplies:
 - compressed air
 - electrical
 - water
 - gas
 10. Carry out **seven** of the following checks, and make corrections/adjustments, as appropriate:

- ensuring that the equipment meets the requirements of the installation
- checking that assembly fits
- checking mechanical integrity
- checking electrical integrity
- making 'off-load' checks
- making 'on-load' checks
- checking level and alignment
- checking vibration levels
- checking temperature levels
- making sensory checks (sight, sound, smell, touch)
- ensuring dangerous areas are properly guarded
- checking torque setting of fasteners
- checking for leaks
- checking system pressures and flows
- checking speeds and feeds
- checking lubrication

11. Deal with **two** of the following conditions during the installation process:

- installations with no faults
- partial equipment malfunction
- complete malfunction of equipment

12. Use **two** of the following fault finding techniques during the checking and testing activities:

- six point
- half-split
- input-to-output
- function testing
- equipment self-diagnostics
- emergent problem sequence
- injection and sampling
- unit substitution

13. Produce installations which comply with **one** or more of the following standards:

- equipment manufacturer's operating spec/range
- BS and/or ISO standards
- customer standards and requirements
- company standards and procedures

14. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:

- installation records
- company specific documentation
- job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that are to be observed when installing pollution control equipment (including the related legislation, regulations and recommendations, such as the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, Safe Working in Confined Spaces, CE supply of machinery regulations)
2. The pre-installation safety preparations (such as obtaining permits to work, risk assessments and other safe working practice requirements)
3. The health and safety requirements specific to the particular plant and site installation details
4. Risk and hazard assessment (such as associated hazardous substances, their measurements and exposure limits), and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. How to interpret installation documentation, drawings, plans, quality control procedures and specifications (including BS and ISO standards, their symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be installed, its operating procedures and function

9. Methods and techniques for setting out the site for installation of the plant and equipment
10. Methods and techniques used to position, assemble, align and secure the plant and equipment
11. Methods of making holes for floor fixing bolts (including the use of various fittings, grouting and adhesives)
12. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
13. The torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
14. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation
15. Methods of lifting, handling and supporting the equipment
16. How to apply methods and techniques to carry out noise and vibration measurement (including noise and vibration attenuation systems)
17. Checks, tests, corrections and adjustments to ensure proper equipment safety, integrity, operation and accuracy
18. How to connect equipment to external supplies (such as electricity, air, water and gas)
19. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
20. The procedure for the safe disposal of waste materials
21. Recognising defects (such as leaks, misalignment, component looseness, damage, or contamination)
22. The importance of ensuring that the completed installation is left in a safe, clean and damage-free state
23. The dangers of leaving any exposed potential energy sources, and how these should be made safe
24. Typical problems that can occur during the installation, and how these can be overcome
25. The importance of using the approved plant change (modification) procedures
26. The different condition monitoring measurement techniques you need to use
27. The different control systems that are used (such as PLCs)
28. The fault-finding techniques to be used when the equipment fails to operate correctly
29. The recording documentation to be completed for the activities undertaken
30. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 12: Installing Environmental Pollution Control Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install one of the following types of environmental pollution control equipment (ONE)				
air pollution control				
effluent treatment equipment				
noise, vibration equipment				
waste, used product, recycling equipment				
Install six of the following mechanical equipment item (SIX)				
actuators				
mechanical drives				
burners				
containment booms				
floor base plates				
enclosures				
guards				
instrumentation				
ducting				
linkages				
pipework and hoses				
pumps				
gear boxes				
couplings				
safety devices				
seals and gaskets				
motors				
filters				
Install six of the following electrical equipment items (SIX)				
annunciator				
building management device				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
distribution board				
switchgear				
control panel/system				
safety device				
sensor				
relay				
solenoid				
monitoring device				
switch				
instrumentation				
cables and cores				
motor and starter				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out				
drilling and hole preparation				
fitting inserts				
positioning equipment				
aligning equipment				
levelling equipment				
shimming and packing				
fitting anti-vibration mountings				
using mechanical fixings				
using screw fasteners				
Use three of the following instruments during the installation activities (THREE)				
straight edges and feeler gauges				
engineers levels				
dial test indicators				
mechanical measuring instruments				
electrical measuring instruments				
fluid power measuring equipment				
vibration transducer				
plumb lines and taut wires				
alignment telescopes				
laser equipment				
self diagnosis equipment				
theodolite				
Move and position equipment using two of the following (TWO)				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers/skates				
hoists				
jacks				
manual handling				
Make two of the following connections to external supplies (TWO)				
compressed air				
electrical				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
water				
gas				
Carry out seven of the following checks and adjustments as appropriate (SEVEN)				
ensuring equipment meets installation requirements				
checking that the assembly fits				
checking mechanical integrity				
checking electrical integrity				
making 'off-load' checks				
making 'on-load' checks				
checking level and alignment				
checking vibration levels				
checking temperature levels				
making sensory checks				
ensuring dangerous areas are guarded				
checking torque settings of fasteners				
checking for leaks				
checking system pressure and flows				
checking speeds and feeds				
checking lubrication				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial equipment malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with one or more of the following standards (ONE)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
customer standards and requirements				
company standards and procedures				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 13: Installing Workplace Environmental Control Equipment

Unit Summary

This unit identifies the competences you need to install workplace environmental control equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install workplace environmental control equipment that will control or monitor a number of different systems, including heating and ventilation, air conditioning and ventilation units, chillers, boilers, lighting, lifts, building/room access, fire systems and CCTV systems, in accordance with approved procedures. The installation will also include sensors, actuators, switches, motor starters, electrical and network cables, thermostats, electronic meters, safety systems/devices, monitoring equipment, inverters, uninterruptible power supplies (UPS), control panels, printed circuit boards, controller units, computer systems, peripheral devices and environmental monitoring and targeting software.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate settings or working clearances, are tightened to the correct torque, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures for workplace environmental control equipment. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install equipment for a workplace environmental control system that monitors/controls **three** of the following:
 - heating and ventilation
 - air conditioning and ventilation
 - lighting
 - CCTV
 - chillers
 - lift control
 - fire systems
 - intruder/alarm systems
 - building/room access
 - other specific system
 - boilers
4. Install **eighteen** of the following types of workplace environmental control equipment and components during the installation:
 - sensors
 - actuators
 - switches
 - motor starters
 - vents/diffusers
 - electrical cables
 - network cables
 - thermostats
 - electronic meters
 - heating elements
 - printers
 - safety systems
 - BMS controller units
 - BMS remote PC

- BMS terminal (PC, server)
 - printed circuit boards
 - monitoring equipment
 - annunciation panel
 - circuit protection devices
 - electronic control panels
 - modems
 - overload protection devices
 - PC peripheral devices
 - monitoring/targeting software
 - inverters
 - uninterruptible power supplies
 - batteries
 - trunking and tray work
5. Apply installation methods and techniques, to include **six** of the following:
- marking out of locating and securing positions
 - drilling and hole preparation
 - fitting inserts (such as rag or expanding bolts)
 - positioning of equipment
 - levelling of equipment
 - connecting wires and cables
 - securing using mechanical fixings
 - securing using masonry fixings
 - applying cable clips and ties
6. Carry out at **six** of the following installation activities:
- terminating mineral or armoured cables
 - bending and forming conduit
 - bending and forming trunking and trays
 - sealing and protecting cable connections
 - making mechanical/screwed/clamped connections
 - soldering and de-soldering
 - attaching suitable cable identification
 - routeing and securing wires and cables
 - heat shrinking (devices and boots)
 - crimping (tags and pins)
 - stripping cable insulation/protection
 - removing cable end fittings
 - extracting/inserting components
 - attaching equipment identification labels/markers
7. Use **three** of the following test instruments/items during the installation activities:
- multimeter
 - watt meter
 - voltmeter
 - ammeter
 - insulation resistance tester
 - light meter
 - earth-loop impedance tester
 - continuity tester
 - phase orientation tester
 - self-diagnostic software
 - other specific test item
 - equipment

8. Make **two** of the following connections to the installed equipment:
 - mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - fluid power connections
 - network connections
 - utility service connections (such as gas, air, water, oil)

9. Carry out checks and adjustments, as appropriate to the equipment being installed, to include:
 - checking that the equipment operates to the installation specification
 Plus **five** more from the following:
 - making visual checks for completeness and freedom from damage
 - making sensory checks (sight, sound, smell, touch)
 - checking security of connections/terminations
 - checking the system for leaks
 - checking signal transmission (electrical, electronic, pneumatic, mechanical)
 - confirming that signal measurement and transmission are satisfactory
 - checking and modifying software programmes
 - carrying out a final start-up of the system and removing any trip defeats

10. Deal with **two** of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

11. Use **two** of the following fault finding techniques during the checking and testing activities:
 - six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution

12. Produce installations which comply with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - BS and/or ISO standards
 - company standards and procedures
 - customer standards and requirements

13. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing workplace environmental control equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements for the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing workplace environmental control equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)

102 Level 3 NVQ in Installation and commissioning

7. How to carry out currency/issue checks on the specifications you are working with
8. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. The various mechanical fasteners that will be used, and their method of installation
10. The torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
11. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation
12. The types of tools and instruments used to position, secure and align the equipment
13. The techniques used to position, align, level, adjust and secure the equipment
14. Methods of lifting, handling and supporting the equipment during the installation activities
15. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
16. The techniques used to assemble electrical equipment (plugs, soldering, screwed, clamped and crimped connections)
17. The use of IEE wiring, and other, regulations for when selecting wires and cables, and when carrying out tests on systems
18. How to make adjustments to components and software programmes to ensure that they function correctly
19. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, water and gas)
20. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
21. The devices and systems for storing programmes
22. The different types of interface cards, and their application
23. The numbering system and codes used for the identification of inputs and outputs
24. How to search a programme within the process controller for specific elements
25. Programming techniques and codes used (such as interlocking, timers, counters, sub-routines, etc)
26. The techniques involved in editing, entering and removing contacts from lines of logic and, where applicable, the procedure to be followed for 'on' and 'off-line' programming
27. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation
28. How to recognise installation defects (such as leaks, poor seals, misalignment, foreign object damage, or contamination)
29. The importance of ensuring that the completed installation is free from dirt and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
30. The calibration/care and control procedures for tools and equipment
31. The problems that can occur with the installation operations, and how these can be overcome
32. The fault-finding techniques to be used when the equipment fails to operate correctly
33. The recording documentation to be completed for the activities undertaken
34. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install equipment for a workplace environmental control system that monitors/controls three of the following (THREE)				
heating and ventilation				
air conditioning and ventilation				
lighting				
CCTV				
chillers				
lift control				
fire systems				
intruder/alarm systems				
building/room access				
other specific system				
boilers				
Install eighteen of the following types of workplace environmental control equipment and components (EIGHTEEN)				
sensors				
actuators				
switches				
motor starters				
vents/diffusers				
electrical cables				
network cables				
thermostats				
electronic meters				
heating elements				
printers				
safety systems				
BMS controller units				
BMS remote PC				
BMS terminal				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
printed circuit boards				
monitoring equipment				
annunciation panel				
circuit protection devices				
electronic control panels				
modems				
overload protection devices				
PC peripheral devices				
monitoring/targeting software				
inverters				
uninterrupted power supplies				
batteries				
trunking and tray work				
Apply installation methods and techniques to include six of the following (SIX)				
marking out				
drilling and hole preparation				
fitting inserts				
positioning of equipment				
Levelling of equipment				
connecting wire and cables				
using mechanical fixings				
using masonry fixings				
applying cable clips and ties				
Carry out six of the following installation activities (SIX)				
terminate mineral/armoured cables				
bend/form conduit				
bend/form trunking/trays				
seal and protect cable connections				
make mechanical, screwed, clamped connections				
soldering/de-soldering				
attach cable identification				
routeing and securing				
heat shrinking				
crimping				
stripping				
removing cable end fittings				
extracting/inserting components				
attach equipment identification labels				
Use three of the following test instruments during the installation activities (THREE)				
multimeter				
watt meter				
voltmeter				
ammeter				
insulation resistance				
light meter				
earth-loop impedance				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
continuity				
phase orientation				
self-diagnostic software				
other test equipment				
Make two of the following connections to the installed equipment (TWO)				
mechanical				
electrical				
fluid power				
network				
utility service				
Carry out checks and adjustments appropriate to the equipment being installed to include				
checking that the equipment operates to specification				
PLUS five more of the following (FIVE)				
visual checks				
sensory checks				
checking security of connections				
checking for leaks				
checking signal transmission				
confirming signal measurement and transmission				
checking and modifying software				
carrying out start up and removing trip defects				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 14: Installing Heating and Ventilation Equipment

Unit Summary

This unit identifies the competences you need to install heating and ventilation equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of heating and ventilation equipment, which will include one of the primary heating sources (gaseous, liquid, solid fuel, electricity and renewable energy). This will also include motors, fans, pumps, valves, couplings, ducting and trunking, heaters, filters, and control devices, such as thermostats and switches.

This unit does not involve maintenance/repair type activities, such as the removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes and the alignment and connection to external units/equipment, such as boilers, control devices, services and power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate settings or working clearances, are tightened to the correct torque, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying heating and ventilation installation procedures. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install equipment for **one** of the following types of heating and ventilating systems:
 - liquid
 - gaseous
 - solid fuel
 - renewable energy
 - electrical
4. Carry out installation which includes **all** of the following
 - all pipework
 - hoses
 - control devicesPlus **twelve** more from the following:
 - boiler
 - motors
 - fans
 - blowers
 - lubricators
 - pumps
 - calorifiers
 - ducting/trunking
 - gauges/indicators
 - regulators
 - sensors and actuators
 - condenser
 - valves
 - safety devices
 - filters
 - electrical wiring and connectors

- electrical components
 - gaskets and seals
 - radiators
 - other (specify)
5. Apply installation methods and techniques to include **five** of the following:
- marking out of locating and securing positions
 - drilling and hole preparation
 - positioning of equipment/components
 - aligning pipes, connections, ducting and equipment
 - dressing and securing pipes and hoses
 - levelling of equipment
 - connecting wires and cables
 - fitting anti-vibration mountings
 - securing by using mechanical fixings
 - securing by using masonry fixings
 - applying screw fastening locking devices
 - applying hose/cable clips and fasteners
6. Move and position equipment using **two** of the following:
- slings
 - cranes
 - fork lift
 - portable lifting devices
 - block and tackle
 - rollers/skates
 - hoists
 - jacks
 - manual handling and moving of loads
7. Use **five** of the following instruments/devices during the installation activities:
- alignment devices
 - electrical measuring instruments
 - mechanical measuring instruments
 - emission testing devices
 - temperature sensing devices
 - flow testing devices
 - pressure sensing and monitoring devices
 - flushing and bleeding devices
8. Make **two** of the following connections to the installed equipment:
- mechanical connections (such as re assembly of transported sub assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - fluid power connections
 - utility service connections (such as gas, electricity, air, water, oil)
9. Carry out checks and adjustments, as appropriate to the equipment being installed, to include:
- checking that the equipment operates to the installation specification
- Plus **six** more from the following:
- setting working clearance
 - leak testing
 - making 'off-load' checks
 - checking level and alignment
 - pressurising the system
 - line pressure testing
 - flow checking
 - making visual checks for completeness and freedom from damage
 - making sensory checks (sight, sound, smell, touch)
 - ensuring that moving parts are guarded and clear of obstruction
 - checking torque setting of fasteners
 - ensuring locking devices are fitted to fasteners (where appropriate)

110 Level 3 NVQ in Installation and commissioning

10. Deal with **two** of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

11. Use **two** of the following fault finding techniques during the checking and testing activities:
 - six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution

12. Produce installations which comply with **two** or more of the following standards:
 - equipment manufacturer's operating specification/range
 - BS and/or ISO standards
 - customer (contractual) standards and requirements
 - company standards and procedures

13. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing mechanical equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing mechanical equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be installed, its operating procedures and function
9. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. Methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)
11. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
12. The torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
13. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
14. The techniques used to position, align, level, adjust and secure the equipment
15. Methods of lifting, handling and supporting the equipment during the installation activities
16. The correct operating ranges, including temperature and pressure of secondary heating sources (air and water)
17. The advantages and disadvantages of the application of different local heating systems (such as radiators, in-line duct heaters, skirting heating, fan coil, convectors, storage pipe heaters and air handling units)
18. The typical building design temperatures, such as offices, factories (light and heavy work) warehouses and canteens
19. How to make adjustments to components to ensure they function correctly
20. Methods of connecting equipment to service supplies (such as electrical, compressed air oil and fuel supplies)

21. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
22. The procedure for the safe disposal of waste materials
23. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
24. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
25. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
26. The calibration/care and control procedures for tools and equipment
27. The problems that can occur with the installation operations, and how these can be overcome
28. The fault-finding techniques to be used when the equipment fails to operate correctly
29. The recording documentation to be completed for the activities undertaken
30. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 14: Installing Heating and Ventilation Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install equipment for one of the following types of heating and ventilation systems (ONE)				
liquid				
gaseous				
solid fuel				
renewable energy				
electrical				
Carry out installations which include all of the following (ALL)				
all pipework				
hoses				
control devices				
PLUS twelve more from the following (TWELVE)				
boilers				
motors				
fans				
blowers				
lubricators				
pumps				
calorifiers				
ducting/trunking				
gauges/indicators				
regulators				
sensors and actuators				
condenser				
valves				
safety devices				
filters				
electrical wiring/connections				
electrical components				
gaskets and seals				
radiators				
others				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out and locating				
drilling and hole preparation				
positioning equipment and components				
aligning pipes connections, ducting and equipment				
dressing and securing pipes and hoses				
levelling of equipment				
connecting wires and cables				
fitting anti-vibration mountings				
using mechanical fixings				
using masonry fixings				
applying screw fastening locking devices				
applying hose/cable clips and fasteners				
Move and position equipment using two of the following (TWO)				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers/skates				
hoists				
jacks				
manual handling and moving				
Use five of the following instruments during the installation activities (FIVE)				
alignment devices				
electrical measuring instruments				
mechanical measuring instruments				
emission testing devices				
temperature sensing devices				
flow testing devices				
pressure sensing and monitoring devices				
flushing and bleeding devices				
Make two of the following connections to the installed equipment (TWO)				
mechanical connections				
electrical wired connections				
fluid power connections				
utility service connections				
Carry out checks and adjustments appropriate to the equipment being installed to include				
checking the equipment operates to specification				
PLUS six more of the following (SIX)				
setting working clearances				
leak testing				
making 'off-load' checks				
check level and alignment				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
pressurising system				
line pressure testing				
flow checks				
making visual checks				
making sensory checks				
ensuring moving parts are guarded				
checking torque settings				
ensuring locking devices are fitted				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 15: Installing Air Conditioning and Ventilation Equipment

Unit Summary

This unit identifies the competences you need to install air conditioning and ventilation equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of air conditioning and ventilation equipment, which will include air generation, distribution and control systems. This will also include motors, fans, pumps, ducting and trunking, heaters, safety devices, sensors and activators and control devices.

This unit does not involve maintenance/repair type activities, such as the removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment, such as motors, control devices, services and power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned, have appropriate settings or working clearances, are tightened to the correct torque, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying air conditioning and ventilation installation procedures. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install equipment for **two** of the following types of air conditioning and ventilating systems:
 - remote air conditioning generation
 - local air conditioning distribution
 - air conditioning control
4. Carry out installation, which includes **all** of the following:
 - all pipework
 - hoses
 - control devicesPlus **twelve** more from the following:
 - motors
 - chillers
 - pumps
 - humidifiers
 - regulators
 - condensers
 - ducting/trunking
 - fans
 - evaporators
 - lubricators
 - heaters
 - sensors and actuators
 - electrical wiring/connectors
 - electrical components
 - gaskets and seals
 - valves
 - safety devices
 - gauges/indicators

- filters
 - other (specify)
5. Apply installation methods and techniques, to include **five** of the following:
- marking out of locating and securing positions
 - drilling and hole preparation
 - positioning of equipment/components
 - aligning pipes, connections, ducting and equipment
 - dressing and securing pipes and hoses
 - levelling of equipment
 - connecting wires and cables
 - fitting anti-vibration mountings
 - securing by using mechanical fixings
 - securing by using masonry fixings
 - applying screw fastening locking devices
 - apply hose/cable clips and fasteners
6. Move and position equipment using **two** of the following:
- slings
 - cranes
 - fork lift
 - portable lifting devices
 - block and tackle
 - rollers
 - hoists
 - jacks
 - manual handling and moving loads
7. Use **three** of the following instruments/devices during the installation activities:
- alignment devices
 - electrical measuring instruments
 - mechanical measuring instruments
 - emission testing devices
 - temperature sensing devices
 - flow testing devices
 - pressure sensing and monitoring devices
 - flushing and bleeding devices
8. Make **two** of the following connections to the installed equipment:
- mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - fluid power connections
 - utility service connections (such as gas, electricity, air, water, oil)
9. Carry out checks and adjustments, as appropriate to the equipment being installed, to include:
- checking that the equipment operates to the installation specification:
- Plus **six** more from the following:
- setting working clearance
 - leak testing
 - making 'off-load' checks
 - checking level and alignment
 - pressurising the system
 - line pressure testing
 - flow checking
 - making visual checks for completeness and freedom from damage
 - making sensory checks (sight, sound, smell, touch)
 - ensuring that moving parts are guarded and clear of obstruction
 - checking the torque setting of fasteners
 - ensuring locking devices are fitted to fasteners (where appropriate)
10. Deal with **two** of the following conditions during the installation process:

118 Level 3 NVQ in Installation and commissioning

- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
11. Use **two** of the following fault finding techniques during the checking and testing activities:
 - six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution
 12. Produce installations which comply with **two** of the following standards:
 - equipment manufacturer's operating specification/range
 - BS and/or ISO standards
 - customer (contractual) standards and requirements
 - company standards and procedures
 13. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing air conditioning equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing air conditioning equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be installed, its operating procedures and function
9. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. Methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)
11. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
12. The torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
13. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
14. The techniques used to position, align, level, adjust and secure the equipment
15. Methods of lifting, handling and supporting the equipment during the installation activities
16. The correct operating ranges, including temperature and pressure of secondary sources (air and water)
17. The advantages and disadvantages of the application of different local air conditioning systems (such as in line ducts, skirting, fan coil, humidifiers, and air handling units)
18. The typical building design temperatures, such as offices, factories (light and heavy work) warehouses and canteens
19. How to make adjustments to components to ensure that they function correctly
20. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
21. Why electrical bonding is critical, and why it must be both mechanically and electrically secure

22. The procedure for the safe disposal of waste materials
23. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
24. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
25. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
26. The calibration/care and control procedures for tools and equipment
27. The problems that can occur with the installation operations, and how these can be overcome
28. The fault-finding techniques to be used when the equipment fails to operate correctly
29. The recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
30. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 15: Installing Air Conditioning and Ventilation Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install equipment for two of the following types of air conditioning and ventilating systems (TWO)				
remote air conditioning generation				
local air conditioning distribution				
air conditioning control				
Carry out installations which include all of the following (ALL)				
all pipework				
hoses				
control devices				
PLUS twelve more from the following (TWELVE)				
motors				
chillers				
pumps				
humidifiers				
regulators				
condensers				
ducting/trunking				
fans				
evaporators				
lubricators				
heaters				
sensors and actuators				
electrical wiring/connectors				
electrical components				
gaskets and seals				
valves				
safety devices				
gauges/indicators				
filters				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
others				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out and locating				
drilling and hole preparation				
positioning equipment and components				
aligning pipes connections, ducting and equipment				
dressing and securing pipes and hoses				
levelling of equipment				
connecting wires and cables				
fitting anti-vibration mountings				
using mechanical fixings				
using masonry fixings				
applying screw fastening locking devices				
applying hose/cable clips and fasteners				
Move and position equipment using two of the following (TWO)				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers				
hoists				
jacks				
manual handling and moving				
Use three of the following instruments during the installation activities (THREE)				
alignment devices				
electrical measuring instruments				
mechanical measuring instruments				
emission testing devices				
temperature sensing devices				
flow testing devices				
pressure sensing and monitoring devices				
flushing and bleeding devices				
Make two of the following connections to the installed equipment (TWO)				
mechanical connections				
electrical wired connections				
fluid power connections				
utility service connections				
Carry out checks and adjustments appropriate to the equipment being installed to include				
checking that the equipment operates to specification				
PLUS six more of the following (SIX)				
setting working clearances				
leak testing				
making 'off-load' checks				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
checking level and alignment				
pressurising system				
line pressure testing				
flow checks				
making visual checks				
making sensory checks				
ensuring moving parts are guarded				
checking torque settings				
ensuring locking devices are fitted				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 16: Installing Compressed Air Equipment

Unit Summary

This unit identifies the competences you need to install compressed air systems equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of compressed air equipment, which will include compressed air generation, distribution and control systems. This will also including installing system components such as pumps, driers, motors, regulators, compressor components, sensors, pipework and hoses, filters, electrical wiring, gaskets and seals.

This unit does not involve maintenance/repair type activities, such as the removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment such as motors, control devices, services and power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments, to ensure that components are correctly positioned and aligned, have appropriate settings or working clearances, are tightened to the correct torque, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying compressed air equipment installation procedures. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install equipment for **two** of the following types of compressed air systems:
 - compressed air generation
 - compressed air distribution
 - compressed air control
4. Carry out installation which includes **all** of the following:
 - all pipework
 - hoses
 - valvesPlus **twelve** more from the following:
 - pumps
 - driers
 - motors
 - compressors
 - silencers
 - manifolds
 - control equipment
 - sensors and actuators
 - gauges/indicators
 - electrical wiring and connectors
 - electrical components
 - monitoring equipment
 - safety devices
 - filters
 - regulators
 - gaskets and seals
 - lubricators
 - other (specify)

5. Apply installation methods and techniques to include **five** of the following:
 - marking out of locating and securing positions
 - drilling and hole preparation
 - positioning of equipment/components
 - aligning of pipes, ducting and equipment
 - dressing and securing pipes and hoses
 - connecting wires and cables
 - fitting anti-vibration mountings
 - securing by using mechanical fixings
 - securing by using masonry fixings
 - applying screw fastening locking devices

6. Use **three** of the following instruments/devices during the installation activities:
 - alignment devices
 - measuring devices (mechanical and electrical)
 - pressure sensing and monitoring devices
 - temperature sensing devices
 - flow testing devices

7. Make **two** of the following connections to the installed equipment:
 - mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - fluid power connections
 - utility service connections (such as gas, electricity, air, water, oil)

8. Carry out checks and adjustments, as appropriate to the equipment being installed, to include:
 - functionally testing the equipment to ensure that it operates correctlyPlus **four** more from the following:
 - setting working clearance
 - tensioning
 - topping up fluid/oil reservoirs
 - making 'off-load' checks
 - checking level and alignment
 - pressurising the system
 - line pressure testing
 - making visual checks for completeness and freedom from damage
 - making sensory checks (sight, sound, smell, touch)
 - ensuring that moving parts are guarded and clear of obstruction
 - checking the torque setting of fasteners
 - ensuring locking devices are fitted to fasteners (where appropriate)

9. Deal with **two** of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

10. Use **two** of the following fault finding techniques during the checking and testing activities:
 - six point
 - half-split
 - input-to-output
 - function testing
 - equipment self-diagnostics
 - emergent problem sequence
 - injection and sampling
 - unit substitution

11. Produce installations which comply with **two** or more of the following standards:
 - equipment manufacturer's operating specification/range
 - BS and/or ISO standards
 - customer (contractual) standards and requirements

- company standards and procedures

12. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:

- installation records
- company specific documents
- job card
-

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing compressed air equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities (especially where working at heights), and the responsibility these requirements place on you
4. The hazards associated with installing compressed air equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be installed, its operating procedures and function
9. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. Methods of drilling holes for rag and expanding bolts (including the use of grouting and adhesives)
11. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, dowels, special securing devices, masonry fixing devices)
12. The torque loading requirements of the fasteners, and what to do if these loadings are exceeded or not achieved
13. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation
14. The types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, crow bars, torque wrenches, engineers levels, alignment telescopes and laser devices)
15. The techniques used to position, align, level, adjust and secure the equipment
16. Methods of lifting, handling and supporting the equipment during the installation activities (including chain and rope hoists, pull-lifts/tirfors, rollers and skates, high lifts and the use of levers and crow bars)
17. The working principals of compressed air generation, distribution and associated control systems
18. The correct pipes, hoses and other equipment to accommodate the ranges of pressure
19. How to make adjustments to components to ensure that they function correctly
20. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
21. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
22. The procedure for the safe disposal of waste materials
23. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
24. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
25. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
26. The calibration/care and control procedures for tools and equipment
27. The fault-finding techniques to be used when the equipment fails to operate correctly
28. The recording documentation to be completed for the activities undertaken
29. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install equipment for two of the following types of compressed air systems (TWO)				
compressed air generation				
compressed air distribution				
compressed air control				
Carry out installations which include all of the following (ALL)				
rigid pipework				
hoses				
valves				
PLUS twelve more from the following (TWELVE)				
pumps				
driers				
motors				
compressors				
silencers				
manifolds				
control equipment				
sensors and actuators				
gauges/indicators				
electrical wiring and connectors				
electrical components				
monitoring equipment				
safety devices				
filters				
regulators				
gaskets and seals				
lubricators				
others				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out				
drilling and hole preparation				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
positioning equipment				
aligning pipes ducting and equipment				
dressing and securing pipes and hoses				
connecting wires, cables				
fitting anti-vibration mountings				
using mechanical fixings				
using masonry fixings				
applying screw fasteners				
Use three of the following instruments during the installation activities (THREE)				
alignment devices				
mechanical/electrical measuring devices				
pressure sensing and monitoring				
temperature sensing				
flow testing devices				
Make two of the following connections to the installed equipment (TWO)				
mechanical connections				
electrical wired connections				
fluid power connections				
utility service connections				
Carry out checks and adjustments appropriate to the equipment being installed to include				
testing that the equipment operates correctly				
PLUS four more of the following (FOUR)				
setting working clearance				
tensioning				
topping up fluid/oil reservoirs				
making 'off-load' checks				
levelling and alignment				
pressurising the system				
line pressure testing				
making visual checks				
making sensory checks				
ensuring moving parts are guarded				
checking torque settings				
ensuring locking devices are fitted				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
six point				
half-split				
input-to-output				
function testing				
equipment self diagnostics				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
emergent problem sequence				
injection and sampling				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 17: Installing Waste/Foul Water Distribution Equipment

Unit Summary

This unit identifies the competences you need to install waste/foul water distribution systems and equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of distribution equipment, such as foul, storm and waste/effluent water systems. The installation will also include fitting and connecting the correct types of pipework and other ancillary equipment, such as pumps, valves, motors and couplings.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment, such as control devices, services and power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed, and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, mechanical, and water supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, are connected and jointed correctly, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures for waste/foul water distribution. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install equipment for **one** of the following types of waste/foul water distribution systems:
 - waste/effluent
 - storm water
 - foul water
4. Install and connect **two** of the following types of pipes:
 - plastic
 - clay
 - iron
 - copper
5. Fit **eleven** of the following components/equipment during the installation:
 - pumps
 - motors
 - gates and valves
 - couplings/connectors
 - dosing plant
 - macerators
 - interceptors
 - faucets and outlets
 - manifolds
 - traps and filters
 - gauges/indicators
 - sensors and switches
 - tanks
 - control devices
 - electrical wiring and connectors
 - ancillary drainage equipment (such as from sinks, toilets, showers)

- gaskets and seals
6. Apply installation methods and techniques, to include **five** of the following:
 - marking out of locating and securing positions
 - drilling and hole preparation
 - positioning of equipment
 - connecting equipment to pipework
 - aligning and securing pipes and flexible hoses
 - levelling and securing equipment
 - connecting wires and cables
 - securing by using mechanical fixings
 - securing by using masonry fixings
 - securing by using adhesives (glues or cements)
 - using the correct lifting and handling equipment
 7. Use **three** of the following instruments/devices during the installation activities:
 - alignment devices
 - multimeter
 - measuring devices
 - pressure testing devices
 - flow testing devices
 8. Make **two** of the following connections to the installed equipment:
 - mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - fluid power connections
 - utility service connections (such as gas, electricity, air, water, oil)
 9. Carry out checks and adjustments, as appropriate to the equipment being installed, to include:
 - functionally testing the equipment to ensure that it operates correctly
 Plus **three** more from the following:
 - checking level and alignment
 - flow checking
 - checking for leaks
 - making visual checks for completeness and freedom from damage
 - making sensory checks (sight, sound, smell, touch)
 - ensuring moving parts are guarded and clear of obstruction
 10. Deal with **two** of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
 11. Use **two** of the following fault finding techniques during the checking and testing activities:
 - half-split
 - input-to-output
 - function testing
 - unit substitution
 12. Produce installations which comply with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - BS and/or ISO standards
 - company standards and procedures
 - customer (contractual) standards and requirements
 13. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific health and safety precautions to be applied during the installation procedure, and their effects on others (to include the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements for the work area where you are carrying out the installation activities (especially where working at heights), and the responsibility these requirements place on you
4. The hazards associated with installing waste/foul water systems, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be installed, its operating procedures and function
9. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. Methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives
11. The techniques used to position, align, level, adjust and secure the pipework and equipment
12. The importance of orientation and flow for certain components/equipment
13. Methods of lifting, handling and supporting the equipment during the installation activities
14. The applications of the different types of pipework systems (such as copper, plastic, lead, iron, clay)
15. The applications of the different types of couplings, and how to make watertight connections between pipes and other components
16. The equipment and tools used to bend, form and thread pipework
17. The types of contaminants in water systems, and the problems they can cause
18. The different methods used to treat water supplies to meet user needs
19. The applications of the different cleaning procedures for pipework and equipment (rod, water jet, solvents)
20. How to make adjustments to components to ensure they function correctly
21. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
22. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
23. The procedure for the safe disposal of waste materials
24. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
25. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
26. The problems that can occur with the installation operations, and how these can be overcome
27. The calibration/care and control procedures for tools and equipment
28. The fault-finding techniques to be used when the equipment fails to operate correctly
29. The recording documentation to be completed for the activities undertaken
30. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 17: Installing Waste/Foul Water Distribution Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install equipment for one of the following types of waste/foul water distribution systems (ONE)				
waste/effluent				
storm water				
foul water				
Install and connect two of the following types of pipes (TWO)				
plastic				
clay				
iron				
copper				
Fit eleven of the following components/equipment during the installation (ELEVEN)				
pumps				
motors				
gates and valves				
couplings/connectors				
dosing plant				
macerators				
interceptors				
faucets and outlets				
manifolds				
traps and filters				
gauges/indicators				
sensors and switches				
tanks				
control devices				
electrical wiring and connections				
ancillary drainage equipment				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
gaskets and seals				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out				
drilling and hole preparation				
positioning equipment				
connecting equipment				
aligning equipment				
levelling equipment				
connecting wires/cables				
using mechanical fixings				
using masonry fixings				
using adhesives				
using lifting and handling equipment				
Use three of the following instruments during the installation activities (THREE)				
alignment devices				
multimeter				
measuring devices				
pressure testing devices				
flow testing devices				
Make two of the following connections to the installed equipment (TWO)				
mechanical				
electrical				
fluid power				
utility services				
Carry out checks and adjustments as appropriate to the equipment being installed to include				
functionally testing the equipment to ensure that it operates correctly				
PLUS three more from the following				
checking level and alignment				
flow checking				
checking for leaks				
making visual checks				
making sensory checks				
ensuring moving parts are guarded				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
half-split				
input-to-output				
function testing				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
customer standards and requirements				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
company standards and procedures				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate:

Date:

Assessor:

Date:

Unit No 18: Installing Fresh Water Distribution Equipment

Unit Summary

This unit identifies the competences you need to install fresh water distribution systems and equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of fresh water equipment, such as mains cold water (drinkable), hot water supplies, cold down service and non-mains supplies (river, well). The installation will also include fitting and connecting the correct types of pipework, pumps, valves, couplings, and other ancillary components and equipment.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment, such as motors, control devices, services and power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed, and the components to be worked installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, mechanical, and water supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, are connected and jointed correctly, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures for fresh water distribution. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
 -
3. Install equipment for **one** of the following types of fresh water distribution systems:
 - mains cold water
 - hot water supplies
 - cold down service
 - non-mains supplies
4. Install and connect **two** of the following types of pipes:
 - plastic
 - clay
 - iron
 - copper
5. Fit **fifteen** of the following components/equipment during the installation:
 - pumps
 - motors
 - heaters
 - gates and valves
 - dosing plant
 - couplings/connectors
 - wet and dry risers
 - cylinders and tanks
 - gaskets and seals
 - gauges/indicators
 - manifolds
 - filters and traps
 - sensors and switches
 - faucets and outlets
 - control devices
 - electrical wiring and connectors

- ancillary equipment (such as sinks, toilets, showers)
6. Apply installation methods and techniques, to include **five** of the following:
 - marking out of locating and securing positions
 - drilling and hole preparation
 - positioning of equipment
 - connecting equipment to pipework
 - aligning and securing pipes and flexible hoses
 - levelling and securing equipment
 - connecting wires and cables
 - fitting anti-vibration fittings
 - securing by using mechanical fixings
 - securing by using masonry fixings
 - securing by using adhesives (glues or cements)
 - using the correct lifting and handling equipment
 7. Use **three** of the following instruments/devices during the installation activities:
 - alignment devices
 - measuring devices
 - pressure testing devices
 - flow testing devices
 - bleeding equipment
 - multimeter
 8. Make **two** of the following connections to the installed equipment:
 - mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - fluid power connections
 - utility service connections (such as gas, electricity, air, water, oil)
 9. Carry out checks and adjustments, as appropriate to the equipment being installed, to include:
 - functionally testing the equipment to ensure that it operates correctly
 Plus **three** more from the following:
 - topping up fluid reservoirs
 - checking level and alignment
 - pressurising the system
 - checking for leaks
 - making visual checks for completeness and freedom from damage
 - making sensory checks (sight, sound, smell, touch)
 - ensuring that moving parts are guarded and clear of obstruction
 10. Deal with **two** of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
 11. Use **two** of the following fault finding techniques during the checking and testing activities:
 - half-split
 - input-to-output
 - function testing
 - unit substitution
 12. Produce installations which comply with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - BS and/or ISO standards
 - company standards and procedures
 - customer (contractual) standards and requirements
 13. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - installation records

140 Level 3 NVQ in Installation and commissioning

- company specific documentation
- job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific health and safety precautions to be applied during the maintenance procedure, and their effects on others (to include the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements for the work area where you are carrying out the installation activities (especially where working at heights), and the responsibility these requirements place on you
4. The hazards associated with installing fresh water distribution equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be installed, its operating procedures and function
9. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. Methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives
11. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation
12. The techniques used to position, align, level, adjust and secure the equipment, and the types of tools and instruments used
13. Methods of lifting, handling and supporting the equipment during the installation activities
14. The importance of orientation and flow for certain components/equipment
15. The applications of the different types of couplings, and how to make watertight connections between pipes and other components
16. The equipment and tools used to bend, form and thread pipework
17. The types of contaminants in water systems, and the problems they can cause
18. The different methods used to treat water supplies to meet user needs
19. How to make adjustments to components to ensure that they function correctly
20. Methods of connecting equipment to service supplies (such as electrical, mechanical and fuel supplies)
21. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
22. The procedure for the safe disposal of waste materials
23. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
24. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
25. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
26. The calibration/care and control procedures for tools and equipment
27. The problems that can occur with the installation operations, and how these can be overcome
28. The fault-finding techniques to be used when the equipment fails to operate correctly
29. The recording documentation to be completed for the activities undertaken
30. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 18: Installing Fresh Water Distribution Equipment

Level 3 NVQ in Installation and commissioning

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install equipment for one of the following types of fresh water distribution systems (ONE)				
mains cold water				
hot water				
cold down service				
non-mains supplies				
Install and connect two of the following types of pipes (TWO)				
plastic				
clay				
iron				
copper				
Fit fifteen of the following components/equipment during the installation (FIFTEEN)				
pumps				
motors				
heaters				
gates and valves				
dosing plant				
couplings/connectors				
wet and dry risers				
cylinders and tanks				
gaskets and seals				
gauges/indicators				
manifolds				
filters and traps				
sensors and switches				
faucets and outlets				
control devices				
electrical wiring and connections				
ancillary equipment				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
drilling and hole preparation				
positioning equipment				
connecting equipment				
aligning equipment				
levelling equipment				
connecting wires/cables				
fitting anti-vibration devices				
using mechanical fixings				
using masonry fixings				
using adhesives				
using lifting and handling equipment				
Use three of the following instruments during the installation activities (THREE)				
alignment devices				
measuring devices				
pressure testing devices				
flow testing devices				
bleeding equipment				
multimeter				
Make two of the following connections to the installed equipment (TWO)				
mechanical				
electrical				
fluid power				
utility services				
Carry out checks and adjustments as appropriate to the equipment being installed to include				
functionally testing the equipment to ensure that it operates correctly				
PLUS three more from the following				
topping up fluid reservoirs				
checking level and alignment				
pressurising system				
checking for leaks				
making visual checks				
making sensory checks				
ensuring moving parts are guarded				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
half-split				
input-to-output				
function testing				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
customer standards and requirements				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
company standards and procedures				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate:

Date:

Assessor:

Date:

Unit No 19: Installing Refrigeration Equipment

Unit Summary

This unit identifies the competences you need to install refrigeration equipment, in accordance with approved procedures. This will require you to survey the site for the proposed installation, and to make any necessary arrangements to have the required lifting and handling equipment, installation tools, any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of refrigeration equipment, which will include compression types using air cooled, water cooled condensers, and secondary refrigerants, and air conditioning cooling plants. This will also include motors, compressors, evaporative condensers, evaporators, safety control devices, valves, refrigerant metering devices, sensors, switches, thermostats, meters, thermocouples, timers, interlocks, electrical components and wiring, electronic boards and components, controller units, computer equipment and peripheral devices.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment, or the installation of simple, self-contained items that have minimal installation requirements. It does, however, include the connection of sub-assemblies, where these have been broken down for transportation purposes, and the alignment and connection to external units/equipment, such as motors, control devices, services and power supplies.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed, and the components to be installed. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections to the required services, which could include electrical, fluid power, water or fuel supplies, as appropriate to the equipment installed. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate settings or working clearances, are tightened to the correct torque, and that they function as per the specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures for refrigeration equipment. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and correct any faults, and ensure that the installed equipment functions to specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out a site check, prior to the installation, and ensure that **all** of the following conditions are met:
 - the site is accessible, free from obstructions or hazards, and suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - any required installation consumables are available
 - safety and environmental conditions can be met
 - the installation activities have been planned, prior to beginning the work
 - checks have been made to ensure currency of installation documentation (such as, drawings, layouts, instructions, manufacturer's data, settings and other documentation)
2. Carry out **all** of the following activities during the installation:
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - provide safe access and working arrangements for the installation area
 - ensure the safe isolation of services during installation (such as mechanical, electricity, gas, air or fluids)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
3. Install equipment for **one** of the following types of refrigeration equipment:
 - compression types using air cooled condensers
 - compression types using water cooled condensers
 - compression types using secondary refrigerants
 - air conditioning cooling plant
4. Fit **eleven** of the following components/equipment during the installation:
 - pipework
 - motors
 - evaporative condensers
 - evaporators
 - compressors
 - hoses and connectors
 - vents/diffusers
 - monitoring equipment
 - safety devices
 - sensors and actuators
 - gaskets and seals
 - uninterrupted power supplies
 - interlocks
 - PC peripheral devices
 - software
 - electrical wiring and connections
 - gauges and indicators (such as temperature, humidity, pressure)
 - electronic modules/components

5. Apply installation methods and techniques, to include **five** of the following:
 - marking out of locating and securing positions
 - drilling and hole preparation
 - positioning of equipment
 - aligning and securing pipes, hoses ducting and equipment
 - levelling of equipment
 - connecting wires and cables
 - installing wiring conduit and enclosures
 - securing by using mechanical fixings
 - securing by using masonry fixings
 - applying screw fastening locking devices

6. Move and position equipment using the correct methods and techniques, to include **two** of the following:
 - slings
 - cranes
 - fork lift
 - portable lifting devices
 - block and tackle
 - rollers
 - hoists
 - jacks
 - manual handling and moving of loads

7. Use **three** of the following instruments/devices during the installation activities:
 - alignment devices
 - pressure testing devices
 - temperature measuring devices
 - leak testing devices
 - multimeter
 - filling and bleeding devices

8. Make **two** of the following connections to the installed equipment:
 - mechanical connections (such as re-assembly of transported sub-assemblies)
 - electrical wired connections (excluding simple 'plug in' connections)
 - fluid power connections
 - utility service connections (such as gas, electricity, air, water, oil)

9. Carry out checks and adjustments, as appropriate to the equipment being installed, to include:
 - functionally testing the equipment to ensure that it operates correctly
 - carrying out pressure leak testsPlus **five** more from the following:
 - purging equipment of all air (such as dry nitrogen)
 - using flushing lines and equipment
 - vapour charging of a system
 - liquid charging of a system
 - making sensory checks (sight, sound, smell, touch)
 - making visual checks for completeness and freedom from damage
 - adding refrigeration lubricants
 - pumping down a system
 - setting pressure cut-outs
 - setting expansion valves
 - setting thermostats and controls

10. Deal with **two** of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

11. Use **two** of the following fault finding techniques during the checking and testing activities:
 - half-split
 - function testing
 - input-to-output
 - equipment self-diagnostics
 - unit substitution

12. Produce installations which comply with **two** or more of the following standards:
 - company standards and procedures
 - equipment manufacturer's operating specification/range
 - customer (contractual) standards and requirements
 - IEE wiring regulations
 - BS and/or ISO standards

13. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing refrigeration equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing refrigeration equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be installed, its operating procedures and function
9. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. Methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives
11. The techniques, tools and instruments used to position, align, level, adjust and secure the equipment
12. Methods of lifting, handling and supporting the equipment during the installation activities
13. The types of compressor, condenser, expansion valves and evaporators, and methods of stopping compressor prime movers
14. The system operating pressures and temperatures, and the relationship between refrigerant gas pressures and temperatures
15. Methods of testing equipment and systems for leaks (such as liquid bubble testing, treated paper, halide torch, sulphur candles, electronic instruments or automatic detection equipment), and the tools and equipment that can be used
16. The types and application of primary and secondary refrigerants, and methods of purging and charging the system using liquid and vapour refrigerants
17. The use of vacuum pumps, pressure gauges, compound gauges, flow gauges and indicators
18. How to check that tools and equipment are free from damage or defects, are in a safe and usable condition, and are configured correctly for their intended purpose
19. How to make adjustments to components to ensure that they function correctly
20. Methods of connecting equipment to service supplies (such as electrical, fluid, compressed air, oil and fuel supplies)
21. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
22. The procedure for the safe disposal of waste materials
23. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
24. The importance of ensuring that the completed installation is free from dirt, swarf and foreign object damage, and of ensuring that any exposed components or pipe ends are correctly covered/protected
25. The calibration/care and control procedures for tools and equipment

148 Level 3 NVQ in Installation and commissioning

26. The problems that can occur with the installation operations, and how these can be overcome
27. The fault-finding techniques to be used when the equipment fails to operate correctly
28. The recording documentation to be completed for the activities undertaken and, where appropriate, the importance of marking and identifying specific pieces of work in relation to the documentation
29. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 19: Installing Refrigeration Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out a site check prior to installation and ensure that all of the following conditions are met (ALL)				
site is accessible, free from obstruction and suitably prepared for the installation				
appropriate utilities available				
any required consumables are available				
safety and environmental conditions are met				
installation activities planned prior to work				
checks undertaken on documentation				
Carry out all of the following activities during the installation (ALL)				
adhere to risk assessment and safety standards				
obtain clearance				
provide safe access				
ensure safe isolation of services				
dispose of waste correctly				
leave work area in a safe and clean condition				
Install equipment for one of the following types of refrigeration equipment (ONE)				
compression using air cooled condensers				
compression using water cooled condensers				
compression using secondary refrigerants				
air conditioning cooling plant				
Fit eleven of the following components/equipment during the installation (ELEVEN)				
pipework				
motors				
evaporative condensers				
compressors				
hoses and connectors				
vents/diffusers				
monitoring equipment				
safety devices				
sensors and actuators				
gaskets and seals				
uninterrupted power supplies				
interlocks				
PC peripheral devices				
software				
electrical wiring/connectors				
gauges/indicators				
electronic modules components				
Apply installation methods and techniques to include five of the following (FIVE)				
marking out and locating				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
drilling and hole preparation				
positioning equipment and components				
aligning pipes connections, ducting and equipment				
dressing and securing pipes and hoses				
levelling of equipment				
connecting wires and cables				
installing conduit and enclosures				
using mechanical fixings				
using masonry fixings				
applying screw fastening locking devices				
Move and position equipment using two of the following (TWO)				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers				
hoists				
jacks				
manual handling and moving				
Use three of the following instruments during the installation activities (THREE)				
alignment devices				
pressure testing devices				
temperature measuring devices				
leak testing devices				
multimeter				
filling and bleeding devices				
Make two of the following connections to the installed equipment (TWO)				
mechanical connections				
electrical wired connections				
fluid power connections				
utility service connections				
Carry out checks and adjustments appropriate to the equipment being installed to include				
functionally testing the equipment for correct operation				
PLUS five more of the following (FIVE)				
purging				
using flushing lines				
vapour charging				
liquid charging				
making sensory checks				
making visual checks				
adding lubricants				
pumping down				
setting pressure cut-outs				
setting expansion valves				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
setting thermostats and controls				
Deal with two of the following conditions during the installation process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Use two of the following fault finding techniques during the checking and testing activities (TWO)				
half-split				
function testing				
input-to-output				
equipment self diagnostics				
unit substitution				
Produce installations which comply with two or more of the following standards (TWO)				
company standards				
equipment manufacturers operation/ specification				
customer standards				
IEE Wiring Regulations				
BS and/or ISO standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 20: Commissioning Mechanical Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on mechanical equipment and systems, in accordance with approved procedures. You will be required to commission a range of mechanical equipment, such as machine tools, process control equipment, rotating mechanical equipment, engines and turbines, conveyors and elevators, lifting and handling equipment, processing plant and storage vessels that have mechanical systems connected to them.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as bench drills, pedestal grinders, small compressors or pumps.

You will be expected to check that the equipment has been installed correctly to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level and alignment, adjusting and setting equipment operating parameters, making 'off-load' checks before starting up the equipment, operating the equipment at reduced loads/speeds to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to electrical, fluid power, PLC control, services and external units/equipment, such as belt and chain drives, clutches and brakes.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying commissioning procedures for mechanical equipment. You will understand the commissioning methods, techniques and procedures used and their application. You will know how the equipment functions, the purpose of the individual units/components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities, correcting or reporting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities so as to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air or fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturers' manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of mechanical equipment/systems:
 - machine tools
 - industrial compressors
 - conveyors
 - turbines
 - elevators
 - processing plant
 - lifting and handling equipment
 - engines
 - other equipment (specify)
 - hoppers or large storage vessels (having mechanical systems connected to them)
 - process control equipment (such as large valves and actuating mechanisms, pumps)
4. Prior to initial start-up, carry out **all** of the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid power, PLC)
 - all fluids, lubricants and grease are at the appropriate level for start-up
 - all moving parts are clear of obstructions
 - all labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable
5. Use **all** of the following commissioning methods, techniques and procedures:

154 Level 3 NVQ in Installation and commissioning

- carry out start-up procedures, and confirm that the equipment/system meets specifications
 - run equipment at the recommended initial settings (eg, reduced power/speed/flow)
 - check for leaks during operations
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as speeds, feeds, pressures, flow, timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow
 - confirm that the final product/process outcomes meet specifications
 - monitor and record measurements and observations
 - shut down/isolate the equipment/installation to a safe condition
6. Use **three** of the following instruments/devices during the commissioning activities:
- alignment devices
 - levelling devices
 - linear measuring instruments
 - speed measuring devices
 - multimeter
 - continuity tester
 - bleeding equipment
 - pressure testing devices
 - flow testing devices
 - specific diagnostic aids
 - PLC/PC equipment
7. Deal with **two** of the following conditions during the commissioning process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:
Either: Produce a report of the commissioning activities that includes **all** of the following:
- checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault
- Or:** Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:
- identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks to confirm that correct operation is now achieved
9. Ensure that the commissioned equipment complies with **two** or more of the following standards:
- equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures
10. Complete the relevant paperwork, to include **one** from the following, and pass it to the appropriate people:
- commissioning log/report
 - corrective action report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning mechanical equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out mechanical commissioning activities (such as handling oils, greases, stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals, instructions and other documentation needed in the commissioning process
7. How to carry out currency/issue checks for the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
10. The procedures to be applied during the commissioning activity
11. The importance of making 'off-load' checks before running the equipment under power
12. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
13. How to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel, setting backlash in gears, adjusting and tensioning belt and chain drives, preloading bearings)
14. The fault diagnostic techniques that can be used to help identify problems with the equipment
15. The uses of measuring equipment, such as micrometers, verniers, run-out devices and other measuring devices
16. The calibration/care and control procedures for the tools and equipment used during commissioning
17. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
18. The methods and techniques used to dismantle mechanical equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)
19. How to re-assemble the removed components, and how to adjust them to meet the operating specification
20. The recording and/or reporting documentation to be completed for the activities undertaken
21. The types of problem associated with the commissioning activity, and how they can be overcome
22. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
23. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 20: Commissioning Mechanical Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of mechanical equipment/systems (ONE)				
machine tools				
industrial compressors				
conveyors				
turbines				
elevators				
processing plant				
lifting and handling equipment				
engines				
other equipment				
hoppers/storage vessels				
process control equipment				
Prior to initial start up carry out all of the following checks (ALL)				
site is safe and meets environmental conditions				
check for equipment damage				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
fluids/lubricants/grease at appropriate level				
moving parts clear of obstructions				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at initial settings				
check for leaks				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
confirm outcomes				
monitor and record				
shut down/isolate safely				
Use three of the following instruments/devices during the commissioning activities (THREE)				
alignment devices				
levelling devices				
linear measuring devices				
speed measuring devices				
multimeter				
continuity tester				
bleeding equipment				
pressure testing devices				
flow testing devices				
specific diagnostic aids				
PLC/PC equipment				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
commissioning log/report				
corrective action report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 21: Commissioning Electrical/Electronic Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on electrical/electronic equipment and systems, in accordance with approved procedures. You will be required to commission a range of electrical equipment/circuits, powered by single phase, three-phase or direct current power supplies, and including equipment/components such as control systems, motors and starters, switchgear and distribution panels, control systems, electronic units, communication systems and luminaires.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as drive motors or light fittings.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking electrical integrity, adjusting and setting equipment operating parameters, making 'offload' checks before powering up the equipment, operating the equipment to prove its function, and making full operational trials. You will also be required to either make a full report of any defects or deviations found, or to resolve any problems by rectifying faults at unit or component level.

The commissioning process will also require you to confirm operational links to mechanical, fluid power, PLC control, services and external units/equipment, such as bus bars, sensors and actuators.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the commissioning of electrical or electronic equipment. You will understand the commissioning methods, techniques and procedures, and their application. You will know how the equipment/components function, the purpose of the individual components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities so as to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - ensure all tools and equipment used is within current calibration dates
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturers' manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning of installations based on **two** of the following power supply systems:
 - single phase power circuit
 - combination power circuits
 - three-phase power circuit
 - low voltage (up to 115V)
 - direct current power circuit
4. Carry out commissioning activities which cover **six** of the following electrical installations/module/components:
 - switchgear
 - alarm devices
 - programmable controllers
 - power factor correction devices
 - motors and starters
 - luminaires
 - control devices
 - communication equipment
 - encoders or resolvers
 - safety devices
 - panels or sub-assemblies
 - emergency/standby batteries
 - overload protection devices
 - sensors and actuators
 - electronic modules/units
 - other electrical equipment (specify)

5. Prior to initial start-up carry out **all** the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid power, PLC)
 - all circuit protection devices are connected and operative
 - all wiring/cables are supported/protected (trunking, tray work, conduit, clips and fastenings)
 - all labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable
6. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start-up procedures and confirm that the equipment/system meets specifications
 - run equipment at the recommended initial settings (eg, reduced power/speed/flow)
 - check electrical integrity (such as voltage, current, power rating, resistance values, frequency)
 - make sensory checks (sight, sound, smell)
 - run through the operating sequence and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as trip defeats speeds, pressures, timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition
7. Use **three** of the following instruments/devices during the commissioning activities:
 - multimeter
 - watt meter
 - voltmeter
 - ammeter
 - insulation resistance tester
 - light meter
 - earth-loop impedance tester
 - other specific test equipment
8. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
- 9 Deal in **one** of the following ways with installations that do not meet specification requirements:

Either: Produce a report of the commissioning activities that includes **all** of the following:

 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

 - identifying the source of the fault using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running commissioning checks to confirm that correct operation is now achieved
10. Ensure that the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures
11. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - corrective action report
 - commissioning log/report
 - job sheet

- customer specific documentation
- handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning electrical/electronic equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out electrical/electronic commissioning activities (such as dangerous voltages, stored charge, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals, instructions (including BS and ISO schematics, IEE regulations, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
10. The procedures to be applied during the commissioning activity
11. The importance of making 'off-load' checks before running the equipment under power
12. The application and use of a range of electrical components (such as plugs, switches, sockets, lighting and fittings, junction boxes, consumer units)
13. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
14. How to make adjustments to components/assemblies to ensure that they function correctly (such as trip speeds, pressure, timing, sequencing)
15. The fault diagnostic techniques that can be used to help identify problems with the equipment
16. The uses of measuring equipment, such as multimeters, resistance testers, light meters and other measuring devices
17. The calibration/care and control procedures for the tools and equipment used during commissioning
18. How to conduct any necessary checks to ensure the equipment/circuit integrity, functionality, accuracy and quality
19. How to recognise installation defects (such as voltage drops, damaged insulation, dry connections, ineffective components, foreign object damage, or contamination)
20. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
21. The methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, proofmarking of components, removal of components by de-soldering)
22. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
23. The recording and/or reporting documentation to be completed for the activities undertaken
24. The types of problem associated with the commissioning activity, and how they can be overcome
25. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
26. The extent of your own authority, and whom you should report to if you have a problem you cannot resolve

Unit No 21: Commissioning Electrical/Electronic Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure safe isolation of services				
ensure tools and equipment are within current dates				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning of installations based on two of the following power supply systems (TWO)				
single phase power circuits				
combination power circuits				
three-phase power circuits				
low voltage				
direct current power circuit				
Carry out commissioning activities which cover six of the following electrical installations/modules/components (SIX)				
switchgear				
alarm devices				
programmable controllers				
power factor correction devices				
motors and starters				
luminaires				
control devices				
communication equipment				
encoders or resolvers				
safety devices				
panels or sub-assemblies				
emergency/standby batteries				
overload protection devices				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
sensors and actuators				
electronic modules/units				
other electrical equipment				
Prior to initial start up carry out all of the following checks (ALL)				
site is safe and meets environmental conditions				
check for equipment damage				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
all circuit protection devices connected and operating				
all wiring/cables supported and protected				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at initial settings				
check electrical integrity				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use three of the following instruments/devices during the commissioning activities (THREE)				
multimeter				
watt meter				
voltmeter				
ammeter				
insulation resistance tester				
light meter				
earth loop impedance tester				
other equipment				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
corrective action report				
commissioning log/report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 22: Commissioning Engineered Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on an engineered system, in accordance with approved procedures. You will be required to commission a range of equipment, all of which encompass an integrated system, involving two or more interactive technologies such as mechanical, electrical, fluid power or process controller. Typical systems will include automated equipment such as robots, CNC machines, automated transfer conveyors and elevators, manufacturing/processing equipment such as packaging machines, material handling equipment, jigs and fixtures, and pick-and-place devices.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as bench drills, pedestal grinders, small compressors or pumps.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level and alignment, adjusting and setting equipment operating parameters, making 'off-load' checks before starting up the equipment, operating the equipment at reduced loads/speeds to prove its function, and making full operational trials.

The commissioning process will also require you to confirm operational links to electrical, fluid power, PLC control, services such as water or fuel as is appropriate to the equipment being commissioned.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying commissioning procedures for an engineered system. You will understand the commissioning methods, techniques and procedures used, and their application. You will know how the equipment functions, the purpose of the individual units/components and associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for ensuring safe isolation of services and applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air or fluids)
 - ensure that all tools and equipment used are within current calibration dates
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning of **one** of the following types of engineered system:
 - automatic equipment (such as robots, CNC machines, automatic welders, paint sprayers)
 - transfer equipment (such as automated conveyers and elevators, stacking devices)
 - product/process checking equipment (such as measuring, metering, monitoring or detection systems)
 - manufacturing/processing equipment (such as packaging machines, automated product manufacture /processing equipment)
 - material handling equipment (such as jigs and fixtures, pick-and-place devices)- which must include **three** of the following interactive technologies:

A. Commissioning mechanical equipment/components

To include confirming **all** of the following:

- the position, level and alignment of mechanical units
- the correct securing method and torque of fixings
- all mechanical connections (such as levers, linkages, shafts and couplings, cams and followers)
- the installation of structures (such as guards and fences, safety equipment, overhead supports)
- the tensioning/torque setting of drive mechanisms (such belt and chain drives)
- the alignment and operation of control mechanisms (such as clutches and brakes)

B. Commissioning electrical and electronic equipment/components

To include confirming **all** of the following:

- electrical/electronic equipment is located and secured correctly
- inspection of wiring enclosures/cable protection systems for damage/defects (such as conduit, trunking and tray work)

- correct operation of electrical/electronic components (such as relays, sensing devices, limit switches, electronic modules)
- correct operation of circuit protectors and safety devices
- terminations of cables to electrical components and main distribution centre (such as screwed, crimped and soldered connections)

C. Commissioning fluid power components

To include confirming **all** of the following:

- fluid power equipment is located and secured correctly
- connections of pipework and hoses are properly made
- correct electrical and mechanical connections to fluid power components
- correct operation of fluid power components
- correct operation of sensors and safety devices

D. Commissioning process controller components

To include confirming **all** of the following:

process controllers or sequential controllers and equipment are located and secured correctly

- correct connections of wires and cables to components
- correct operation of input/output interfacing
- data connection links
- programme entries and events (such as counter and timer settings)
- correct operation of programme logic controller peripherals (eg, modems, monitors, PC peripheral devices)
- signal measurement and transmission are satisfactory

E. Commissioning instrumentation and control components

To include confirming **all** of the following:

- instrumentation and control equipment is located and secured correctly
- correct connections of process pipe work
- correct operation of peripherals (such as sensors, actuators, relays, switches)
- settings and calibration of individual instruments (gauges, sensors, actuators)
- correct connections of electrical/pneumatic supply to instruments/sensors
- signal transmission supply to instruments/sensors
- signal measurement and transmission are satisfactory

4. Prior to initial start-up, carry out **all** the following checks:

- the site is free from obstructions/hazards, and safety/environmental conditions have been met
- check for damage to equipment following the installation
- the equipment has been installed and secured/torqued in position, according to specification
- all utilities are connected and operative
- all connections have been made correctly (mechanical, electrical, fluid power, PLC)
- all fluids, lubricants and grease are at the appropriate level for start-up
- all moving parts are clear of obstructions
- all labels, safety and warning signs are attached in the correct locations
- all guards, fences and safety systems are in position and operable

5. Use **all** of the following commissioning techniques, methods and procedures:

- carry out start-up procedures and confirm that the equipment/system meets specifications
- run the system at reduced power/speed/flow/pressure
- check for leaks during operations
- make sensory checks (sight, sound, smell, touch)
- run through the operating sequence, and check for correct function
- load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as speeds, feeds, pressures, flow, timing, sequence)
- conduct a trial run of the system at full power/speed/flow/pressure
- monitor and record measurements and observations
- shut down/isolate equipment/installations to a safe condition

6. Use **four** of the following instruments/devices during the commissioning activities:
 - alignment devices
 - measuring devices
 - electrical measuring equipment
 - fluid power testing equipment
 - instrumentation test equipment
 - PLC/PC test equipment

7. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

8. Deal with installations that do not meet specification requirements in **one** of the following ways:

Either: Produce a report of the commissioning activities, that includes **all** of the following:

 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

 - identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks to confirm that correct operation is now achieved

9. Ensure the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures

10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - commissioning log/report
 - corrective action report
 - Job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning engineered systems equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out engineered system commissioning activities (such as handling oils, greases, stored pressure/force/charge, dangerous voltages, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals, instructions and other documentation needed in the commissioning process
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function, and how component systems interact

170 Level 3 NVQ in Installation and commissioning

9. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
10. The procedures to be applied during the commissioning activity
11. The importance of making 'off-load' checks before running the equipment under power
12. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
13. How to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel, setting backlash in gears, adjusting and tensioning belt and chain drives, preloading bearings, levelling and aligning)
14. Methods of connecting to mechanical power transmission devices (such as shafts, couplings belt and chain drives)
15. The commissioning of electrical/electronic equipment/components (such as control, safety and alarm devices)
16. The different types of cabling used in the installation activities, and their methods of termination
17. The different types of wiring enclosures that are used (to include conduit, trunking and tray work systems)
18. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
19. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
20. The commissioning of a range of fluid power components (such as pumps, valves, cylinders/actuators, sensors)
21. The fault diagnostic techniques that can be used to help identify problems with the equipment
22. The uses of measuring equipment (such as micrometers, verniers, run-out devices and other measuring devices)
23. The calibration/care and control procedures for tools and equipment used during commissioning
24. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
25. The methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)
26. How to re-assemble the removed components, and how to adjust them to meet the operating specification
27. Recognition of contaminants, and the effects and likely symptoms of contamination in the system
28. The commissioning of process instrumentation and associated peripheral devices (such as pressure, flow, temperature)
29. The commissioning of PLC systems and associated peripheral devices (such as I/O devices, monitors)
30. The recording and/or reporting documentation to be completed for the activities undertaken
31. The types of problem associated with the commissioning activity, and how they can be overcome
32. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
33. The extent of your own authority, and whom you should report to when you have a problem you cannot resolve

Unit No 22: Commissioning Engineered Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure safe isolation of services				
ensure tools and equipment are within current dates				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of engineered system (ONE)				
automatic equipment				
transfer equipment				
product/process checking equipment				
manufacturing/processing equipment				
material handling equipment				
Which must include three of the following interactive technologies A – E (THREE)				
A – Commissioning mechanical equipment/components to include confirming all of the following (ALL)				
positioning, level and alignment of units				
correct securing and torque for fixings				
mechanical connections				
installation of structures				
tensioning/torque setting of drive mechanisms				
alignment and operation of control mechanisms				
B- Commissioning electrical and electronic equipment/components to include confirming all of the following (ALL)				
equipment located and secured correctly				
wiring enclosures/cable protection systems free from damage				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
correct component operation				
correct operation of circuit protectors				
secure terminations				
C – Commissioning fluid power components to include confirming all of the following (ALL)				
equipment located and secured correctly				
connections correct for pipework and hoses				
correct electrical and mechanical connections				
correct component operation				
correct operation of sensors and safety devices				
D – Commissioning process controller components to include confirming all of the following (ALL)				
equipment located and secured correctly				
correct connections of wires and cables				
correct operation for input/output				
data connection				
programme entries/events				
correct operation of PLC peripherals				
satisfactory signal and transmission				
E – Commissioning instrumentation and control components to include confirming all of the following (ALL)				
equipment located and secured correctly				
connections correct for process pipework				
correct operation of peripherals				
settings and calibrations correct				
correct electrical/pneumatic connections				
signal supply to instruments/sensors correct				
satisfactory signal and transmission				
Prior to initial start up carry out all of the following checks (ALL)				
site is safe and meets environmental conditions				
check for equipment damage				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
fluids/lubricants/grease at appropriate level				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
moving parts clear of obstructions				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced power/flow/speed/pressure				
check for leaks				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use four of the following instruments/devices during the commissioning activities (FOUR)				
alignment devices				
measuring devices				
electrical measuring equipment				
fluid power testing equipment				
instrumentation test equipment				
PLC/PC equipment				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
commissioning log/report				
corrective action report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 23: Commissioning Process Controller Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on process controller equipment and systems, in accordance with approved procedures. You will be required to commission equipment controlled by a process or sequential controller, such as programmable logic controller (PLC), or personal computer (PC), which is working in an integrated system involving two or more interactive technologies, such as mechanical, electrical or fluid power.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as printers or remote PCs.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, including checking peripheral components, communication links and loading/downloading of process controller programmes before starting up the equipment, checking and editing programmes, creating back-up copies of completed final programmes, operating the equipment to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, fluid power, PLC control, services and external units/equipment such as monitoring devices, sensors and actuators.

You will also be required to either make a full report of any defects or deviations found, or to resolve any problems and rectify faults at component or unit level.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the commissioning of process control equipment. You will understand the commissioning methods, techniques and procedures, and their application. You will know how the equipment functions, the purpose of the individual components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

- 1 Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation/programmes used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - ensure that all tools and equipment used are within current calibration dates
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out the commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of process control installations:
 - monitoring system
 - safety system
 - diagnostic system
 - combination system
 - process/product control system
 - business management system

- Which must include **one** of the following:

 - fixed I/O units
 - rack-mount controller units
 - modular controller units

Plus **four** of the following types of PLC peripheral equipment:

 - sensors
 - actuators
 - switches
 - motor starters
 - electrical wire and cable connections
 - modems
 - printers
 - signal transmission components/cables
 - overload protection devices
 - PC peripheral devices

4. Prior to initial start-up, carry out **eight** the following checks:
 - electrostatic precautions are used when handling sensitive components and circuit boards
 - check for damage to pipework/wiring/equipment following the installation
 - the equipment has been installed and secured in position according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid power, PLC)
 - all input and output devices are connected and operative
 - communications links are ready for start-up
 - all wiring/cables/pipework are clear of moving parts
 - labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable

5. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start-up procedures, and confirm that the equipment/system meets specifications
 - run the equipment at reduced power/speed/flow
 - check for leaks during operations
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition

6. During commissioning, carry out **seven** of the following programming activities:
 - select and use appropriate programming devices (such as terminals, hand-held programmers, PCs)
 - programme by computer-based authoring (to include subroutines)
 - use ladder logic, statement lists, or system flowcharts
 - produce back-ups of completed programs
 - edit, enter and remove contacts from lines of logic
 - carry out on-line monitoring of programs
 - use 'on-' and 'off-line' programming
 - use single-step mode of operation
 - load, read and save programs
 - alter counter and timer settings
 - force contacts on and off

7. Use **three** of the following instruments/devices during the commissioning activities:
 - multimeter
 - watt meter
 - voltmeter
 - programming devices
 - ammeter
 - insulation resistance tester
 - signal generator
 - earth-loop impedance tester
 - monitoring devices
 - other specific test equipment

8. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment/programme malfunction
 - complete malfunction of equipment/programme

9. Deal, in **one** of the following ways, with installations that do not meet specification requirements:
Either: for equipment being controlled by the process controller, produce a report of the commissioning activities that includes **all** of the following:
 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect

178 Level 3 NVQ in Installation and commissioning

- recommended actions to correct the fault

Or: for faults in the process controller or associated peripheral equipment, rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

- identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
- isolating and dismantling the equipment to unit, sub-assembly or component level
- replacing damaged or defective items
- re-running the commissioning checks to confirm correct operation is now achieved

Or: for faults in the process controller programme, rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

- rewriting or editing the programme to correct the fault
- re-running the commissioning checks and programme to confirm that correct operation is now achieved

10. Ensure that the commissioned equipment complies with **two** or more of the following standards:

- equipment manufacturer's operating spec/range
- IEE wiring regulations
- BS and/or ISO standards
- health, safety and environmental requirements
- customer standards and requirements
- company standards and procedures

11. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:

- corrective action report
- commissioning log/report
- job sheet
- customer specific documentation
- handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning PLC equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out commissioning activities on PLC equipment (such as unexpected programme operation, out of sequence operations), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, IEE regulations, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The procedures to be applied during the commissioning activity
9. The equipment to be commissioned, its operating procedures and function
10. The procedures for using computer-based authoring software for design and development
11. The numbering system and codes used for identification inputs and outputs
12. Programming techniques and codes used (interlocking, timers, counters, sub-routines, etc)
13. The techniques involved in editing, entering and removing contacts from lines of logic and, where applicable, the procedure to be followed for 'on-' and 'off-line' programming
14. The checks to be carried out on the equipment/circuit prior to undertaking the commissioning operations (such as installation damage, I/O function, electrical connections, components are free from moving parts, all guards and safety devices are in place)
15. How to make adjustments to components/assemblies to ensure that they function correctly (such as timing, sequencing)
16. The fault diagnostic techniques that can be used to help identify problems with the equipment
17. The uses of measuring/test equipment, such as multimeters, signal generators, and other measuring devices or monitoring devices

18. The calibration/care and control procedures for the tools and equipment used during commissioning
19. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
20. The methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, forcing contacts on and off, proofmarking of components, removal of components by de-soldering)
21. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
22. The recording and/or reporting documentation to be completed for the activities undertaken
23. The types of problem associated with the commissioning activity, and how they can be overcome
24. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
25. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 23: Commissioning Process Controller Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure safe isolation of services				
ensure tools and equipment are within current dates				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of process control installations (ONE)				
monitoring system				
safety system				
diagnostic system				
combination system				
process/product control system				
business management system				
Which MUST include one of the following (ONE)				
fixed I/O units				
rack-mount controller units				
modular controller units				
PLUS four of the following types of PLC peripheral equipment (FOUR)				
sensors				
actuators				
switches				
motor starters				
electrical wire and cable connectors				
modems				
printers				
signal transmission				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
components/cables				
overload protection devices				
PC peripheral devices				
Prior to initial start up carry out eight of the following checks (EIGHT)				
electrostatic precautions are used				
check for damage				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
input/output devices connected and operative				
communications links ready				
all wiring/cables are clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced power/flow/speed				
check for leaks				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
During commissioning carry out seven of the following programme activities (SEVEN)				
use programming devices				
programme by computer base authoring				
use ladder logic, statement list, system flowcharts				
produce program back-ups				
edit, enter, remove contacts				
carry out on-line monitoring				
use 'on-' and 'off-line' programming				
use single step mode				
load read and save programs				
alter counter/timer settings				
force contacts on and off				
Use three of the following instruments/devices during the commissioning activities (THREE)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
multimeter				
watt meter				
voltmeter				
programming devices				
ammeter				
insulation resistance tester				
signal generator				
earth loop impedance tester				
monitoring devices				
other equipment				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: for equipment being controlled by the process controller produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: for faults in the process controller or associated peripheral equipment rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
OR: for faults in the process controller programme, rectify the faults as part of the commissioning process to include carrying out all of the following (ALL)				
rewriting or editing the programme				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
corrective action report				
commissioning log/report				
job sheet				
customer specific documentation				
handover report				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 24: Commissioning Instrumentation and Control Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on instrumentation and control equipment and systems, in accordance with approved procedures. You will be required to commission a range of instrumentation and control equipment, such as pressure, flow, and temperature monitoring and control systems, fiscal monitoring equipment (gas/electricity meters, etc), fire and gas detection and alarm systems, industrial weighing systems, speed measurement and control systems, vibration monitoring equipment, nucleonics and radiation measurement, analysers, recorders and indicators, telemetry systems and emergency shutdown systems.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as small weighing machines, or other hand-held testing equipment.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking instrument calibration, adjusting and setting equipment operating parameters, making 'off-load' checks before powering up the equipment, operating the equipment to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, fluid power, PLC control, services and external units/equipment, such as monitoring devices, sensors and actuators. You will also be required to either make a full report of any defects or deviations found, or to resolve any problems and rectify faults at component or unit level.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the commissioning of instrumentation and control equipment. You will understand the commissioning methods, techniques and procedures, and their application. You will know how the equipment functions, the purpose of the individual components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

- 1 Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation/programmes used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air or fluids)
 - ensure that all tools and equipment used are within current calibration dates
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of instrumentation and control systems:
 - pressure monitoring/control system
 - flow monitoring/control system
 - temperature monitoring/control system
 - weight monitoring/control system
 - fiscal metering
 - fire detection and alarm system
 - gas detection and alarm system
 - control systems (such as indexing, positioning, sequencing)
 - emergency shutdown system
 - speed measurement
 - speed control system
 - vibration monitoring/control system
 - nucleonic and radiation system
 - analysis systems
 - telemetry systems
4. Prior to initial start-up, carry out **eight** of the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid power, PLC)
 - all signalling devices are connected and operative

- settings, calibration of individual instruments (gauges, sensors, actuators)
 - all fluid levels, air pressures are appropriate for start-up
 - all wiring/cables/pipework are clear of moving parts
 - labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable
5. Use **all** of the following commissioning techniques, methods and procedures:
- carry out start-up procedures and confirm that the equipment/system meets specifications
 - run the equipment at reduced power/speed/flow/pressure
 - check for leaks during operations
 - check that instruments respond as per their operational specifications
 - monitor and check signal transmission strength
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct function
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as temperature range, pressures, weight limits, flow, timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow/pressure
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition
6. Use **three** of the following instruments/devices during the commissioning activities:
- signal testing devices
 - standard test gauges
 - analogue and digital meters
 - digital pressure indicators
 - calibrated flow meters
 - special purpose test equipment
 - pressure testing devices
 - comparators
 - manometers
 - current injection devices
 - calibrated weights
 - logic probes
 - temperature baths
 - workshop potentiometers
 - dead weight testers
 - insulation testers
7. Deal with **two** of the following conditions during the commissioning process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:
- Either:** Produce a report of the commissioning activities that includes **all** of the following:
- checks and tests undertaken
 - recommended actions to correct the fault
 - probable causes/sources of the defect
 - where the installation fails to meet the specification
- Or:** Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:
- identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks, to confirm that correct operation is now achieved
9. Ensure that the commissioned equipment complies with **two** or more of the following standards:
- equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements

- customer standards and requirements
 - company standards and procedures
10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- corrective action report
 - commissioning log/report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning instrumentation and control equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out instrumentation commissioning activities (such as stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, IEE regulations, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
10. The procedures to be applied during the commissioning activity
11. The importance of making 'off-load' checks before running the equipment under power
12. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
13. How to make adjustments to components/assemblies to ensure that they function correctly (such as temperature, pressure, weight, timing, sequencing)
14. The fault diagnostic techniques that can be used to help identify problems with the equipment
15. The uses of measuring equipment (such as signal testing devices, flow or pressure meters and other measuring devices)
16. The calibration/care and control procedures for the tools and equipment used during commissioning
17. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
18. The methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/force, proofmarking of components, removal of components by de-soldering)
19. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
20. The recording and/or reporting documentation to be completed for the activities undertaken
21. The types of problem associated with the commissioning activity, and how they can be overcome
22. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
23. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 24: Commissioning Instrumentation and Control Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of instrumentation and control systems (ONE)				
pressure monitoring/control				
flow monitoring/control				
temperature monitoring/control				
weight monitoring/control				
fiscal monitoring				
fire detection and alarm				
gas detection and alarm				
control systems				
emergency shutdown				
speed measurement				
speed control				
vibration monitoring/control				
nucleonic and radiation analysis systems				
telemetry systems				
Prior to initial start up carry out eight of the following checks (EIGHT)				
site is safe and meets environmental conditions				
check for wiring/ equipment damage				
equipment installed and				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
secured to specification				
utilities connected and operational				
connections correctly made				
signalling devices connected and operative				
settings calibrated				
fluid levels/air pressures are appropriate				
wiring/cables/pipework clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced power/speed/flow/pressure				
check for leaks				
check instruments respond as per specification				
monitor/check signal transmission strength				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use three of the following instruments/devices during the commissioning activities (THREE)				
signal testing devices				
standard test gauges				
analogue and digital meters				
digital pressure indicators				
calibrated flow meters				
special purpose testers				
pressure testing devices				
comparators				
manometers				
current injection devices				
calibrated weights				
logic probes				
temperature baths				
workshop potentiometers				
dead weight testers				
insulation testers				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
commissioning log/report				
corrective action report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____
Assessor: _____

Date: _____
Date: _____

Unit No 25: Commissioning Fluid Power Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on fluid power equipment and systems, in accordance with approved procedures. You will be required to commission a range of fluid power systems including hydraulic, pneumatic and vacuum equipment, which will include units such as pumps, valves, actuators, sensors, intensifiers, regulators, compressors, pipes and hoses and other specific fluid power equipment.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as portable compressors or pumps.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking installation and line pressure, adjusting and setting equipment operating parameters, making 'off-load' checks before powering up the equipment, operating the equipment to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, PLC control, services and external units/equipment, such as monitoring devices, sensors and actuators. You will also be required to either make a full report of any defects or deviations found, or to resolve any problems and rectify faults at component or unit level.

Following successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the commissioning of fluid power equipment and systems. You will understand the commissioning methods, techniques and procedures, and their application. You will know how the equipment functions, the purpose of the individual components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation/programmes used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of fluid power installations:
 - pneumatic
 - hydraulic
 - vacuum
 - combination

- Which must include **seven** of the following:

 - pumps
 - compressors
 - reservoirs/storage
 - lubricators
 - valves
 - accumulators
 - pressure intensifiers
 - regulators
 - cylinders
 - switches
 - receivers
 - actuators
 - sensors
 - other specific

4. Prior to initial start-up, carry out **eight** the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to pipework/wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative (mechanical, electrical, PLC)
 - all fluid power connections have been made correctly
 - check all ladder logic or sequential tables against actual installation
 - all sensors are connected and operative
 - check for contamination, and that fluid levels and line pressures are appropriate for start-up
 - all wiring/cables/pipework are clear of moving parts
 - labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable

5. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start-up procedures and confirm that the equipment/system meets specifications
 - run the equipment at reduced pressure/speed/flow
 - check for leaks during operations
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition

6. Use **three** of the following instruments/devices during the commissioning activities:
 - alignment devices
 - pressure testing devices
 - flow testing devices
 - measuring devices (mechanical and electrical)
 - bleeding devices
 - specific diagnostic aids
 - PLC/PC equipment

7. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:

Either: Produce a report of the commissioning activities, that includes **all** of the following:

 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

 - identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-pressurising and bleeding the system (where appropriate)
 - re-running the commissioning checks, to confirm that correct operation is now achieved

9. Ensure that the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures

10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - corrective action report
 - commissioning log/report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning fluid power equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out fluid power commissioning activities (such as handling oils, greases, stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals, instructions (including BS and ISO schematics, IEE regulations, symbols and terminology) and other documents needed in the commissioning process
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The principles and theories associated with fluid power equipment (including cascading and logic/ladder tables)
10. The identification and application of different types of fluid power components
11. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
12. The procedures to be applied during the commissioning activity
13. The importance of making 'off-load' checks before running the equipment under power
14. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
15. How to make adjustments to components/assemblies to ensure that they function correctly (such as pressure, timing, sequencing)
16. The fault diagnostic techniques that can be used to help identify problems with the equipment
17. The uses of instruments (such as pressure, flow testing devices, bleeding devices and other measuring devices)
18. The calibration/care and control procedures for the tools and equipment used during commissioning
19. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
20. The methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressure/force, proofmarking of components, removal of pipes and connections)
21. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
22. The recording and/or reporting documentation to be completed for the activities undertaken
23. The types of problem associated with the commissioning activity, and how they can be overcome
24. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
25. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 25: Commissioning Fluid Power Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of fluid power installations (ONE)				
pneumatic				
hydraulic				
vacuum				
combination				
Which must include seven of the following (SEVEN)				
pumps				
compressors				
reservoirs/storage				
lubricators				
valves				
accumulators				
pressure intensifiers				
regulators				
cylinders				
switches				
receivers				
actuators				
sensors				
other specific				
Prior to initial start up carry out eight of the following checks (EIGHT)				
site is safe and meets				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
environmental conditions				
check for damage to pipework/wiring/equipment				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
check ladder logic and sequential tables				
sensors connected and operative				
contaminant free, fluid and pressure levels appropriate				
wiring/cables/pipework clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced power/flow/speed/pressure				
check for leaks				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use three of the following instruments/devices during the commissioning activities (THREE)				
alignment devices				
pressure testing devices				
flow testing devices				
measuring devices				
bleeding devices				
specific diagnostic devices				
PLC/PC equipment				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-pressure/bleed system				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
commissioning log/report				
corrective action report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 26: Commissioning Emergency Electrical Power Generation Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on emergency electrical power generation equipment and systems, in accordance with approved procedures. You will be required to commission a range of emergency electrical power generation equipment, such as turbine alternator sets, piston engine sets, and generators.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as portable generators or batteries.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level and alignment, adjusting and setting equipment operating parameters, making 'off-load' checks before starting up the equipment, operating the equipment at reduced loads/speeds to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, PLC control, fuel supplies and external units/equipment, such as belts and chain drives, clutches and brakes. You will also be required to either make a full report of any defects or deviations found, or to resolve any problems and rectify faults at component or unit level.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the commissioning of emergency power generation equipment. You will understand the commissioning methods, techniques and procedures, and their application. You will know how the equipment functions, the purpose of the individual components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

- 1 Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types emergency electrical power generation installations:
 - turbine alternator sets
 - piston engine alternator sets
 - generators
4. Prior to initial start-up, carry out **all** of the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to pipework/wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid power, PLC)
 - all sensors are connected and operative
 - check for contamination, and that fluids, lubricants and grease are at the appropriate levels for start-up
 - all wiring/cables/pipework are clear of moving parts
 - all labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable
5. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start-up procedures and confirm that the equipment/system meets specifications
 - run the equipment at recommended initial settings (eg, reduced power)
 - check for leaks during operations
 - check to ensure that any exhaust emission meets environmental requirements
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning

- load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as speeds, power output, temperature)
 - conduct a trial run of the equipment at full power/speed
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition
6. Use **three** of the following instruments/devices during the commissioning activities:
- straight edges and feeler gauges
 - dial test indicators
 - electrical measuring devices
 - strobe
 - mechanical measuring devices
7. Deal with **two** of the following conditions during the commissioning process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:
- Either:** Produce a report of the commissioning activities that includes **all** of the following:
- checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault
- Or:** Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:
- identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks, to confirm that correct operation is now achieved
9. Ensure the commissioned equipment complies with **two** or more of the following standards:
- equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures
10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- corrective action report
 - commissioning log/report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning emergency power generation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out emergency power generation commissioning activities (such as handling oils, greases, stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals and instructions
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
10. The procedures to be applied during the commissioning activity
11. The importance of making 'off-load' checks before running the equipment under power
12. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
13. How to make adjustments to components/assemblies to ensure they function correctly (such as setting working clearance, setting travel, setting backlash in gears, adjusting and tensioning belt and chain drives, preloading bearings)
14. The fault diagnostic techniques that can be used to help identify problems with the equipment
15. The uses of measuring equipment (such as micrometers, verniers, run-out devices and other measuring devices)
16. The calibration/care and control procedures for the tools and equipment used during commissioning
17. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
18. The methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)
19. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
20. The recording and/or reporting documentation to be completed for the activities undertaken
21. The types of problem associated with the commissioning activity, and how they can be overcome
22. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
23. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 26: Commissioning Emergency Electrical Power Generation Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of emergency electrical power generation installations (ONE)				
turbine alternator sets				
piston engine alternator sets				
generators				
Prior to initial start up carry out all of the following checks (ALL)				
site is safe and meets environmental conditions				
check for pipework/wiring/equipment damage				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
sensors connected and operative				
contaminant free and fluid, lubricants, grease at appropriate level				
wiring/cables/pipework clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at initial settings				
check for leaks				
check emissions meet environmental requirement				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use three of the following instruments/devices during the commissioning activities (THREE)				
straight edge and feeler gauges				
dial test indicators				
electrical measuring devices				
strobe				
mechanical measuring devices				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
commissioning log/report				
corrective action report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 27: Commissioning Environmental Pollution Control Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on environmental pollution control equipment and systems, in accordance with approved procedures. You will be required to commission a range of equipment, all of which is encompassed within an overall installation. Typical installations will include environmental pollution control system/equipment, which could be air pollution control equipment such as decarbonisation (CO₂ reduction), de-nitrification, deodorising, desulphurisation, dust collectors, smoke filters, scrubbers, and removal of refrigerant gases; effluent treatment equipment, such as aerobic and anaerobic biochemical treatment, filter screens and presses, liquid separators, waste oil treatment, sewage treatment, industrial waste water treatment; noise and vibration equipment, such as vibration prevention and isolation, noise attenuation and acoustic enclosures; waste and used product handling, storing and recycling equipment, such as appliance recycling, battery recycling, incinerators, ash handling, heat recovery, shredders and crushers, conveyors and sorters, and compaction.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such mobile and portable items of equipment, or simple fixed units.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level and alignment, adjusting and setting equipment operating parameters, making 'off-load' checks before starting up the equipment, operating the equipment at reduced loads/speeds to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, fluid power, PLC control, and services such as water or fuel, as appropriate to the equipment being commissioned.

Following successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, and this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying commissioning procedures for environmental pollution control equipment. You will understand the commissioning methods, techniques and procedures used, and their application. You will know how the equipment functions, the purpose of the individual units/components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards (such as COMAH, CDM)
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - EC machinery regulations
 - commissioning procedures
 - product/process specifications
 - installation report
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Commission **one** of the following types of environmental pollution control equipment:
 - air pollution control equipment (such as decarbonisation (CO₂ reduction), de-nitrification, deodorising, desulphurisation, dust collectors, smoke filters, scrubbers, and removal of refrigerant gases)
 - effluent treatment equipment (such as aerobic and anaerobic biochemical treatment, filter screens and presses, liquid separators, waste oil treatment, sewage treatment, industrial waste water treatment)
 - noise and vibration equipment (such as vibration prevention and isolation, noise attenuation and acoustic enclosures)
 - waste and used product handling, storing and recycling equipment (eg, appliance recycling, battery recycling, incinerators, ash handling, heat recovery, shredders and crushers, conveyors and sorters, compaction)
4. Commission **six** of the following mechanical equipment items:
 - actuators
 - mechanical drives
 - burners
 - guards
 - instrumentation
 - linkages
 - pumps
 - gear boxes
 - couplings
 - safety devices

5. Commission **six** of the following electrical equipment items:
- annunciator
 - building management device
 - distribution board
 - switch gear
 - control panel/system
 - sensors
 - monitoring device
 - instrumentation
 - motor and starter
 - safety device
6. Prior to initial start-up, carry out **all** of the following checks:
- the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to the equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid power, PLC)
 - all fluids, lubricants and grease are at the appropriate level for start-up
 - all moving parts are clear of obstructions
 - all labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable
7. Use **all** of the following commissioning methods, techniques and procedures:
- carry out start-up procedures, and confirm that the equipment/system meets specifications
 - run the equipment at recommended initial settings (eg, reduced power/speed/flow)
 - check for leaks during operations
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as speeds, feeds, pressures, flow, timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow
 - confirm that the final product/process outcomes meet specifications
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition
8. Use **four** of the following instruments/devices during the commissioning activities:
- alignment devices
 - PLC/PC test equipment
 - electrical measuring equipment
 - mechanical measuring equipment
 - fluid power testing equipment
 - instrumentation test equipment
9. Deal with **two** of the following conditions during the commissioning process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
10. Deal, in **one** of the following ways, with installations that do not meet specification requirements:
- Either:** Produce a report of the commissioning activities that includes **all** of the following:
- checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault
- Or:** Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:
- identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks, to confirm that correct operation is now achieved

11. Ensure that the commissioned equipment complies with **one** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures
12. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - commissioning log/report
 - corrective action report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning plant and equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials, such as the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, Safe Working in Confined Spaces, and CE supply of machinery regulations)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out environmental pollution control equipment commissioning activities (such as associated hazardous substances, their measurements and exposure limits), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals and job instructions
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
10. The procedures to be applied during the commissioning activity
11. How to apply methods and techniques to carry out noise and vibration measurement (including noise and vibration attenuation systems)
12. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
13. The importance of making 'off-load' checks before running the equipment under power
14. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
15. How to make adjustments to components/assemblies to ensure they function correctly (such as setting working clearance, setting travel, setting backlash in gears, adjusting and tensioning belt and chain drives, preloading bearings)
16. The fault diagnostic techniques that can be used to help identify problems with the equipment
17. The uses of measuring equipment (such as micrometers, verniers, run-out devices and other measuring devices)
18. The calibration/care and control procedures for the tools and equipment used during commissioning
19. The importance of using the approved plant change (modification) procedures
20. The different condition monitoring measurement techniques you need to use
21. The different control systems that are used (such as PLCs)
22. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
23. The methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)
24. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
25. The recording and/or reporting documentation to be completed for the activities undertaken
26. The types of problem associated with the commissioning activity, and how they can be overcome

27. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
28. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 27: Commissioning Environmental Pollution Control Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
EC machinery regulations				
commissioning procedures				
product/process specifications				
resources required				
Commission one of the following types of environmental pollution control equipment (ONE)				
air pollution control				
effluent treatment				
noise and vibration				
waste and product handling				
Commission six of the following mechanical equipment items (SIX)				
actuators				
mechanical drives				
burners				
guards				
instrumentation				
linkages				
pumps				
gear boxes				
pumps				
safety devices				
Commission six of the following electrical equipment items (SIX)				
annunciator				
building management device				
distribution board				
switchgear				
control panel/system				
sensors				
monitoring device				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
instrumentation				
motor and starter				
safety device				
Prior to initial start up carry out all of the following checks (ALL)				
site is safe and meets environmental conditions				
check for equipment damage				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
all fluids/lubricants/grease at the appropriate level				
all moving parts are clear of obstruction				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at initial settings				
check for leaks				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
confirm outcomes meet specification				
monitor and record				
shut down/isolate safely				
Use four of the following instruments/devices during the commissioning activities (FOUR)				
alignment devices				
PLC/PC test equipment				
electrical measuring equipment				
mechanical measuring equipment				
fluid power testing equipment				
instrumentation test equipment				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with one or more of the following standards (ONE)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
commissioning log/report				
corrective action report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 28: Commissioning Workplace Environmental Control Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on workplace environmental control equipment and systems, in accordance with approved procedures. You will be required to commission workplace environmental control equipment that will control or monitor a number of different systems, including heating and ventilation, air conditioning and ventilation units, chillers, boilers, lighting, lifts, building/room access, fire systems and CCTV systems.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level and alignment, adjusting and setting equipment operating parameters and programmes, making pre-checks before starting up the equipment, operating the equipment in incremental stages to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, electronic and software equipment/systems.

Following successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying commissioning procedures for workplace environmental control equipment. You will understand the commissioning methods, techniques and procedures used, and their application. You will know how the equipment functions, the purpose of the individual units/components/programmes and about any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities, correcting or reporting faults and solving functional and software problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carrying out commissioning of a workplace environmental control system that controls/monitors **three** of the following:
 - heating and ventilation
 - air conditioning and ventilation
 - lighting
 - CCTV
 - chillers
 - lift control
 - fire systems
 - intruder/alarm systems
 - building/room access
 - boilers
 - other system (specify)
4. Prior to initial start-up, carry out **all** the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to equipment following the installation
 - the equipment has been installed and secured in position according to specification
 - the correct software/programme has been installed
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid power, PLC)
 - all labels, safety and warning signs are attached in the correct locations
 - all safety systems are operable

5. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start up procedures and confirm that the equipment/system meets specifications
 - check for leaks during operations
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - make all necessary adjustments to equipment settings and programmes to achieve specification parameters (such as trip defeats, speeds, flow, timing, sequence)
 - identify and resolve any functional, component or software problems
 - conduct a trial run of the equipment/system where this is acceptable
 - confirm that the system outcomes meet specifications
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition

6. Use **three** of the following instruments/aids during the commissioning activities:
 - multimeter
 - watt meter
 - voltmeter
 - ammeter
 - insulation resistance tester
 - light meter
 - earth-loop impedance
 - continuity tester
 - phase orientation tester
 - self diagnostic software
 - other test equipment (specify)

7. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:

Either: Produce a report of the commissioning activities that includes **all** of the following:

 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

 - identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks to confirm that correct operation is now achieved

9. Ensure that the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures

10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - commissioning log/report
 - corrective action report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning workplace environmental control systems and equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out workplace environmental control systems commissioning activities (such as misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals and instructions
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
10. The procedures to be applied during the commissioning activity
11. The importance of making 'off-load' checks before running the equipment under power
12. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
13. How to make adjustments to components/assemblies to ensure that they function correctly
14. The fault diagnostic techniques that can be used to help identify problems with the equipment
15. The uses of measuring equipment (such as multimeter, wattmeter, voltmeter, ammeter, insulation resistance tester, light meter, earth-loop impedance tester, continuity tester, phase orientation tester, self-diagnostic software and other measuring devices)
16. The calibration/care and control procedures for tools and equipment used during commissioning
17. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
18. The methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of components by extraction or pressing)
19. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
20. The recording and/or reporting documentation to be completed for the activities undertaken
21. The types of problem associated with the commissioning activity, and how they can be overcome
22. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
23. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 28: Commissioning Workplace Environmental Control Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning of a workplace environmental control system that controls/monitors three of the following (THREE)				
heating and ventilation				
air conditioning and ventilation				
lighting				
CCTV				
chillers				
lift control				
fire systems				
intruder/alarm systems				
building/room access				
boilers				
other system				
Prior to initial start up carry out all of the following checks (ALL)				
site is safe and meets environmental conditions				
check for equipment damage				
equipment installed and secured to specification				
correct software/programme				
utilities connected and operational				
connections correctly made				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
labels/safety/warning signs correctly attached				
safety systems operable				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
check for leaks				
make sensory checks				
run operating sequence to carry out function checks				
adjust settings to meet specification parameters				
identify and resolve functional, component, software problems				
conduct trail run				
confirm outcomes				
monitor and record				
shut down/isolate safely				
Use three of the following instruments/devices during the commissioning activities (THREE)				
multimeter				
watt meter				
voltmeter				
ammeter				
insulation resistance tester				
light meter				
earth-loop impedance				
continuity tester				
phase orientation tester				
specific diagnostic software				
other equipment				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
commissioning log/report				
corrective action report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 29: Commissioning Heating and Ventilation Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on heating and ventilation equipment and systems, in accordance with approved procedures. You will be required to commission a range of heating and ventilation systems, which will include equipment using primary heating sources (gaseous, liquid, solid fuel, electricity and renewable energy). The system will also include motors, fans, pumps, valves, couplings, ducting and trunking, heaters, filters, and control devices such as thermostats and switches.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as portable heaters or fans.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level, alignment and air/fluid flow, adjusting and setting equipment operating parameters, making 'off-load' checks before powering up the equipment, operating the equipment to prove its function and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, fluid, PLC control, services and external units/equipment such as monitoring devices, sensors and actuators. You will also be required to either make a full report of any defects or deviations found, or to resolve any problems and rectify faults at component or unit level.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the commissioning of heating and ventilation equipment. You will understand the commissioning methods, techniques and procedures, and their application. You will know how the equipment functions, the purpose of the individual components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

- 1 Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of heating and ventilation installations:
 - liquid
 - gaseous
 - solid fuel
 - renewable energy
 - electrical

- Which must include **ten** of the following:

 - pipework
 - boiler
 - motors
 - fans
 - blowers
 - pumps
 - calorifiers
 - ducting/trunking
 - gauges/indicators
 - lubricators
 - sensors and actuators
 - condenser
 - control devices
 - safety devices
 - regulators
 - valves

- radiators
 - electrical components
 - electrical wiring and connectors
 - other (specify)
 - local heating system (such as in-line duct heaters, skirting heating, fan coil, convectors, storage pipe heaters and air handling units)
4. Prior to initial start-up, carry out **eight** the following checks:
- the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to pipework/ducting/wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid , PLC)
 - provisions have been made for emissions to meet environmental requirements
 - all sensors are connected and operative
 - check for contamination, and that fluid levels and pressures are appropriate for start-up
 - all wiring/cables/pipework are clear of moving parts
 - labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable
5. Use **all** of the following commissioning techniques, methods and procedures:
- carry out start-up procedures and confirm that the equipment/system meets specifications
 - run the equipment at reduced speed/flow/pressure
 - check for leaks during operations
 - check environmental conditions, including emission to atmosphere
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition
6. Use **four** of the following instruments/devices during the commissioning activities:
- alignment devices
 - pressure sensing and monitoring
 - flow testing devices
 - measuring devices (mechanical and electrical)
 - flushing/bleeding devices
 - temperature sensing device
 - specific diagnostic aids
 - emission testers
 - PLC/PC equipment
7. Deal with **two** of the following conditions during the commissioning process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:
- Either:** Produce a report of the commissioning activities that includes **all** of the following:
- checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault
- Or:** Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:
- identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks to confirm that correct operation is now achieved

9. Ensure that the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures
10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - corrective action report
 - commissioning log/report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning heating and ventilation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
 2. The procedures to be carried out before starting work on commissioning activities (e.g. obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
 3. The specific health and safety precautions to be applied during the commissioning procedure, and the effects on others (including the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)
 4. Hazards associated with carrying out heating and ventilation commissioning activities (such as stored pressure/fluids, hot surfaces, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise them
 5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
 6. How to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, IEE regulations, symbols and terminology)
 7. How to carry out currency/issue checks on the specifications you are working with
 8. Typical building design temperatures (such as for offices, factories (light and heavy work), warehouses and canteens)
 9. The equipment to be commissioned, its operating procedures and function
 10. The principles and theories associated with heating and ventilation systems/equipment
 11. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
 12. The procedures to be applied during the commissioning activity
 13. The importance of making 'off-load' checks before running the equipment under power
 14. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
 15. How to make adjustments to components/assemblies to ensure that they function correctly (such as pressure, flow, temperature, timing, sequencing)
 16. The fault diagnostic techniques that can be used to help identify problems with the equipment
 17. The uses of measuring equipment (such as pressure, flow testing devices, bleeding devices and other measuring devices)
 18. The calibration/care and control procedures for the tools and equipment used during commissioning
 19. The procedure for obtaining replacement parts, materials and other consumables necessary for commissioning
 20. The methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/fluid, proofmarking of components, removal of components by de-soldering)
 21. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
 22. The recording and/or reporting documentation to be completed for the activities undertaken
 23. The types of problem associated with the commissioning activity, and how they can be overcome
 24. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
- The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 29: Commissioning Heating and Ventilation Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of heating and ventilation installations (ONE)				
liquid				
gaseous				
solid fuel				
renewable energy				
electrical				
Which must include ten of the following (TEN)				
pipework				
boiler				
motors				
fans				
blowers				
pumps				
calorifiers				
ducting/trunking				
gauges/indicators				
lubricators				
sensors and actuators				
condenser				
control devices				
safety devices				
regulators				
valves				
radiators				
electrical components				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
electrical wiring/connectors				
other				
local heating system				
Prior to initial start up carry out eight of the following checks (EIGHT)				
site is safe and meets environmental conditions				
check for damage to pipework/wiring/equipment				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
emissions meet environmental requirements				
sensors connected and operative				
contaminant free, fluid and pressure levels appropriate				
wiring/cables/pipework clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced power/flow/speed/pressure				
check for leaks				
check environmental conditions				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use four of the following instruments/devices during the commissioning activities (FOUR)				
alignment devices				
pressure sensing/monitoring				
flow testing devices				
measuring devices				
flushing/bleeding devices				
temperature sensing				
specific diagnostic devices				
emission testers				
PLC/PC equipment				
Deal with two of the following conditions during the commissioning process (TWO)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
corrective action report				
commissioning log/report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 30: Commissioning Air Conditioning and Ventilation Equipment and Systems

Unit Summary

This unit identifies the competencies you need to carry out commissioning activities on air conditioning and ventilation equipment and systems, in accordance with approved procedures. You will be required to commission a range of air conditioning and ventilation systems, which will include airflow generation, distribution and control systems. This will also include equipment such as motors, fans, pumps, ducting and trunking, heaters, safety devices, sensors and activators, and control devices.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as portable fans or humidifiers.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level, alignment and air/fluid flow, adjusting and setting equipment operating parameters, making 'off-load' checks before powering up the equipment, operating the equipment to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, fluid, PLC control, services and external units/equipment such as monitoring devices, sensors and actuators. You will also be required to either make a full report of any defects or deviations found, or to resolve any problems and rectify faults at component or unit level.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the commissioning of air conditioning and ventilation equipment. You will understand the commissioning methods, techniques and procedures, and their application. You will know how the equipment functions, the purpose of the individual components, and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of air conditioning and ventilation installations:
 - remote air conditioning generation
 - local air conditioning distribution
 - air conditioning controlWhich must include **ten** of the following:
 - pipework
 - motors
 - chillers
 - pumps
 - humidifiers
 - condensers
 - ducting/trunking
 - fans
 - evaporators
 - heaters
 - sensors and actuators
 - electrical wiring/connectors
 - control devices
 - safety devices
 - gauges/indicators
 - electrical components
 - other (specify)

4. Prior to initial start-up, carry out **all** of the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to pipework/ducting/wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid, PLC)
 - provisions have been made for emissions to meet environmental requirements
 - all sensors are connected and operative
 - check for contamination, and that fluid levels and pressures are appropriate for start-up
 - all wiring/cables/pipework are clear of moving parts
 - labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable

5. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start-up procedures and confirm that the equipment/system meets specifications
 - run the equipment at reduced pressure/speed/flow
 - check for leaks during operations
 - check environmental conditions, including emission to atmosphere
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition

6. Use **four** of the following instruments/devices during the commissioning activities, as appropriate to the equipment:
 - alignment devices
 - pressure sensing and monitoring
 - flow testing devices
 - measuring devices (mechanical and electrical)
 - flushing and bleeding devices
 - temperature sensing device
 - specific diagnostic aids
 - emission testers
 - PLC/PC equipment

7. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:

Either: Produce a report of the commissioning activities that includes **all** of the following:

 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

 - identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks, to confirm that correct operation is now achieved

9. Ensure that the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements

- customer standards and requirements
 - company standards and procedures
10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- corrective action report
 - commissioning log/report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning air conditioning and ventilation equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
 2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
 3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others (including the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)
 4. Hazards associated with carrying out air conditioning and ventilation commissioning activities (such as stored pressure/fluid, hot/cold surfaces, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise them
 5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
 6. How to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, IEE regulations, symbols and terminology)
 7. How to carry out currency/issue checks on the specifications you are working with
 8. The equipment to be commissioned, its operating procedures and function
 9. Typical building design temperatures (such as for offices, factories (light and heavy work), warehouses and canteens)
 10. The principles and theories associated with air conditioning and ventilation equipment
 11. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
 12. The procedures to be applied during the commissioning activity
 13. The importance of making 'off-load' checks before running the equipment under power
 14. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
 15. How to make adjustments to components/assemblies to ensure that they function correctly (such as emissions, pressure, flow, temperature, timing, sequencing)
 16. The fault diagnostic techniques that can be used to help identify problems with the equipment
 17. The uses of measuring equipment (such as flow testing devices, emission detectors, bleeding devices and other measuring devices)
 18. The calibration/care and control procedures for tools and equipment used during commissioning
 19. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
 20. The methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/fluid, proofmarking of components, removal of components by de-soldering)
 21. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
 22. The recording and/or reporting documentation to be completed for the activities undertaken
 23. The types of problem associated with the commissioning activity, and how they can be overcome
 24. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
- The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 30: Commissioning Air Conditioning and Ventilation Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of air conditioning and ventilation installations (ONE)				
remote air conditioning				
local air conditioning				
air conditioning control				
Which must include ten of the following (TEN)				
pipework				
motors				
chillers				
pumps				
humidifiers				
condensers				
ducting/trunking				
fans				
evaporators				
heaters				
sensors and actuators				
electrical wiring/connectors				
control devices				
safety devices				
gauges/indicators				
electrical components				
other				
Prior to initial start up carry out all of the following checks (ALL)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
site is safe and meets environmental conditions				
check for damage to pipework/wiring/equipment				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
emissions meet environmental requirements				
sensors connected and operative				
contaminant free, fluid and pressure levels appropriate				
wiring/cables/pipework clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced power/flow/speed/pressure				
check for leaks				
check environmental conditions				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use four of the following instruments/devices during the commissioning activities (FOUR)				
alignment devices				
pressure sensing/monitoring				
flow testing devices				
measuring devices				
flushing/bleeding devices				
temperature sensing				
specific diagnostic devices				
emission testers				
PLC/PC equipment				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
corrective action report				
commissioning log/report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 31: Commissioning Compressed Air Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on compressed air systems and equipment, in accordance with approved procedures. You will be required to commission a range of compressed air equipment, which will include compressed air generation, distribution and control systems. This will also include system components such as pumps, driers, motors, regulators, compressor components and sensors.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as pumps or driers.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level, alignment and air flow, adjusting and setting equipment operating parameters, making 'off-load' checks before starting up the equipment, operating the equipment to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to electrical, fluid power, PLC control, services and external units/equipment, such as monitoring devices, sensors and actuators. You will also be required to either make a full report of any defects or deviations found, or to resolve any problems and rectify faults at component or unit level.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the commissioning of compressed air systems and equipment. You will understand the commissioning methods, techniques and procedures, and their application. You will know how the equipment functions, the purpose of the individual components, and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of compressed air system installations:
 - compressed air generation
 - compressed air distribution
 - compressed air control
 - Which must include **ten** of the following:
 - pumps
 - driers
 - motors
 - compressors
 - manifolds
 - gauges/indicators
 - regulators
 - silencers
 - control equipment
 - sensors and actuators
 - electrical wiring and connectors
 - electrical components
 - lubricators
 - monitoring equipment
 - safety devices
 - other (specify)

4. Prior to initial start-up, carry out **all** the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to pipework/ducting/wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid , PLC)
 - provisions have been made for emissions to meet environmental requirements
 - all sensors are connected and operative
 - check for contamination, and that fluid levels and pressures are appropriate for start-up
 - all wiring/cables/pipework are clear of moving parts
 - labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable

5. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start up procedures and confirm that the equipment/system meets specifications
 - run the equipment at reduced power/speed/flow/pressure
 - check for leaks during operations
 - check environmental conditions, including emission to atmosphere
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, emissions)
 - identify and resolve any functional problems
 - conduct a trial run on the equipment at full power/speed/flow/pressure
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition

6. Use **four** of the following instruments/devices during the commissioning activities, as appropriate to the equipment:
 - alignment devices
 - pressure sensing and monitoring
 - flow testing devices
 - measuring devices (mechanical and electrical)
 - flushing and bleeding devices
 - temperature sensing device
 - specific diagnostic aids
 - emission testers
 - PLC/PC equipment

7. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:

Either: Produce a report of the commissioning activities that includes **all** of the following:

 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

 - identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks, to confirm that correct operation is now achieved

9. Ensure that the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements

- customer standards and requirements
 - company standards and procedures
10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- corrective action report
 - commissioning log/report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning compressed air equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out commissioning activities on compressed air installations (such as stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The working principals of compressed air generation, distribution and control systems
10. The correct pipes, hoses and other equipment to accommodate different pressure ranges
11. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
12. The procedures to be applied during the commissioning activity
13. The importance of making 'off-load' checks before running the equipment under power
14. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
15. How to make adjustments to components/assemblies to ensure they function correctly (such as emissions, pressure, flow)
16. The fault diagnostic techniques that can be used to help identify problems with the equipment
17. The uses of measuring equipment (such as pressure, flow testing devices, emission detectors, bleeding devices and other measuring devices)
18. The calibration/care and control procedures for tools and equipment used during commissioning
19. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
20. The methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/force, proofmarking of components, removal of components)
21. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
22. The recording and/or reporting documentation to be completed for the activities undertaken
23. The types of problem associated with the commissioning activity, and how they can be overcome
24. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
25. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 31: Commissioning Compressed Air Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of compressed air system installations (ONE)				
compressed air generation				
compressed air distribution				
compressed air control				
Which must include ten of the following (TEN)				
pumps				
driers				
motors				
compressors				
manifolds				
gauges/indicators				
regulators				
silencers				
control equipment				
sensors and actuators				
electrical wiring/connectors				
electrical components				
lubricators				
monitoring equipment				
safety devices				
other				
Prior to initial start up carry out all of the following checks (ALL)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
site is safe and meets environmental conditions				
check for damage to pipework/wiring/equipment				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
emissions meet environmental requirements				
sensors connected and operative				
contaminant free, fluid and pressure levels appropriate				
wiring/cables/pipework clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced power/flow/speed/pressure				
check for leaks				
check environmental conditions				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
identify and resolve problems				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use four of the following instruments/devices during the commissioning activities (FOUR)				
alignment devices				
pressure sensing/monitoring				
flow testing devices				
measuring devices				
flushing/bleeding devices				
temperature sensing				
specific diagnostic devices				
emission testers				
PLC/PC equipment				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
corrective action report				
commissioning log/report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____
Assessor: _____

Date: _____
Date: _____

Unit No 32: Commissioning Waste/Foul Water Distribution Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on waste/foul water distribution equipment and systems, in accordance with approved procedures. You will be required to commission a range of distribution systems, such as foul, storm and waste/effluent water systems. The commissioning will also include the fitting and connection of pipework and other ancillary equipment, such as pumps, valves, motors and couplings.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as portable toilets.

You will be expected to check that the distribution system has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking levels and alignment, adjusting and setting equipment operating parameters, making 'off-load' checks before starting up the system, operating the system at reduced input to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, fluid, PLC control services and external units/equipment, such as sensors and activators.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying commissioning procedures for waste/foul water distribution systems and equipment. You will understand the commissioning methods, techniques and procedures used, and their application. You will know how the system and equipment functions, the purpose of the individual units/components, and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

- 1 Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of waste/foul water distribution systems:
 - waste/effluent
 - storm water
 - foul water

- Which must include **eleven** or more of the following waste/foul distribution system equipment:

 - pumps
 - motors
 - gates and valves
 - couplings/connectors
 - macerators
 - faucets and outlets
 - sensors and switches
 - electrical wiring and connectors
 - manifolds
 - traps
 - tanks
 - dosing plant
 - gauges/indicators
 - control devices
 - interceptors
 - pipework (plastic, clay, copper, iron)
 - ancillary drainage equipment (such as from sinks, toilets, showers)

4. Prior to initial start-up, carry out **all** the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to pipework/ducting/wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid, PLC)
 - provisions have been made for emissions to meet environmental requirements
 - all sensors are connected and operative
 - check for contamination, and that fluid levels and pressures are appropriate for start-up
 - all wiring/cables/pipework are clear of moving parts
 - labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable

5. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start-up procedures, and confirm that the system/equipment meets specifications
 - run the equipment at reduced pressure/speed/flow
 - check for leaks during operations
 - check environmental conditions, including emission to atmosphere
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition

6. Use **three** of the following instruments/devices during the commissioning activities:
 - alignment devices
 - multimeter
 - emission testers
 - measuring devices
 - pressure testing devices
 - PLC/PC
 - flow testing devices
 - diagnostic systems

7. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:

Either: Produce a report of the commissioning activities that includes **all** of the following:

 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

 - identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running commissioning checks to confirm correct operation is now achieved

9. Ensure that the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures

10. Complete the relevant paperwork, to include **one** of the following, and pass to the appropriate people:
 - corrective action report
 - commissioning log/report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning waste/foul water distribution systems equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others (including the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)
4. Hazards associated with carrying out waste/foul water distribution system commissioning activities (such as stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals and work instructions
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The types of contaminants in water systems, and the problems they can cause
10. The different methods used to treat water supplies to meet user needs
11. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
12. The procedures to be applied during the commissioning activity
13. The importance of making 'off-load' checks before running the equipment under power
14. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
15. How to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting water levels, shut-off conditions)
16. The fault diagnostic techniques that can be used to help identify problems with the equipment
17. The uses of measuring equipment (such as alignment devices, pressure and flow testers and other measuring devices)
18. The calibration/care and control procedures for the tools and equipment used during commissioning
19. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
20. The methods and techniques used to dismantle equipment in order to replace defective components (such as pressures/force, proofmarking of components, removal of glued/cemented components)
21. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
22. The recording and/or reporting documentation to be completed for the activities undertaken
23. The types of problem associated with the commissioning activity, and how they can be overcome
24. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
25. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 32: Commissioning Waste/Foul Water Distribution Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of waste/foul water distribution systems (ONE)				
waste/effluent				
storm water				
foul water				
Which must include eleven or more of the following waste/foul distribution system equipment (ELEVEN)				
pumps				
motors				
gates and valves				
couplings/connectors				
macerators				
faucets and outlets				
sensors and switches				
electrical wiring/connectors				
manifolds				
traps				
tanks				
dosing plant				
gauges/indicators				
control devices				
interceptors				
pipework				
ancillary equipment				
Prior to initial start up carry out all of the following checks (ALL)				
site is safe and meets environmental conditions				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
check for damage to pipework/wiring/equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
emissions meet environmental requirements				
sensors connected and operative				
contaminant free, fluid and pressure levels appropriate				
wiring/cables/pipework clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced pressure/speed//flow				
check for leaks				
check environmental conditions				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use three of the following instruments/devices during the commissioning activities (THREE)				
alignment devices				
multimeter				
emission testers				
measuring devices				
pressure testing devices				
PLC/PC				
flow testing devices				
diagnostic systems				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
corrective action report				
commissioning log/report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 33: Commissioning Fresh Water Distribution Equipment and Systems

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on fresh water distribution equipment and systems, in accordance with approved procedures. You will be required to commission a range of fresh water systems, such as mains cold water (drinkable), hot water supplies, cold down service and non-mains supplies (river, well). The commissioning will also include fittings and connections, pipework and equipment, such as pumps, valves, couplings, and other ancillary components and equipment.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as portable drinking fountains.

You will be expected to check that the distribution system has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers' instructions. This will involve the application of a range of commissioning methods and techniques, such as checking levels and alignment, adjusting and setting equipment operating parameters, making 'off-load' checks before starting up the system, operating the system at reduced input to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, fluid, PLC control, services and external units/equipment such as sensors and activators.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying commissioning procedures for fresh water distribution systems and equipment. You will understand the commissioning methods, techniques and procedures used, and their application. You will know how the system and equipment functions, the purpose of the individual units/components, and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of fresh water distribution systems:
 - mains cold water
 - hot water supplies
 - cold down service
 - non-mains supplies

- Which must include **ten** of the following fresh water distribution system equipment:

 - pumps
 - motors
 - heaters
 - traps
 - couplings/connectors
 - wet and dry risers
 - cylinders and tanks
 - sensors and switches
 - gauges/indicators
 - manifolds
 - dosing plant
 - gates and valves
 - faucets and outlets
 - control devices
 - electrical wiring and connectors
 - pipework (clay, plastic, copper, iron)
 - ancillary drainage equipment (such as from sinks, toilets, showers)

4. Prior to initial start-up carry out **all** the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to pipework/ducting/wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid, PLC)
 - provisions have been made for emissions to meet environmental requirements
 - all sensors are connected and operative
 - check for contamination, and that fluid levels and pressures are appropriate for start-up
 - all wiring/cables/pipework are clear of moving parts
 - labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable

5. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start-up procedures, and confirm that the system/equipment meets specifications
 - run the equipment at reduced pressure/speed/flow
 - check for leaks during operations
 - check environmental conditions, including emission to atmosphere
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence)
 - conduct a trial run of the equipment at full power/speed/flow
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition

6. Use **three** of the following instruments/devices during the commissioning activities:
 - alignment devices
 - multimeter
 - emission testers
 - measuring devices
 - pressure testing devices
 - PLC/PC
 - flow testing devices
 - diagnostic systems

7. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:

Either: Produce a report of the commissioning activities that includes **all** of the following:

 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

 - identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks, to confirm that correct operation is now achieved

9. Ensure that the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards
 - health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures

10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - corrective action report
 - commissioning log/report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when commissioning fresh water distribution systems and equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others (to include the Water Regulations Advisory Scheme (WRAS), the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)
4. Hazards associated with carrying out commissioning activities on fresh water distribution systems (such as stored pressure/force, using damaged or badly maintained tools and equipment, not following laid-down commissioning procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals and work instructions
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. The types of contaminants in water systems, and the problems they can cause
10. The different methods used to treat water supplies to meet user needs
11. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
12. The procedures to be applied during the commissioning activity
13. The importance of making 'off-load' checks before running the equipment under power
14. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
15. How to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting water levels, shut-off conditions)
16. The fault diagnostic techniques that can be used to help identify problems with the equipment
17. The uses of measuring equipment (such as alignment devices, pressure and flow testers and other measuring devices)
18. The calibration/care and control procedures for the tools and equipment used during commissioning
19. The procedure for obtaining replacement parts, materials and other consumables necessary for the commissioning
20. The methods and techniques used to dismantle equipment in order to replace defective components (such as release of pressures/force, proofmarking of components, removal of glued/cemented components)
21. How to re-assemble the removed components and, where necessary, how to adjust them to meet the operating specification
22. The recording and/or reporting documentation to be completed for the activities undertaken
23. The types of problem associated with the commissioning activity, and how they can be overcome
24. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
25. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of fresh water distribution systems (ONE)				
mains cold water				
hot water supplies				
cold down services				
non-mains supplies				
Which must include ten of the following fresh water distribution system equipment (TEN)				
pumps				
motors				
heaters				
traps				
couplings/connectors				
wet and dry risers				
cylinders and tanks				
sensors and switches				
gauges/indicators				
manifolds				
dosing plant				
gates and valves				
faucets and outlets				
control devices				
electrical wiring/connectors				
pipework				
ancillary equipment				
Prior to initial start up carry out all of the following checks (ALL)				
site is safe and meets environmental conditions				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
check for damage to pipework/wiring/equipment				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
emissions meet environmental requirements				
sensors connected and operative				
contaminant free, fluid and pressure levels appropriate				
wiring/cables/pipework clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced pressure/speed//flow				
check for leaks				
check environmental conditions				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use three of the following instruments/devices during the commissioning activities (THREE)				
alignment devices				
multimeter				
emission testers				
measuring devices				
pressure testing devices				
PLC/PC				
flow testing devices				
diagnostic systems				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
corrective action report				
commissioning log/report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 34: Commissioning Refrigeration Equipment and Systems

Unit Summary

This unit identifies the competencies you need to carry out commissioning activities on refrigeration equipment and systems, in accordance with approved procedures. You will be required to commission a range of refrigeration equipment, which will include compression types using air cooled or water cooled condensers, and secondary refrigerants, and also air conditioning cooling plants. Additionally, this will include equipment such as motors, compressors, evaporative condensers, evaporators, safety control devices, refrigerant metering devices, sensors, switches, electrical components and wiring, electronic components, computer systems and peripheral devices.

This unit does not involve the commissioning of items of equipment that are simple, self-contained items requiring the minimum of commissioning, such as domestic refrigerators.

You will be expected to check that the equipment has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, in accordance with company policy and manufacturers instructions. This will involve the application of a range of commissioning methods and techniques, such as checking level, alignment and air/fluid flow, adjusting and setting equipment operating parameters, making 'off-load' checks before starting up the equipment, operating the equipment to prove its function, and making full operational trials. The commissioning process will also require you to confirm operational links to mechanical, electrical, fluid, PLC control, services and external units/equipment such as monitoring devices, sensors and actuators. You will also be required to either make a full report of any defects or deviations found, or to resolve any problems and rectify faults at component or unit level.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the commissioning of refrigeration equipment. You will understand the commissioning methods, techniques and procedures, and their application. You will know how the equipment functions, the purpose of the individual components, and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities and, where appropriate, correcting faults and solving functional problems, ensuring that the equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for applying power in incremental stages. You will also understand your responsibilities for safety, and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **six** of the following:
 - client requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - environmental requirements
 - installation reports
 - commissioning procedures
 - product/process specifications
 - resources necessary to carry out commissioning (such as manpower, supplies, time constraints)
3. Carry out commissioning on **one** of the following types of refrigeration installations:
 - compression types using air cooled condensers
 - compression types using water cooled condensers
 - compression types using secondary refrigerants
 - air conditioning cooling plant

- Which must contain **ten** of the following components/equipment:

 - hoses and connectors
 - monitoring equipment
 - sensors and actuators
 - evaporative condensers
 - electrical wiring and connections
 - electronic modules/components
 - compressors
 - vents/diffusers
 - motors
 - pipework
 - safety devices
 - evaporators
 - gaskets and seals
 - uninterrupted power supplies
 - interlocks
 - PC peripheral devices
 - software
 - gauges and indicators (temperature, humidity, pressure)

4. Prior to initial start-up, carry out **all** the following checks:
 - the site is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to pipework/wiring/equipment following the installation
 - the equipment has been installed and secured/torqued in position, according to specification
 - all utilities are connected and operative
 - all connections have been made correctly (mechanical, electrical, fluid , PLC)
 - provisions have been made for emissions to meet environmental requirements
 - all sensors are connected and operative
 - check for contamination, and that fluid levels and pressures are appropriate for start-up
 - all wiring/cables/pipework are clear of moving parts
 - labels, safety and warning signs are attached in the correct locations
 - all guards, fences and safety systems are in position and operable

5. Use **all** of the following commissioning techniques, methods and procedures:
 - carry out start-up procedures and confirm that the system/equipment meets specifications
 - run the equipment at reduced speed/flow
 - check for leaks during operations
 - check environmental conditions, including emission to atmosphere
 - make sensory checks (sight, sound, smell, touch)
 - run through the operating sequence, and check for correct functioning
 - load the system incrementally, and make any necessary adjustments to settings to achieve the specification parameters (such as pressures, flow, temperature, timing, sequence)
 - conduct a trial run of the equipment at full speed/flow
 - monitor and record measurements and observations
 - shut down/isolate equipment/installations to a safe condition

6. Use **four** of the following instruments/devices during the commissioning activities, as appropriate to the equipment:
 - alignment devices
 - pressure sensing and monitoring
 - temperature sensing device
 - leak testing devices
 - flow testing devices
 - flushing and bleeding devices
 - specific diagnostic aids
 - emission testers
 - PLC/PC equipment
 - mechanical measuring devices
 - electrical measuring instruments

7. Deal with **two** of the following conditions during the commissioning process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

8. Deal, in **one** of the following ways, with installations that do not meet specification requirements:

Either: Produce a report of the commissioning activities that includes **all** of the following:

 - checks and tests undertaken
 - where the installation fails to meet the specification requirements
 - probable causes/sources of the defect
 - recommended actions to correct the fault

Or: Rectify the faults as part of the commissioning process, to include carrying out **all** of the following:

 - identifying the source of the fault, using appropriate fault finding techniques and/or diagnostic aids
 - isolating and dismantling the equipment to unit, sub-assembly or component level
 - replacing damaged or defective items
 - re-running the commissioning checks, to confirm that correct operation is now achieved

9. Ensure the commissioned equipment complies with **two** or more of the following standards:
 - equipment manufacturer's operating spec/range
 - IEE wiring regulations
 - BS and/or ISO standards

- health, safety and environmental requirements
 - customer standards and requirements
 - company standards and procedures
10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- corrective action report
 - commissioning log/report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices & procedures that you need to observe when commissioning refrigeration equipment (including any specific legislation/regulations/codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on commissioning activities (such as obtaining permits to work, obtaining and complying with risk assessments and other health & safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out refrigeration commissioning activities (such as stored pressure/fluid, hot/cold surfaces, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals and instructions (including BS and ISO schematics, IEE regulations, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The equipment to be commissioned, its operating procedures and function
9. Types of compressor, condenser, expansion valves and evaporators, and methods of stopping compressor prime movers
10. The system operating pressures and temperatures, and the relationship between refrigerant gas pressures and temperatures
11. Types and application of primary and secondary refrigerants, and methods of purging and charging the system (using liquid and vapour refrigerants)
12. The checks to be carried out on the equipment prior to undertaking the commissioning operations (such as installation damage, contamination, level and alignment, security of fastenings, electrical connections are correct, moving parts are free from obstructions, all guards and safety devices are in place)
13. The procedures to be applied during the commissioning activity
14. The importance of making 'off-load' checks before running the equipment under power
15. The importance of running the equipment at reduced power and/or in incremental stages to ensure satisfactory performance before applying full load checks
16. How to make adjustments to components/assemblies to ensure that they function correctly (such as emissions, pressure, flow, temperature, timing, sequencing)
17. The fault diagnostic techniques that can be used to help identify problems with the equipment
18. The uses of measuring equipment (such as pressure, leak testers, flow testing devices, emission detectors, bleeding devices and other measuring devices)
19. The calibration/care and control procedures for the tools and equipment used during commissioning
20. Procedure for obtaining replacement parts, materials & other consumables necessary for commissioning
21. The methods and techniques used to dismantle equipment in order to replace defective components (such as isolation procedure, release of pressure/fluid, proofmarking of components, removal of components by de-soldering)
22. How to re-assemble removed components & where necessary how to adjust to meet operating specification
23. The recording and/or reporting documentation to be completed for the activities undertaken
24. The types of problem associated with the commissioning activity, and how they can be overcome
25. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
26. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 34: Commissioning Refrigeration Equipment and Systems

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include six of the following (SIX)				
client requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
environmental requirements				
installation reports				
commissioning procedures				
product/process specifications				
resources required				
Carry out commissioning on one of the following types of refrigeration installations (ONE)				
compression using air cooled condensers				
compression using water cooled condensers				
compression using secondary refrigerants				
air conditioning cooling plant				
Which must contain ten of the following components/equipment (TEN)				
hoses and connectors				
monitoring equipment				
sensors and actuators				
evaporative condensers				
electrical wiring/connectors				
electronic components				
compressors				
vents/diffusers				
motors				
pipework				
safety devices				
evaporators				
gaskets and seals				
uninterrupted power supply				
interlocks				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
PC peripheral devices				
software				
gauges/indicators				
Prior to initial start up carry out all of the following checks (ALL)				
site is safe and meets environmental conditions				
check for damage to pipework/wiring/equipment				
equipment installed and secured to specification				
utilities connected and operational				
connections correctly made				
emissions meet environmental requirements				
sensors connected and operative				
contaminant free, fluid and pressure levels appropriate				
wiring/cables/pipework clear of moving parts				
labels/safety/warning signs correctly attached				
guards/fences/safety systems in place, working				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment/systems meet specifications				
run equipment at reduced speed/flow/				
check for leaks				
check environmental conditions				
make sensory checks				
run operating sequence to carry out function checks				
load system and adjust settings to meet specification parameters				
conduct trail run				
monitor and record				
shut down/isolate safely				
Use four of the following instruments/devices during the commissioning activities (FOUR)				
alignment devices				
pressure sensing/monitoring				
temperature sensing				
leak testing				
flow testing devices				
flushing/bleeding devices				
specific diagnostic aids				
emission testers				
PLC/PC equipment				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
mechanical measuring devices				
electrical measuring devices				
Deal with two of the following conditions during the commissioning process (TWO)				
installations with no faults				
partial malfunction				
complete malfunction				
Deal in one of the following ways with installations that do not meet specification requirements (ONE)				
EITHER: Produce a report of the commissioning activities that includes all of the following (ALL)				
checks and tests undertaken				
failure to meet specification				
probable cause/source of defects				
recommended action				
OR: Rectify the faults as part of the commissioning process to include all of the following (ALL)				
identify the fault				
isolate and dismantle				
replace damaged/defective items				
re-commission to confirm correct operation				
Ensure the commissioned equipment complies with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
IEE Wiring Regulations				
BS and/or ISO standards				
health/safety environmental requirements				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
corrective action report				
commissioning log/report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate: _____
Assessor: _____

Date: _____
Date: _____

Unit No 35: Carrying Out Fault Diagnosis on Lift Installations

Unit Summary

This unit identifies the competences you need to carry out fault diagnosis on lift installations, in accordance with approved procedures. You will be required to diagnose faults on a lift involving two or more of the following interactive technologies: mechanical, electrical, fluid power or electronics, both at assembly and sub-assembly/component level. You will be expected to use a variety of fault diagnosis methods and techniques, and to utilise a number of diagnostic aids and equipment. From the evidence gained, you will be expected to identify the fault and its probable cause, and to suggest suitable action to remedy the problem.

Your responsibilities will require you to comply with organisational policy and procedures for the fault diagnostic activities undertaken, and to report any problems with these activities, or the tools and equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying fault diagnosis procedures on lift equipment. You will understand the various fault diagnosis methods and techniques used, and their application. You will know how to apply and interpret information obtained from diagnostic aids and equipment, in adequate depth to provide a sound basis for carrying out the activities, identifying faults or conditions that are outside the acceptable specification. You will know about the interaction of the other associated integrated technologies, and will have adequate knowledge to carry out effective fault diagnosis of the lift installation.

You will understand the safety precautions required when carrying out the fault diagnosis activities, especially those for isolating the equipment. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Review and use all relevant information on the symptoms and problems associated with the products or assets
- c. Investigate and establish the most likely causes of the faults
- d. Select, use and apply diagnostic techniques, tools and aids to locate faults
- e. Complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
- f. Determine the implications of the fault for other work and for safety considerations
- g. Use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
- h. Record details on the extent and location of the faults in an appropriate format

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the fault diagnostic activities:
 - plan the fault diagnosis to cause minimum disruption to normal working
 - use the correct issue of company and/or manufacturers' drawings and installation documentation
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure the safe isolation of the equipment (such as mechanical, electricity, or fluids)
 - ensure safe access and working arrangements for the installation area
 - carry out the fault diagnostic activities using approved techniques and procedures
 - identify the fault and determine appropriate corrective action
 - dispose of waste items in safe and environmentally acceptable manner, and leave the work area in a safe condition
2. Carry out fault diagnosis on **three** of the following aspects of the lift system:
 - mechanical
 - fluid power
 - electrical
 - electronic
3. Collect evidence regarding the fault from **two** of the following sources:
 - monitoring equipment
 - sensory input (such as sight, sound, smell, touch)
 - recording devices
 - operation of the equipment
4. Use a range of fault diagnostic techniques, to include:
 - half-split techniquePlus **two** more from the following:
 - emergent problem sequence
 - six point technique
 - unit substitution
 - function testing
 - injection and sampling
 - input/output technique
5. Use a variety of diagnostic aids and equipment, to include **two** of the following:
 - manufacturer's manual
 - algorithms
 - probability charts/reports
 - equipment self-diagnostics
 - circuit diagrams/specifications
 - logic diagrams
 - flow charts
 - fault analysis charts (such as fault trees)
 - troubleshooting guides

6. Use **two** of the following types of test equipment to help in the fault diagnosis:
 - mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
 - electrical/electronic measuring instruments (such as multimeters, logic probes, special test instruments)
 - fluid power test equipment (such as test rigs, flow meters, pressure gauges)
7. Deal with **two** of the following conditions during the installation process:
 - intermittent problem
 - partial failure/out-of-specification operation
 - complete malfunction
8. Provide a record of the outcome of the fault diagnosis, using **one** of the following:
 - step-by-step analytical report
 - corrective action report
 - company-specific reporting procedure

Knowledge statements:

You must have knowledge and understanding of:

1. The health and safety requirements of the area in which you are carrying out the fault diagnosis activities
2. The specific safety precautions to be taken when carrying out the fault diagnosis of lift equipment
3. The isolation and lock-off procedures or permit-to-work procedure that applies
4. The importance of wearing protective clothing and other appropriate safety equipment during the fault diagnosis process; the type of equipment to be used, and where to obtain it
5. Hazards associated with carrying out fault diagnosis on lifts (such as handling oils/greases, stored pressure/force, electrical contact, process controller interface, using faulty or damaged tools and equipment, using practices/procedures that do not follow laid-down procedures), and how they can be minimised
6. How to recognise and deal with victims of electric shock (to include methods of safely removing the victim from the power source, isolating the power source, and methods of first aid resuscitation)
7. Where to obtain, and how to interpret, drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed in the fault diagnosis activities
8. The various fault finding techniques that can be used, and how they are applied (such as half-split, input/output, emergent problem sequence, six point technique, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)
9. How to evaluate the various types of information available for fault diagnosis (such as reports, monitoring equipment, sensory inputs, installation records, and operation of the lift)
10. How to evaluate sensory information (from sight, sound, smell, touch)
11. The procedures to be followed for investigating faults, and how to deal with intermittent conditions
12. How to use the various aids and reports available for fault diagnosis
13. The type of equipment that can be used to aid fault diagnosis (such as mechanical measuring instruments, electrical measuring instruments, test rigs and pressure and flow devices), how to check it is calibrated or configured correctly for the intended use and that it is free from damage and defects
14. How to analyse and evaluate possible characteristics and causes of specific faults/problems
15. How to relate previous reports/records of similar fault conditions
16. How to evaluate the likely risk of running the equipment with the displayed fault, and the effects the fault could have on the overall operation
17. How to prepare a report which complies with the company policy on fault diagnosis
18. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 35: Carrying Out Fault Diagnosis on Lift Installations

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all of the following during the fault diagnostic activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure safe isolation of services				
ensure safe access				
carry out fault diagnosis				
identify faults and determine action				
dispose of waste and leave the work area in a safe and clean condition				
Carry out fault diagnosis on three of the following aspects of the lift system (THREE)				
mechanical				
fluid power				
electrical				
electronic				
Collect evidence regarding the fault from two of the following sources (TWO)				
monitoring equipment				
sensory input				
recording devices				
operation of the equipment				
Use a range of fault diagnostic techniques to include (ONE)				
half-split technique				
PLUS two more from the following (TWO)				
emergent problem sequence				
six point technique				
unit substitution				
function testing				
injection and sampling				
input/output technique				
Use a variety of diagnostic aids and equipment to include two of the following (TWO)				
manufacturers manual				
algorithms				
probability charts/reports				
equipment self diagnostics				
circuit diagrams/specifications				
logic diagrams				
flow charts				
fault analysis charts				
troubleshooting guides				
Use two of the following types of test equipment to help in the fault diagnosis (TWO)				
mechanical measuring equipment				
electrical/electronic measuring instruments				
fluid power test equipment				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Deal with two of the following conditions during the installation process (TWO)				
intermittent problem				
partial failure				
complete malfunction				
Provide a record of the outcome of fault diagnosis using one of the following (ONE)				
step-by-step analytical report				
corrective action report				
company specific report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 36: Measuring and Setting Out Lift Installations

Unit Summary

This unit identifies the competences you need to measure and set out the lift well and machine room/space for the subsequent installation of lift equipment, in accordance with approved procedures. You will be required to measure and set out for new or reconstructed traction or hydraulic lift equipment.

This will require you to assess the site for the proposed installation, and to make the necessary arrangements to have the required tools and equipment, so that the measuring and setting out can be carried out safely and efficiently. You will be required to plumb, measure, check and set out a number of lift well features, including 'plumbing' the lift well to establish vertical references, measuring and recording lift well dimensions, accurately marking datum lines with plumb lines, marking the car guide centre line and guides, marking the positions of ancillary components, checking that there are safe and adequate running clearances, and that the lift can be installed to the design and specification.

You will also be required to measure and set out a number of machine room space features, including overall machine room/space dimensions, projecting and marking the car/counterweight guide centre lines to the machine room/space, marking the line of the driving sheave and diverting pulley, marking the position of the supporting steels, marking the rope/chain pick up points, marking the position of the machine room/space components, and confirming that the equipment will be able to be installed safely.

You will be required to select the appropriate tools and equipment to use, based on the measuring and setting out operations to be carried out. You will be expected to use appropriate tools and techniques to measure and set out the lift well and machine room/space to meet the required specification. The measuring and setting out activities will include making all necessary checks and adjustments to ensure that the lift features and components will be correctly positioned and aligned, and have appropriate working clearances, in-order that the installation will meet the required specification.

Your responsibilities will require you to comply with organisational policy and procedures for the measuring and setting out activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with minimal supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The measuring and setting out activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying measuring and setting out techniques and procedures to lift well and machine rooms/space. You will know about the equipment being installed, its installation requirements, the correct function of the equipment and associated measuring and setting out problems, in adequate depth to provide a sound basis for carrying out the measuring and setting out activities safely and effectively. You will also understand the installation methods and procedures used, and their applications in sufficient depth to be able to carry out the measuring and setting out activities, identify and resolve any problems, and ensure that the measuring and setting out meets the specification.

You will understand the safety precautions required when carrying out the measuring and setting out activities, especially those safeguards to protect yourself and others in the workplace. You will be required to demonstrate safe working practices throughout.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Obtain and use the correct information for marking out
- c. Obtain the appropriate marking out equipment and check that it is in a usable condition
- d. Prepare suitable datums and marking out surfaces
- e. Mark out using appropriate methods
- f. Check that the marking out complies with the specification
- g. Deal promptly and effectively with problems within your control and report those that cannot be resolved

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following activities during the measuring and setting out activity:
 - use the correct general arrangement drawings
 - use the correct contractual drawings
 - interpret dimensions accurately
 - check that tools to be used are within their calibration dates
 - relay the site instructions to management
 - reconcile any site difficulties
 - establish the final positions of the lift shaft and lift motor equipment
2. Use **four** of the following when measuring and setting out lift installations:
 - plumb lines
 - rule/tapes
 - engineer's level
 - carpenter's level
 - engineer's square
 - laser equipment
3. Plumb, measure and set out **all** of the following lift well features:
 - 'plumb' the lift well to establish vertical references
 - measure and record the lift well dimensions
 - accurately mark datum lines with plumb lines
 - ensure safe and adequate running clearances
 - establish and mark the car guide centre line
 - establish and mark the positions of lift car guides
 - mark out the routes of all trunking and conduit within the well
 - mark out positions of ancillary components (such as buffers, landing frame, switches, push boxes, indicators)
 - check that the lift can be installed to the design and specification
4. Measure and set out the lift machine room/space, to include **all** the following:
 - measure the machine room/space dimensions
 - confirm that equipment can be installed safely
 - using plumb lines, project and mark the car/counterweight guide centre lines up to the machine room/space
 - mark the line of the driving sheave and diverting pulley
 - mark the position of the supporting steels
 - mark the rope/chain pick up points (where appropriate)
 - mark the position of the lifting machine, motor generator, floor selector, overspeed governor and controller
5. Ensure that all measuring and marking out complies with **two** or more of the following standards:
 - British Standards including BS EN 81
 - BS 7255 (code of practice)
 - customer standards and requirements
 - company standards and procedures

6. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- installation records
 - job card
 - company specific documentation

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when measuring and setting out lift installations (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting the measuring and setting out (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the measuring and setting out activities, and the responsibility these requirements place on you
4. The hazards associated with measuring and setting out lift installations, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the measuring and setting out activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The importance of working to the correct specifications when measuring and setting out the lift well and machine room/space
9. Any necessary preparations that need to be carried out on the lift well and machine room/space prior the measuring and setting out
10. The lift equipment to be installed, its operating procedures and function
11. The features that have to be marked out in the lift well and machine room/space (including ancillary components)
12. The procedures for ensuring that you have the correct equipment for the measuring and setting out activities
13. The types of equipment used to measure and set out the lift well and machine room/space (such as plumb lines, rules/tapes, engineer's and carpenter's levels, engineer's square and laser devices)
14. The methods and techniques used to measure and set out the lift well and machine room/space
15. How to set up and correctly use plumb lines to establish datum lines
16. The importance of taking measurements in three planes (front to back, side to side, and top to bottom) when making sure the lift well will accommodate the lift
17. The points in the lift well where dimensions should be taken (such as at every floor level, and where there are deviations or projections)
18. The calibration/care and control procedures for the tools and equipment used during the measuring and setting activities
19. The problems that can occur with measuring and setting out the lift well and machine room/space, and how these can be overcome
20. The recording documentation to be completed for the measuring and setting out activities undertaken
21. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
22. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 36: Measuring and Setting Out Lift Installations

270 Level 3 NVQ in Installation and commissioning

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following activities during the measuring and setting out activity (ALL)				
use correct general arrangement drawings				
use correct contract drawings				
interpret dimensions accurately				
check tools are within correct dates				
relay site instructions to management				
reconcile any site differences				
establish final positions of lift shaft and lift motor				
Use four of the following when measuring and setting out lift installations (FOUR)				
plumb lines				
rule/tapes				
engineers level				
carpenters level				
engineers square				
laser equipment				
Plumb measure and set out all of the following lift well features (ALL)				
plumb lift well for vertical references				
measure and record dimensions				
mark datum lines				
ensure safe and adequate running clearances				
establish and mark car guide centre line				
establish and mark positions of lift car guides				
mark out routes of trunking and conduit				
mark positions of ancillary components				
check for conformity to design and specification				
Measure and set out the lift machine room/space to include all of the following (ALL)				
measure machine room/space dimensions				
confirm equipment can be installed safely				
mark car/counterweight centre lines to machine room/space				
mark line of driving sheave/diverting pulley				
mark position of supporting sheets				
mark rope/chain pick up points				
mark position of related components				
Ensure that all measuring and marking out complies with two or more of the following standards (TWO)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
British Standards BS EN 81				
BS 755 (CoP)				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following, and pass it to the appropriate people (ONE)				
installation records				
job card				
company specific				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 37: Installing Lift Well and Ancillary Equipment

Unit Summary

This unit identifies the competences you need to install lift well and ancillary equipment, in accordance with approved procedures. This will require you to assess the site for the proposed installation, and to make the necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of lift well and ancillary components, such as guide brackets, safety gear, car frame, guide shoes/rollers, isolation and multiplying pulleys, counterweight structure, filler weights, car enclosure panels, landing push boxes, indicator panels, buffers, well switches and cams, floor selector devices and decorative finishes.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the equipment and components to be worked on during the installation. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections, to the required specification. The installation activities will include making all necessary checks and adjustments, to ensure that the components are correctly positioned and aligned, have appropriate working clearances, are tightened to the correct torque, and that the installation meets the required specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures for lift well and ancillary equipment. You will know about the equipment being installed, its installation requirements, the correct function of the equipment and any associated problems, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and resolve any installation problems, and ensure that the installed equipment meets the specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will be required to demonstrate safe working practices throughout, taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the installation activities:
 - plan the installation activities to minimise disruption to normal working
 - ensure that you have the correct installation documentation (such as drawings, instructions, manufacturer's data, settings and other documentation)
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - ensure that electrical supplies have been isolated
 - ensure safe access and working arrangements for the installation area
 - carry out the installation activities using appropriate techniques and procedures
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Confirm that **all** of the following conditions have been met, prior to installing the lift equipment:
 - the site is suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - the site is accessible, and free from obstructions or hazards
 - any required installation consumables are available
 - safety and environmental conditions can be met
3. Install **twelve** of the following types of lift well components and ancillary equipment:
 - guide brackets
 - car frame
 - safety gear
 - guide shoes/rollers
 - filler weights
 - landing push boxes
 - indicator panels
 - buffers
 - well switches and cams
 - floor selector devices
 - decorative finishes
 - isolation and multiplying pulleys
 - conduit or trunking
 - cables and wires
 - counterweight structure and shoes/rollers
 - car enclosure panels (such as roof, sides and back)
4. Apply the correct installation methods and techniques for **nine** of the following:
 - drilling and hole preparation
 - positioning and securing equipment
 - aligning of equipment
 - levelling of equipment
 - shimming and packing
 - lifting and supporting
 - removing protective coatings and burrs
 - dressing guide joints

- connecting electrical wires and cables
 - securing by using mechanical fixings
 - securing by using masonry fixings
 - applying screw fastening locking devices
5. Move and position equipment, using **two** of the following:
- slings
 - portable lifting equipment
 - block and tackle
 - manual handling
6. Use **two** of the following instruments/devices during the installation activities:
- straight edges
 - engineer's levels
 - mechanical measuring instruments/devices
 - electrical measuring instruments
 - laser equipment
 - self-diagnosis equipment
7. Carry out the necessary checks, and adjust/rectify where appropriate, to include **all** of the following:
- working clearance is correct
 - fluid/oil reservoirs are at an appropriate level
 - making 'off-load' checks
 - level and alignment are correct
 - electrical wiring is encased and secure
 - electrical continuity is achieved
 - visual (for completeness and freedom from damage)
 - other sensory checks (sound, smell, touch)
 - moving parts are clear of obstruction and guarded
 - torque setting of fasteners is correct
 - locking devices are fitted to fasteners (if appropriate)
8. Produce installations which comply with **two** or more of the following:
- equipment manufacturer's operating spec/range
 - BS and/or ISO standards (including BS EN 81, ISO 9000)
 - BS 7255 (code of practice)
 - the Lift Regulations
 - customer standards and requirements
 - company standards and procedures
9. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing lift well and ancillary equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing lift well and ancillary equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)

7. How to carry out currency/issue checks on the specifications you are working with
8. Any necessary preparations to be carried out on the equipment prior to installation
9. The equipment to be installed, its operating procedures and function
10. The various mechanical fasteners that will be used, and their method of installation (including threaded fasteners, special securing devices, masonry fixing devices)
11. The importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved
12. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
13. The types of tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches, engineer's levels and laser devices)
14. The techniques used to position, align, level, adjust and secure the equipment
15. Methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)
16. The importance of electrical bonding, why it is critical, and why it must be both mechanically and electrically secure
17. The appropriate electrical checks that must be carried out
18. The procedure for the safe disposal of waste materials
19. How to conduct any necessary checks and adjustments to ensure the equipment integrity, accuracy and quality of the installation
20. How to recognise installation defects (such as leaks, poor seals, misalignment, levels, ineffective fasteners, damage, or contamination)
21. The importance of ensuring that the completed installation is free from dirt, damage and defects
22. The calibration/care and control procedures for the tools and equipment used during the installation activities
23. The problems that can occur with the installation operations, and how these can be overcome
24. The recording documentation to be completed for the activities undertaken
25. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
26. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 37: Installing Lift Well and Ancillary Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all of the following activities during the installation (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
obtain clearance				
ensure isolation of electrical supplies				
ensure safe access				
carry out appropriate installation activities				
dispose of waste correctly				
leave work area in a safe and clean condition				
Confirm that all of the following conditions have been met prior to installing the lift equipment (ALL)				
site is suitably prepared for the installation				
appropriate utilities available				
site is accessible, free from obstruction				
any required consumables are available				
safety and environmental conditions are met				
Install twelve of the following types of lift well components and ancillary equipment (TWELVE)				
guide brackets				
car frame				
safety gear				
guide shoes/rollers				
filler weights				
landing push boxes				
indicator panels				
buffers				
well switches and cams				
floor selector devices				
decorative finishes				
isolation/multiplying pulleys				
conduit or trunking				
cables and wires				
counterweight structure and shoes/rollers				
car enclosure panels				
Apply the correct installation methods and techniques for nine of the following (NINE)				
drilling and hole preparation				
positioning equipment				
aligning equipment				
levelling equipment				
shimming and packing				
lifting and supporting				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
removing protective coatings/burrs				
dressing guide joints				
connecting electrical wires/cables				
using mechanical fixings				
using masonry fixings				
using screw fasteners				
Move and position equipment using two of the following (TWO)				
slings				
portable lifting devices				
block and tackle				
manual handling				
Use two of the following instruments/devices during the installation activities (TWO)				
straight edges				
engineers levels				
mechanical measuring instruments				
electrical measuring instruments				
laser equipment				
self-diagnosis equipment				
Carry out the necessary checks and adjust/rectify where appropriate to include all of the following (ALL)				
setting correct working clearance				
topping up fluid/oil reservoirs				
making 'off-load' checks				
level and alignment correct				
electrical wiring secure				
electrical continuity				
visual checks				
other sensory checks				
ensuring moving parts are guarded and clear of obstruction				
checking torque settings				
ensuring locking devices are fitted				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
BS 7255				
Lift Regulations				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 38: Installing Traction Lift Equipment

Unit Summary

This unit identifies the competences you need to install traction lift equipment in accordance with approved procedures. This will require you to assess the site for the proposed installation, and to make the necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of traction lift equipment, such as lifting machine, traction sheave, diverting pulley, over-speed governor, controller and lift machine isolation pads.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the equipment and components to be worked on during the installation. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections, to the required specification. The installation activities will include making all necessary checks and adjustments to ensure the components are correctly positioned and aligned, have appropriate working clearances and are tightened to the correct torque, and that the installation meets the required specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures for traction lift equipment. You will know about the equipment being installed, its installation requirements, the correct function of the equipment and any associated problems, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and resolve any problems, and ensure that the installed equipment meets the required specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the installation activities:
 - plan the installation activities to minimise disruption to normal working
 - ensure that you have the correct installation documentation (such as, drawings, instructions, manufacturer's data, settings and other documentation)
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - ensure that electrical supplies have been isolated
 - ensure safe access and working arrangements for the installation area
 - carry out the installation activities using appropriate techniques and procedures
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Confirm that **all** of the following conditions have been met, prior to installing the lift equipment:
 - the site is suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - the site is accessible and free from obstructions or hazards
 - any required installation consumables are available
 - safety and environmental conditions can be met
3. Install **all** of the following types of traction lift equipment:
 - lifting machine
 - over-speed governor
 - diverting pulley
 - traction sheave
 - lift controller equipment
 - lift machine isolation pads
 - conduit/trunking
 - cables and wires
4. Apply the correct installation methods and techniques for **nine** of the following:
 - drilling and hole preparation
 - positioning and securing the equipment
 - aligning equipment to plumb lines and marked dimensions
 - aligning pulley with sheave and counterweight
 - plumbing with rope pick-up points
 - aligning governor with rope anchorage and tension frame
 - levelling the equipment
 - shimming and packing
 - lifting and supporting
 - protecting the installation from weather
 - connecting electrical wires and cables
 - securing by using mechanical fixings
 - applying screw fastening locking devices

5. Move and position equipment using **two** of the following:
 - slings
 - portable lifting equipment
 - block and tackle
 - manual handling and moving of loads

6. Use **two** of the following instruments/devices during the installation activities:
 - straight edges
 - engineer's levels
 - dial test indicators
 - mechanical measuring instruments/devices
 - electrical measuring instruments
 - self-diagnostic equipment

7. Carry out all necessary checks, and adjust/rectify where appropriate, to include **all** of the following:
 - working clearance is appropriate
 - correct application of oils and greases
 - making 'off-load' checks
 - level and alignment is correct
 - electrical wiring is encased and secure
 - electrical continuity is achieved
 - visual (for completeness and freedom from damage)
 - other sensory checks (sound, smell, touch)
 - moving parts are guarded and clear of obstruction
 - torque setting of fasteners is correct
 - locking devices are fitted to fasteners (where appropriate)

8. Produce installations which comply with **two** or more of the following:
 - equipment manufacturer's operating spec/range
 - BS and/or ISO standards (including BS EN 81)
 - BS 7255 (code of practice)
 - customer standards and requirements
 - company standards and procedures
 - the Lift Regulations

9. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing traction lift equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing traction lift equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The preparations that need to be carried out on equipment prior to installation
9. The equipment to be installed, its operating procedures and function
10. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices)

11. The importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved
12. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
13. The types of tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches, engineer's levels)
14. The techniques used to position, align, level, adjust and secure the equipment
15. Methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)
16. The appropriate electrical checks to be carried out on traction lift equipment
17. How to conduct any necessary checks and adjustments to ensure the equipment integrity, accuracy and quality of the installation (including the fitting of guards to all moving parts and covers on electrical connections)
18. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, damage)
19. The lubrication requirements, and methods for protecting equipment from mechanical and weather damage
20. The importance of ensuring that the completed installation is free from dirt and damage, and that components are correctly covered/protected
21. The calibration/care and control procedures for the tools and equipment used during the installation activities
22. The problems that can occur with the installation operations, and how these can be overcome
23. The recording documentation to be completed for the activities undertaken
24. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
25. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all of the following activities during the installation (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
obtain clearance				
ensure isolation of electrical supplies				
ensure safe access				
carry out appropriate installation activities				
dispose of waste correctly				
leave work area in a safe and clean condition				
Confirm that all of the following conditions have been met prior to installing the lift equipment (ALL)				
site is suitably prepared for the installation				
appropriate utilities available				
site is accessible, free from obstruction				
any required consumables are available				
safety and environmental conditions are met				
Install all of the following types of traction lift equipment (ALL)				
lifting machine				
over-speed governor				
diverting pulley				
traction sheave				
lift controller equipment				
lift machine isolation pads				
conduit/trunking				
cables and wires				
Apply the correct installation methods and techniques for nine of the following (NINE)				
drilling and hole preparation				
positioning equipment				
aligning equipment				
aligning pulley with sheave and counterweights				
plumbing with rope pick up points				
aligning governor, rope anchorage, tension frame				
levelling equipment				
shimming and packing				
lifting and supporting				
protection from the weather				
connecting electrical wires/cables				
using mechanical fixings				
using screw fasteners				
Move and position equipment using two of the following (TWO)				
slings				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
portable lifting devices				
block and tackle				
manual handling				
Use two of the following instruments/devices during the installation activities (TWO)				
straight edges				
engineers levels				
dial test indicators				
mechanical measuring instruments				
electrical measuring instruments				
self-diagnosis equipment				
Carry out the necessary checks and adjust/rectify where appropriate to include all of the following (ALL)				
working clearance correct				
correct application of oils/grease				
making 'off-load' checks				
level and alignment correct				
electrical wiring secure				
electrical continuity				
visual checks				
other sensory checks				
ensuring moving parts are guarded and clear of obstruction				
checking torque settings				
ensuring locking devices are fitted				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
BS 7255				
customer standards				
company standards				
Lift Regulations				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 39: Installing Lift Ropes and Chains

Unit Summary

This unit identifies the competences you need to install lift ropes and chains, in accordance with approved procedures. This will require you to assess the site for the proposed installation, and to make the necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of lift ropes and chains, such as suspension ropes and chains, safety ropes and chains, governor ropes and chains.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the equipment and components to be worked on during the installation. You will be expected to use appropriate tools and techniques to position, level, align and tension the equipment, and to make all necessary connections, to the required specification. The installation activities will include making all necessary checks and adjustments to ensure the components are correctly positioned and aligned, have appropriate tension or working clearances, are tightened to the correct torque, and that the installation meets the required specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures for lift ropes and chains. You will know about the equipment being installed, its installation requirements, the correct function of the equipment and any associated problems, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and resolve any installation problems, and ensure that the installed equipment meets the required specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the installation activities:
 - plan the installation activities to minimise disruption to normal working
 - ensure that you have the correct installation documentation (such as, drawings, instructions, manufacturer's data, settings and other documentation)
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - ensure that electrical supplies have been isolated
 - ensure safe access and working arrangements for the installation area
 - carry out the installation activities, using appropriate techniques and procedures
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Confirm that **all** of the following conditions have been met, prior to installing the lift ropes and chains:
 - the site is suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - the site is accessible and free from obstructions or hazards
 - any required installation consumables are available
 - safety and environmental conditions can be met
3. Install **all** of the following types of lift ropes and chains:
 - suspension ropes
 - suspension chains
 - safety ropes
 - safety chains
 - governor ropes
 - governor chains
4. Apply suitable installation methods and techniques, to include **all** of the following:
 - measuring the position of the car, counterweight or jack crosshead
 - calculating chain length (including allowances for stretching, overrun/run-by)
 - calculating rope length (including allowances for stretching, overrun/run-by)
 - cutting ropes
 - cutting chains
 - terminating ropes
 - terminating chains
 - positioning and securing ropes
 - positioning and securing chains
 - aligning and tensioning ropes
 - aligning and tensioning chains
 - lifting and supporting
 - securing using mechanical fixings
5. Move and position equipment, using **two** of the following:
 - slings
 - portable lifting equipment
 - block and tackle

- manual handling and moving of loads
6. Carry out all relevant checks, and adjust/rectify where appropriate, to include **all** the following:
 - working clearance is appropriate
 - rope tension and length is correct
 - chain tension and length is correct
 - correct application of oils and greases
 - travel limits are set
 - alignment is correct
 - visual (for completeness and freedom from damage)
 - visual (ropes are installed correctly)
 - visual (chains are installed correctly)
 - moving parts are guarded and clear of obstruction
 - torque setting of fasteners is correct (where appropriate)
 - locking devices are fitted to fasteners (where appropriate)
 7. Produce installations which comply with **two** or more of the following:
 - equipment manufacturer's operating spec/range
 - BS EN 81
 - customer standards and requirements
 - company standards and procedures
 8. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - installation records
 - company specific documentation
 - job card
 - rope test certificate

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing lift ropes and chains (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing lift ropes and chains, and with the tools and equipment used, and how they can be minimised
5. The safe use of rope/chain cutting equipment, in accordance with company and statutory legislation
6. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
7. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
8. How to carry out currency/issue checks on the specifications you are working with
9. The preparations that need to be carried out on the various ropes and chains prior to installation
10. The different ropes and chains to be installed, their construction and operating parameters
11. The different types of rope and chain terminations used
12. How to calculate the correct chain/rope length (including allowances for stretching, overrun/run-by)
13. The measuring equipment used to ensure ropes and chains are the correct length
14. How the length of suspension, safety and governor ropes/chains are calculated from measurements of the relative positions of the lift car counterweight or jack/ram cross head
15. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices)
16. The importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved
17. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
18. The types of tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches)
19. The techniques used to position, align, adjust, tension and secure the equipment

20. Methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)
21. How to conduct any necessary checks to ensure the equipment integrity, accuracy and quality of the installation
22. How to recognise installation defects (such as misalignment, ineffective fasteners, damage, broken strands, kinks)
23. The importance of ensuring that the completed installation is free from dirt and damage
24. The calibration/care and control procedures for the tools and equipment used during the installation activities
25. The problems that can occur with the installation operations, and how these can be overcome
26. The recording documentation to be completed for the activities undertaken
27. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
28. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 39: Installing Lift Ropes and Chains

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all of the following activities during the installation (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
obtain clearance				
ensure isolation of electrical supplies				
ensure safe access				
carry out appropriate installation activities				
dispose of waste correctly				
leave work area in a safe and clean condition				
Confirm that all of the following conditions have been met prior to installing the lift ropes and chains (ALL)				
site is suitably prepared for the installation				
appropriate utilities available				
site is accessible, free from obstruction				
any required consumables are available				
safety and environmental conditions are met				
Install all of the following types of lift ropes and chains (ALL)				
suspension ropes				
suspension chains				
safety ropes				
safety chains				
governor ropes				
governor chains				
Apply suitable installation methods and techniques to include all of the following (ALL)				
measuring positions				
calculating chain length				
calculating rope length				
cutting ropes				
cutting chains				
terminating ropes				
terminating chains				
positioning securing ropes				
positioning securing chains				
aligning tensioning ropes				
aligning tensioning chains				
lifting and supporting				
using mechanical fixings				
Move and position equipment using two of the following (TWO)				
slings				
portable lifting devices				
block and tackle				
manual handling				
Carry out all relevant checks and adjust/rectify where appropriate to include all of the following (ALL)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
working clearance correct				
rope tension and length correct				
chain tension and length correct				
correct application of oils/greases				
travel limits set				
alignment correct				
visual check for damage				
visual check of ropes				
visual check of chains				
moving parts are guarded and clear of obstruction				
checking torque settings				
ensuring locking devices are fitted				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS EN 81				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				
rope test certificate				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 40: Installing Lift Doors, Frames and Ancillary Components

Unit Summary

This unit identifies the competences you need to install lift doors and frames, and ancillary components, in accordance with approved procedures. This will require you to assess the site for the proposed installation, and to make the necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of lift doors, frames and ancillary components, such as centre opening doors, two speed opening doors, manual doors, bi-parting doors, shutter gates, landing door frame, lift car door frame, landing sill, locks and rollers, door hangers, fire trim and architraves, door operators and safety devices, coupler/skate and door guide shoes.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the equipment and components to be worked on during the installation. You will be expected to use appropriate tools and techniques to position, level and align the equipment, and to make all necessary connections, to the required specification. The installation activities will include making all necessary checks and adjustments to ensure the components are correctly positioned and aligned, have appropriate tension or working clearances, are tightened to the correct torque, and that the installation meets the required specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures. You will know about the equipment being installed, its installation requirements, its correct function and any associated problems, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and resolve any installation problems, and to ensure that the installed equipment meets the required specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the installation activities:
 - plan the installation activities to minimise disruption to normal working
 - ensure that you have the correct installation documentation (such as, drawings, instructions, manufacturer's data, settings and other documentation)
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - ensure that electrical supplies have been isolated
 - ensure safe access and working arrangements for the installation area
 - carry out the installation activities, using appropriate techniques and procedures
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Confirm that **all** of the following conditions have been met, prior to installing the lift equipment:
 - the site is suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - the site is accessible and free from obstructions or hazards
 - any required installation consumables are available
 - safety and environmental conditions can be met
3. Install **all** of the following door frames and ancillary components:
 - landing door frame
 - lift car door frame
 - landing sill
 - door guide shoes
 - door locks and rollers
 - door hangers
 - fire trim and architraves
 - cables and wires
 - door operators
 - door safety devices
 - coupler/skate
4. Install **all** of the following types of lift door:
 - centre opening doors
 - two speed opening doors
 - manual doors
 - bi-parting doors
 - shutter gates
5. Apply installation methods and techniques for **seven** of the following:
 - drilling and hole preparation
 - positioning and secure doors and frames
 - aligning of equipment
 - levelling of equipment
 - shimming and packing
 - lifting and supporting

- removing protective coverings
 - connecting electrical wires and cables
 - securing by using mechanical fixings
 - applying screw fastening locking devices
6. Use **all** of the following instruments/devices during the installation activities:
- straight edges
 - gap gauges
 - engineer's levels
 - mechanical measuring instruments/devices
 - electrical measuring instruments
7. Carry out all relevant checks, and adjust/rectify where appropriate, to include **all** the following:
- working clearance is suitable
 - correct application of oils and greases
 - travel limits are set
 - making 'off-load' checks
 - level and alignment is correct
 - electrical wiring is encased and secure
 - electrical continuity is achieved
 - visual (for completeness and freedom from damage)
 - other sensory checks (sound, smell, touch)
 - moving parts are guarded and clear of obstruction
 - torque setting of fasteners is correct
 - locking devices are fitted to fasteners (where appropriate)
8. Produce installations which comply with **two** or more of the following:
- equipment manufacturer's operating spec/range
 - British Standard BS EN 81
 - customer standards and requirements
 - company standards and procedures
9. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- installation records
 - job card
 - company specific documentation

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing lift doors, frames and ancillary components (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing lift doors and frames, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The preparations that need to be carried out on the equipment prior to installation
9. The equipment to be installed, its operating procedures and function
10. The application of the different types of door (including why they have been selected)
11. The different types of door operating systems
12. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices)
13. The importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved

14. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
15. The types of tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches, engineers levels)
16. The techniques used to position, align, level, adjust and secure the equipment
17. Methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)
18. The importance of carrying out electrical checks on lift doors and ancillary components
19. How to conduct any necessary checks and adjustments to ensure the equipment integrity, accuracy and quality of the installation
20. How to recognise installation defects (such as jamming, misalignment, ineffective fasteners, damage)
21. The lubrication requirements, and methods for protecting equipment from damage
22. The importance of ensuring that the completed installation is free from dirt and damage, and of ensuring that any exposed components are correctly covered/protected
23. The tools and equipment used in the installation activities, and their calibration/care and control procedures
24. The problems that can occur with the installation operations, and how these can be overcome
25. The recording documentation to be completed for the activities undertaken
26. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
27. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all of the following activities during the installation (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
obtain clearance				
ensure isolation of electrical supplies				
ensure safe access				
carry out appropriate installation activities				
work to approved methods				
dispose of waste correctly				
leave work area in a safe and clean condition				
Confirm that all of the following conditions have been met prior to installing the lift equipment (ALL)				
site is suitably prepared for the installation				
appropriate electrical supply available				
site is accessible, free from obstruction				
any required consumables are available				
safety and environmental conditions are met				
Install all of the following door frames and ancillary equipment (ALL)				
landing door frame				
lift car door frame				
landing sill				
door guide shoes				
door locks and rollers				
door hangers				
fire trim and architraves				
cables and wires				
door operators				
door safety devices				
coupler/skate				
Install two of the following types of lift door (TWO)				
centre opening doors				
two speed opening doors				
manual doors				
bi-parting doors				
shutter gates				
Apply installation methods and techniques for seven of the following (SEVEN)				
drilling and hole preparation				
positioning equipment				
aligning equipment				
levelling equipment				
shimming and packing				
lifting and supporting				
removing protective coverings				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
connecting electrical wires/cables				
using mechanical fixings				
using screw fasteners				
Use all of the following instruments/devices during the installation activities (ALL)				
straight edges				
gap gauges				
engineers levels				
mechanical measuring instruments				
electrical measuring instruments				
Carry out the relevant checks and adjust/rectify where appropriate to include all of the following (ALL)				
working clearance correct				
correct application of oils/grease				
travel limits set				
making off load checks				
level and alignment correct				
electrical wiring secure				
electrical continuity achieved				
visual checks				
other sensory checks				
ensuring moving parts are guarded and clear of obstruction				
checking torque settings				
ensuring locking devices are fitted				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS EN 81				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
job card				
company specific document				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 41: Checking and Setting Lift Installations

Unit Summary

This unit identifies the competences you need to carry out checks on lift installations, in accordance with approved procedures. You will be required to carry out a number of checks on various lift components, such as safety circuits, ropes and chains, trailing cables, door operators, alarm systems, lift controller, safety mechanisms, lift machine, hydraulic pump and gearbox. You will also be expected to carry out checks on the lift sequence and ride quality. You will check that the lift has been installed to the required specification by carrying out checks in a planned and logical sequence. This will involve adjusting, functional checking, resolving problems and rectifying faults at component or sub-assembly level, in accordance with company policy and manufacturer's instructions.

You will be expected to apply a range of installation checking methods and techniques, such as checking settings, aligning and adjusting components, torque loading components, making 'off-load' checks, and running the lift at reduced and full speed.

Following successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people.

Your responsibilities will require you to comply with organisational policy and procedures for the checking activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the checking activities are removed from the work area on completion of the activities, and that all necessary handover documentation is completed accurately and legibly. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying procedures for the checking of lift installations. You will understand the checking methods, techniques and procedures, and their application. You will know how the lift functions, the purpose of the individual components and any associated defects, in adequate depth to provide a sound basis for carrying out the checking activities and solving functional problems, ensuring that the equipment performs to the required specification. In addition, you will have sufficient in-depth knowledge to ensure that all components are fit for purpose and meet the specifications.

You will understand the safety precautions required when carrying out the checking activities, especially those for isolating the equipment. You will also understand your responsibilities for safety and the importance of taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow and make appropriate use of the specifications for the product or asset being checked
- c. Use all the correct tools and inspection equipment and check that they are in useable condition
- d. Carry out the checks in an appropriate sequence using approved methods and procedures
- e. Identify and assess any defects or variations from the specification and take appropriate action
- f. Report completion of compliance activities in line with organisational procedures

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the checking activities:
 - use the correct issue of drawings, job instructions and installation specifications
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure safe access and working arrangements when checking lift installations
 - check calibration dates of the tools and measuring instruments to be used
 - carry out the checks on lift installations using the appropriate techniques and procedures
 - leave the work area in a safe condition
 - handover the lift installation and documentation to the appropriate people
2. Check lift installations using **all** of the following information:
 - customer requirements
 - equipment specifications
 - installation data
 - installation standards
3. Carry out installation checks on **one** of the following types of lift equipment:
 - hydraulic
 - traction
4. Prior to initial start-up, carry out **all** of the following checks:
 - the lift is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to lift assemblies following the installation
 - the lift has been installed and positioned according to specification
 - all connections have been made correctly (mechanical, electrical, fluid power)
 - all lubricants and grease have been applied before start-up
 - all moving parts are clear of obstructions
 - all fluid levels are correct before start-up
 - all labels, safety and warning signs are placed in the correct locations
 - all guarding and safety systems are in position and operable
5. Use **all** of the following checking techniques, methods and procedures:
 - carry out start-up procedures and confirm that the lift and associated equipment meets specifications
 - run the lift equipment at reduced speed
 - check for leaks during operations
 - make sensory checks (sight, sound, smell, touch)
 - check the lift operation/sequence including door opening/closing
 - identify any functional problems
 - monitor and record measurements and/or observations
 - shut down/isolate lift to a safe condition
6. Use **two** of the following instruments/devices when checking the lift installation:
 - linear measuring devices
 - multimeter
 - pressure testing devices
 - specific diagnostic aids

7. Carry out **all** the following installation checks, and adjust where appropriate:
 - supply phases and connections to motors
 - rope terminations
 - chain terminations
 - rope tension
 - chain tension
 - trailing cables are looped correctly
 - lubrication points are oiled/greased to specification
 - gearbox or hydraulic oil levels

8. Carry out **all** the following checks, and adjust/rectify where appropriate to include:
 - safety circuits
 - door operators
 - overrun/run-by
 - door closing protection devices
 - lift machine/hydraulic pump unit
 - lift controller equipment
 - alarm systems
 - lift car travel
 - ancillary equipment
 - counterweight operates correctly (traction lifts only)

9. Rectify faults as part of the checking process, to include carrying out **all** of the following:
 - identifying the source of the fault
 - dismantling equipment to unit, sub-assembly or component level
 - proofmarking/labelling components to aid re-assembly
 - replacing or repairing damaged or defective components
 - setting, aligning and adjusting replaced components
 - tightening fastenings to the required torque
 - replenishing oils and greases (where appropriate)
 - re-running the checks to confirm that correct operation is now achieved

10. Ensure that the lift installation complies with **two** or more of the following standards:
 - BS standards and procedures (such as BS EN 81)
 - customer standards and requirements
 - company standards and procedures
 - specific system requirements
 - the Lift Regulations

11. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - job card
 - installation report
 - company specific documentation

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when checking lift installations (including any specific legislation, regulations or codes of practice for the activities and lift equipment)
2. The procedures to be carried out before checking the lift installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the checking procedure, and their effects on others
4. Hazards associated with carrying out checks on lift installations (handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down checking procedures), and how to minimise them
5. The importance of wearing personal protective equipment (PPE) during the checking process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals, instructions, and other documents needed in the checking process
7. How to carry out currency/issue checks on the specifications you are working with

300 Level 3 NVQ in Installation and commissioning

8. The principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
9. The checks to be carried out prior to starting up the lift (including installation damage, lift obstructions, mechanical and electrical connections, gearbox/hydraulic oil levels, lubrication points, rope and chain terminations and tension)
10. The functional checks that need to be carried out at reduced speed (including door operators, overrun/run-by, safety systems, alarm system, lift machine/hydraulic pump, lift controller, counterweight and lift car travel)
11. The equipment operating and control procedures to be applied during the checking activity
12. The importance of making 'off-load' checks before running the equipment under power
13. The importance of running the equipment at reduced speed to ensure satisfactory performance
14. How to make adjustments to lift components/assemblies to ensure that they function correctly
15. The fault diagnostic techniques that can be used to help identify problems with the running of the equipment
16. The measuring equipment used when checking lift installations (such as linear measuring devices, electrical measuring instruments, pressure testing devices and self-diagnostic aids)
17. How to check that tools and equipment are free from damage or defects, are in a safe and usable condition
18. The recording and/or reporting documentation to be completed for the activities undertaken
19. The types of problem associated with the checking activity, and how they can be overcome
20. The organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
21. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 41: Checking and Setting Lift Installations

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the checking activities (ALL)				
ensure currency of documentation				
adhere to risk assessment and safety standards				
provide safe access				
ensure tools and equipment are within current dates				
use appropriate techniques for checking				
leave work area in a safe and clean condition				
handover to appropriate people				
Check lift installations using all of the following information (ALL)				
customer requirements				
equipment specifications				
installation data				
installation standards				
Carry out installation checks on one of the following types of lift equipment (ONE)				
hydraulic				
traction				
Prior to initial start up carry out all of the following checks (ALL)				
lift free from obstructions and meets safety and environmental conditions				
check for damage				
lift installed and positioned to specification				
connections correctly made				
lubricants, grease applied				
moving parts clear of obstructions				
fluid levels correct				
safety/warning signs correctly located				
guards/safety systems in position and operable				
Use all of the following checking techniques methods and procedures (ALL)				
carry out start up and confirm equipment meets specifications				
run lift at reduced speed				
check for leaks				
make sensory checks				
check lift operating sequence and door opening and closing				
identify functional problems				
monitor/record measurements				
shut down safely				
Use two of the following instruments/devices during the escalator installation (TWO)				
linear measuring devices				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
multimeter				
pressure testing devices				
specific diagnostic aids				
Carry out all the following installation checks and adjust where appropriate (ALL)				
supply phases/connections				
rope terminations				
chain terminations				
rope tension				
chain tension				
looping of trailing cables				
lubrication points oiled/greased				
gearbox/hydraulic oil levels				
Carry out all the following checks and adjust/rectify where appropriate to include (ALL)				
safety circuits				
door operators				
overrun/run-by				
door closing protection devices				
lift machine/hydraulic pump unit				
lift controller equipment				
alarm systems				
lift car travel				
ancillary equipment				
counterweight operation				
Rectify faults as part of the checking process to include carrying out all of the following (ALL)				
identify the fault				
dismantling equipment				
labelling for reassembly				
replace/repair damaged or defective items				
setting/aligning adjusting replaced components				
tightening to required torque				
replenishing oils/grease				
re-commission to confirm correct operation				
Ensure that the lift installation complies with two or more of the following standards (TWO)				
BS Standards BS EN 81				
customer standards				
company standards				
specific system requirements				
Lift regulations				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
job card				
installation report				
company specific documentation				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 42: Installing Hydraulic Lift Equipment

Unit Summary

This unit identifies the competences you need to install hydraulic lift equipment, in accordance with approved procedures. This will require you to assess the site for the proposed installation, and to make the necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of hydraulic lift equipment, such as the cylinder base plate, hydraulic cylinder, jack assembly, pump unit, hydraulic pipes and hoses, cylinder and jack brackets and guides, and lift controller equipment.

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and equipment and components that need to be worked on during the installation. You will be expected to use appropriate tools and techniques to position, level, align and tension the equipment, and to make all necessary connections to the required specification. The installation activities will include making all necessary checks and adjustments to ensure the components are correctly positioned and aligned, have appropriate tension or working clearances, are tightened to the correct torque, and that the installation meets the required specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying installation procedures for hydraulic lift equipment. You will know about the equipment being installed, its installation requirements, the correct function of the equipment and any associated problems, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and resolve any installation problems, and ensure that the installed equipment meets the required specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. You will be required to demonstrate safe working practices throughout and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the installation activities:
 - plan the installation activities to minimise disruption to normal working
 - ensure that you have the correct installation documentation (such as, drawings, instructions, manufacturer's data, settings and other documentation)
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - ensure that electrical supplies have been isolated
 - ensure safe access and working arrangements for the installation area
 - carry out the installation activities, using appropriate techniques and procedures
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Confirm that **all** of the following conditions have been met, prior to installing the hydraulic lift equipment:
 - the site is suitably prepared for the installation to take place
 - appropriate utilities are available (such as gas, water, air, electricity)
 - the site is accessible and free from obstructions or hazards
 - any required installation consumables are available
 - safety and environmental conditions can be met
3. Install **both** types of hydraulic lifts:
 - direct acting
 - indirect acting
4. Install **all** of the following types of hydraulic lift equipment:
 - cylinder base plate
 - hydraulic cylinder
 - pump unit
 - valve block
 - jack/ram assembly
 - hydraulic pipes and hoses
 - over-speed governor
 - ram head pulley
 - cylinder, jack/ram brackets and guides
 - hydraulic controller equipment
5. Apply installation methods and techniques to include **nine** of the following:
 - drilling and hole preparation
 - positioning and securing equipment to plumbed set-out lines
 - aligning of equipment
 - bleeding the fluid power system
 - topping up fluid/oil reservoirs
 - levelling of equipment
 - shimming and packing
 - lifting and supporting
 - protecting the installation from weather

- connecting electrical wires and cables
 - securing by using mechanical fixings
 - securing by using masonry fixings
 - applying screw fastening locking devices
6. Move and position equipment, using **two** of the following:
- slings
 - portable lifting equipment
 - block and tackle
 - manual handling and moving of loads
7. Use **two** of the following instruments during the installation activities:
- straight edges
 - engineer's levels
 - mechanical measuring instruments/devices
 - electrical measuring instruments
8. Carry out all necessary checks, and adjust/rectify where appropriate, to include **all** the following:
- working clearance is appropriate
 - making 'off-load' checks
 - level and alignment is correct
 - fluid/oil reservoirs are at an appropriate level
 - the system is leak free
 - electrical wiring is encased and secure
 - electrical continuity is achieved
 - rotation of the pump is correct
 - connections are correctly made (mechanical, hydraulic)
 - the cylinder and jack/ram extend parallel to the car guide
 - visual (for completeness and freedom from damage)
 - other sensory checks (sound, smell, touch)
 - moving parts are guarded and clear of obstruction
 - torque setting of fasteners is correct
 - locking devices are fitted to fasteners (where appropriate)
9. Produce installations which comply with **two** or more of the following:
- equipment manufacturer's operating spec/range
 - BS and/or ISO standards (including BS EN 81, ISO 9000)
 - BS7255 (code of practice)
 - the Lift Regulations
 - customer standards and requirements
 - company standards and procedures
10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing hydraulic lift equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing hydraulic lift equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained

6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The preparations that need to be carried out on equipment prior to installation
9. The equipment to be installed, its operating procedures and function
10. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
11. The importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved
12. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
13. The tools and instruments used to position, secure and align the equipment (such as spanners, crow bars, torque wrenches, engineer's levels)
14. The techniques used to position, align, level, adjust and secure the equipment
15. The techniques used during installation of hydraulic equipment (release of pressures/force, cylinder/valve movement, sequencing)
16. Methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)
17. The importance of carrying out the appropriate electrical checks on hydraulic lift equipment
18. How to conduct any necessary checks and adjustments to ensure the equipment integrity accuracy and quality of the installation (including the fitting of guards and covers on electrical connections)
19. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, damage)
20. The lubrication requirements, and methods for protecting equipment from mechanical and weather damage
21. The importance of ensuring that the completed installation is free from dirt and damage, and of ensuring that any exposed components are correctly covered/protected
22. The tools and equipment used in the installation activities, and their calibration/care and control procedures
23. The problems that can occur with the installation operations, and how these can be overcome
24. The recording documentation to be completed for the activities undertaken
25. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
26. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 42: Installing Hydraulic Lift Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all of the following during the installation activities (ALL)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
activities planned to minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
obtain clearance				
ensure safe isolation of services				
ensure safe access				
installation activities undertaken correctly				
dispose of waste correctly				
leave work area in a safe and clean condition				
Confirm that all of the following conditions have been met prior to installing the hydraulic lift equipment (ALL)				
site is suitably prepared for the installation				
appropriate utilities available				
site is accessible and free from obstructions/hazards				
required consumables are available				
safety and environmental conditions are met				
Install both types of hydraulic lifts (ALL)				
direct acting				
indirect acting				
Install all of the following types of hydraulic lift equipment (ALL)				
cylinder base plate				
hydraulic cylinder				
pump unit				
valve block				
jack/ram assembly				
hydraulic pipes and hoses				
over speed governor				
ram head pulley				
cylinder, jack/ram brackets and guides				
hydraulic control equipment				
Apply installation methods and techniques to include nine of the following (NINE)				
drilling and hole preparation				
positioning equipment				
aligning equipment				
bleeding the system				
topping up reservoirs				
levelling equipment				
shimming and packing				
lifting and supporting				
protecting from the weather				
connecting wires, cables				
using mechanical fixings				
using masonry fixings				
applying screw fasteners				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Move and position equipment using two of the following (TWO)				
slings				
portable lifting equipment				
block and tackle				
manual handling				
Use two of the following instruments during the installation activities (TWO)				
straight edges				
engineers levels				
mechanical measuring devices				
electrical measuring devices				
Carry out all necessary checks and adjust/rectify where appropriate to include all of the following (ALL)				
working clearance				
making 'off-load' checks				
levelling and alignment				
fluid/oil reservoirs correct				
leak checks				
electrical wiring secure				
electrical continuity correct				
pump rotation correct				
connections correct				
cylinder and jack/ram parallel to car guide				
visual checks				
sensory checks				
moving parts are guarded				
torque settings correct				
locking devices fitted				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS and/or ISO standards				
BS 7255 (CoP)				
Lift Regulations				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 43: Carrying Out Fault Diagnosis on Escalator Installations

Unit Summary

This unit identifies the competences you need to carry out fault diagnosis on escalator installations, in accordance with approved procedures. You will be required to diagnose faults on an escalator involving two or more of the

310 Level 3 NVQ in Installation and commissioning

following interactive technologies: mechanical, electrical, or electronics, at both assembly and sub-assembly/component level. You will be expected to use a variety of fault diagnosis methods and techniques, and to utilise a number of diagnostic aids and equipment. From the evidence gained, you will be expected to identify the fault and its probable cause, and to suggest appropriate action to remedy the problem.

The equipment to be diagnosed could be either an escalator or passenger conveyor equipment.

Your responsibilities will require you to comply with organisational policy and procedures for the fault diagnostic activities undertaken, and to report any problems with these activities, or the tools and equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying fault diagnostic procedures on escalator installations. You will understand the various fault diagnosis methods and techniques used, and their application. You will know how to apply and interpret the information obtained from diagnostic aids and equipment, in adequate depth to provide a sound basis for carrying out the activities, and identifying faults or conditions that are outside the acceptable specification. You will know about the interaction of the other associated integrated technologies, and will have adequate knowledge to carry out effective fault diagnosis of the escalator installation.

You will understand the safety precautions required when carrying out the fault diagnosis activities, especially those for isolating the equipment. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Review and use all relevant information on the symptoms and problems associated with the products or assets
- c. Investigate and establish the most likely causes of the faults
- d. Select, use and apply diagnostic techniques, tools and aids to locate faults
- e. Complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
- f. Determine the implications of the fault for other work and for safety considerations
- g. Use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
- h. Record details on the extent and location of the faults in an appropriate format

Scope of the Unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the fault diagnostic activities:
 - plan the fault diagnosis to cause minimal disruption to normal working
 - use the correct issue of company and/or manufacturers' drawings and maintenance documentation
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure the safe isolation of equipment (such as mechanical or electricity)
 - provide safe access and working arrangements for the maintenance area
 - carry out the fault diagnostic activities using approved techniques and procedures
 - identify the fault and determine the appropriate corrective action
 - dispose of waste items in safe and environmentally acceptable manner, and leave the work area in a safe condition
2. Carry out fault diagnosis on **two** of the following types of escalator equipment:
 - mechanical
 - electrical
 - electronic
3. Collect evidence regarding the fault from **two** of the following sources:
 - monitoring equipment
 - recording devices
 - sensory input (such as sight, sound, smell, touch)
 - operation of the equipment
4. Use a range of fault diagnostic techniques to include:
 - half-split techniquePlus **one** more from the following:
 - emergent problem sequence
 - six point technique
 - unit substitution
 - function testing
 - injection and sampling
 - input/output technique
5. Use a variety of diagnostic aids and equipment to include **two** of the following:
 - manufacturer's manual
 - algorithms
 - probability charts/reports
 - equipment self-diagnostics
 - circuit diagrams/specifications
 - logic diagrams
 - flow charts
 - fault analysis charts (such as fault trees)
 - troubleshooting guides

6. Use **all** of the following types of test equipment to help in the fault diagnosis:
 - mechanical measuring equipment (such as dial test indicators, torque instruments)
 - electrical/electronic measuring instruments (such as multimeters, logic probes, special test equipment)
7. Find faults that have resulted in **two** of the following conditions during the installation:
 - intermittent problem
 - partial failure/out-of-specification operation
 - complete malfunction
8. Provide a record of the outcome of the fault diagnosis using **one** of the following:
 - installation records
 - job card
 - company specific documentation

Knowledge statements:

You must have knowledge and understanding of:

1. The health and safety requirements of the area in which you are carrying out the fault diagnosis activities
2. The specific safety precautions to be taken when carrying out the fault diagnosis of escalator equipment
3. The isolation and lock-off procedure or permit-to-work procedure that applies
4. The importance of wearing protective clothing and other appropriate safety equipment during the fault diagnosis process; the type of equipment to be used, and where to obtain it
5. Hazards associated with carrying out fault diagnosis on escalators (such as handling oils/greases, electrical contact, process controller interface, using faulty or damaged tools and equipment, using practices that do not follow laid-down procedures), and how they can be minimised
6. How to recognise and deal with victims of electric shock (to include methods of safely removing the victim from the power source, isolating the power source, and methods of first aid resuscitation)
7. Where to obtain, and how to interpret, drawings, circuit diagrams, specifications, manufacturers' manuals and other documents needed in the fault diagnosis process
8. The various fault finding techniques that can be used, and how they are applied (such as half-split, input/output, emergent problem sequence, six point technique, function testing, unit substitution, injection and sampling techniques and equipment self-diagnostics)
9. How to evaluate the various types of information available for fault diagnosis (such as monitoring equipment, sensory input, and operation of the escalator)
10. How to evaluate sensory conditions by sight, sound, smell, touch
11. The procedures to be followed to investigate faults, and how to deal with intermittent conditions
12. How to use the various aids and reports available for fault diagnosis
13. The type of equipment that can be used to aid fault diagnosis (such as mechanical measuring instruments, electrical measuring instruments), and how to check it is calibrated or configured correctly for the intended use, and that it is free from damage and defects
14. The application of specific fault finding methods and techniques best suited to the problem
15. How to analyse and evaluate possible characteristics and causes of specific faults/problems
16. How to evaluate the likely risk of running the equipment with the fault, and the effects the fault could have on the overall operation
17. How to prepare a report which complies with the company policy on fault diagnosis
18. The extent of your own responsibility, and whom you should report to if you have problems that you cannot resolve

Unit No 43: Carrying Out Fault Diagnosis on Escalator Installations

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all of the following during the fault diagnostic activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure safe isolation of services				
ensure safe access				
carry out fault diagnosis				
identify faults and determine action				
dispose of waste and leave the work area in a safe and clean condition				
Carry out fault diagnosis on two of the following types of escalator equipment (TWO)				
mechanical				
electrical				
electronic				
Collect evidence regarding the fault from two of the following sources (TWO)				
monitoring equipment				
recording devices				
sensory input				
operation of the equipment				
Use a range of fault diagnostic techniques to include (ONE)				
half-split technique				
PLUS one more from the following (ONE)				
emergent problem sequence				
six point technique				
unit substitution				
function testing				
injection and sampling				
input/output technique				
Use a variety of diagnostic aids and equipment to include two of the following (TWO)				
manufacturers manual				
algorithms				
probability charts/reports				
equipment self diagnostics				
circuit diagrams/specifications				
logic diagrams				
flow charts				
fault analysis charts				
troubleshooting guides				
Use all of the following types of test equipment to help in the fault diagnosis (ALL)				
mechanical measuring equipment				
electrical/electronic measuring instrument				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Find faults that have resulted in two of the following conditions during the installation (TWO)				
intermittent problem				
partial failure				
complete malfunction				
Provide a record of the outcome of fault diagnosis using one of the following (ONE)				
installation records				
job card				
company specific report				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 44: Installing Escalator Equipment

Unit Summary

This unit identifies the competences you need to install escalator equipment, in accordance with approved procedures. This will require you to assess the site for the proposed installation, and to make the necessary arrangements to have the required lifting and handling equipment, installation tools and any specified components and site services available, so that the installation can be carried out safely and efficiently. You will be required to install a range of escalator components and sub-assemblies, such as gearbox, motor, brake equipment, guide system, chains, steps, step rollers, balustrades, handrails, skirting, safety devices, control equipment, panelling and décor, and cables and wires.

This unit does not involve maintenance/repair type activities, such as the removal and replacement of existing equipment.

You will be required to select the appropriate tools and equipment to use, based on the operations to be performed and the equipment and components to be worked on during the escalator installation. You will be expected to use appropriate tools and techniques to position and align the equipment, and to make all necessary connections to the required specification. The installation activities will include making all necessary checks and adjustments to ensure that components are correctly positioned and aligned, have appropriate working clearances, are tightened to the correct torque, and that the escalator installation meets the required specification.

Your responsibilities will require you to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, tools or equipment used that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that all necessary job/task documentation is completed accurately and legibly.

You will be expected to work with a minimum of supervision, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out. The installation activity may be carried out as a team effort, but you must be able to demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard. Competence in all the areas required by the standard must be demonstrated.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying escalator installation procedures. You will know about the equipment being installed, its installation requirements, the correct function of the equipment and any associated problems, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively. You will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation activities, identify and resolve any problems, and ensure that the installed equipment meets the required specification.

You will understand the safety precautions required when carrying out the installation activities, especially those for ensuring safe isolation of services. You will be required to demonstrate safe working practices throughout and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant drawings and specifications for the installation being carried out
- c. Use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
- d. Install, position and secure the equipment and components in accordance with the specification
- e. Ensure that all necessary connections to the equipment are complete
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Check that the installation is complete and that all components are free from damage

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the installation activities:
 - plan the installation activities to minimise disruption to normal working
 - ensure that correct installation documentation is used (eg, drawings, instructions and other documentation)
 - adhere to risk assessment, COSHH and other relevant safety standards
 - obtain clearance to carry out the installation activities
 - ensure that electrical supplies have been isolated
 - ensure safe access and working arrangements for the installation area
 - carry out the installation activities using appropriate techniques and procedures
 - work to approved method statements and safe systems of work
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Confirm that **all** of the following conditions have been met, prior to installing the escalator equipment:
 - the site is suitably prepared for the installation to take place
 - the appropriate electrical supply is available
 - the site is accessible and free from obstructions or hazards
 - any required installation consumables are available
 - safety and environmental conditions can be met
3. Install **all** of the following escalator components or sub-assemblies:
 - gearbox
 - motor
 - brake equipment
 - guide system
 - chains
 - steps
 - step rollers
 - balustrade
 - handrails
 - skirting
 - safety devices
 - electrical control equipment
 - panelling and décor
 - cables and wires
4. Apply appropriate installation methods and techniques, to include **nine** of the following:
 - drilling and hole preparation
 - positioning and securing equipment
 - aligning of equipment
 - assembling components
 - shimming and packing
 - lifting and supporting
 - protecting the installation from the environment
 - connecting electrical wires and cables

- securing by using mechanical fixings
 - applying screw fastening locking devices
5. Move and position equipment using **two** of the following:
- slings
 - portable lifting equipment
 - block and tackle
 - manual handling and moving of loads
6. Use **two** of the following instruments/devices during the installation activities:
- straight edges
 - engineer's levels
 - mechanical measuring instruments/devices
 - electrical measuring instruments
 - self-diagnostic equipment
7. Carry out all relevant checks, and adjust/rectify where appropriate, to include **all** the following:
- working clearance is appropriate
 - correct application of oils and greases
 - level and alignment is correct
 - electrical wiring is terminated correctly
 - electrical wiring is encased and secure
 - visual (for completeness and freedom from damage)
 - other sensory checks (sound, smell, touch)
 - moving parts are guarded and clear of obstruction
 - torque setting of fasteners is correct
 - locking devices are fitted to fasteners (where appropriate)
8. Produce installations which comply with **two** or more of the following:
- equipment manufacturer's operation range
 - British Standard BS 7801 (code of practice)
 - customer standards and requirements
 - company standards and procedures
9. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
- installation records
 - company specific documentation
 - job card

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when installing escalator equipment (including any specific legislation, regulations or codes of practice for the activities, equipment or materials)
2. The procedures to be carried out before starting work on the installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The health and safety requirements of the work area where you are carrying out the installation activities, and the responsibility these requirements place on you
4. The hazards associated with installing escalator equipment, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment (PPE) that you need to use for the installation activities, and where it can be obtained
6. The interpretation of drawings, standards, quality control procedures and specifications used for the installation, (including BS and ISO schematics, symbols and terminology)
7. How to carry out currency/issue checks on the specifications you are working with
8. The importance of working to the correct specifications when installing escalator equipment
9. The preparations that need to be carried out on equipment prior to installation
10. The equipment to be installed, its operating procedures and function
11. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices)

12. The importance of applying the correct torque loading on the fasteners, and what can happen if these loadings are exceeded or not achieved
13. The procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
14. The tools and instruments used to position, secure and align the equipment (such as spanners, torque wrenches)
15. The techniques used to position, align, adjust and secure the equipment
16. Methods of lifting, handling and supporting the equipment during the installation activities (such as portable lifting equipment, block and tackle, slings and manual handling)
17. The appropriate electrical checks to be carried out on escalator equipment
18. How to conduct any necessary checks and adjustments to ensure the equipment integrity, function, accuracy and quality of the installation
19. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, damage)
20. The lubrication requirements, and methods for protecting equipment from mechanical and environmental damage
21. The importance of ensuring that the completed installation is free from dirt and damage, and that electrical components are correctly covered/protected
22. The calibration/care and control procedures for the tools and equipment used during the installation activities
23. The problems that can occur with the installation operations, and how these can be overcome
24. The recording documentation to be completed for the activities undertaken
25. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
26. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 44: Installing Escalator Equipment

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all of the following activities during the installation (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
obtain clearance				
ensure isolation of electrical supplies				
ensure safe access				
carry out appropriate installation activities				
work to approved methods				
dispose of waste correctly				
leave work area in a safe and clean condition				
Confirm that all of the following conditions have been met prior to installing the escalator equipment (ALL)				
site is suitably prepared for the installation				
appropriate electrical supply available				
site is accessible, free from obstruction				
any required consumables are available				
safety and environmental conditions are met				
Install all of the following escalator components or sub-assemblies (ALL)				
gearbox				
motor				
brake equipment				
guide system				
chains				
steps				
step rollers				
balustrade				
handrails				
skirting				
safety devices				
electrical control equipment				
panelling and decor				
cables and wires				
Apply appropriate installation methods and techniques to include nine of the following (NINE)				
drilling and hole preparation				
positioning equipment				
aligning equipment				
assembling components				
shimming and packing				
lifting and supporting				
protection from the weather				
connecting electrical wires/cables				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
using mechanical fixings				
using screw fasteners				
Move and position equipment using two of the following (TWO)				
slings				
portable lifting devices				
block and tackle				
manual handling				
Use two of the following instruments/devices during the installation activities (TWO)				
straight edges				
engineers levels				
mechanical measuring instruments				
electrical measuring instruments				
self-diagnosis equipment				
Carry out the relevant checks and adjust/rectify where appropriate to include all of the following (ALL)				
working clearance correct				
correct application of oils/grease				
level and alignment correct				
electrical wiring terminated correctly				
electrical wiring secure				
visual checks				
other sensory checks				
ensuring moving parts are guarded and clear of obstruction				
checking torque settings				
ensuring locking devices are fitted				
Produce installations which comply with two or more of the following standards (TWO)				
equipment manufacturers operation/ specification				
BS 7801 (CoP)				
customer standards				
company standards				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				
installation records				
company specific document				
job card				

Knowledge and understanding reference:

Candidate: _____

Date: _____

Assessor: _____

Date: _____

Unit No 45: Commissioning Escalator Installations

Unit Summary

This unit identifies the competences you need to carry out commissioning activities on escalator installations, in accordance with approved procedures. You will be expected to check that the escalator has been installed correctly, to specification, and then to carry out a planned and logical commissioning process, including resolving problems and rectifying faults at component or sub-assembly level, in accordance with company policy and manufacturers' instructions.

You will be required to carry out a number of commissioning procedures on escalator equipment, prior to initial start-up, such as checking the escalator for damage, escalator position, security of mechanical and electrical connections, lubricants and grease have been applied, fluid levels are correct, safety and warning signs are placed in the correct position, all moving parts are clear of obstructions, safety systems are operable, the working clearances between combs, steps and skirts are correct and machinery access covers are fitted correctly.

You will also be required to carry out a number of functional checks and adjustments, to ensure that the escalator meets the operational specification, such as checking stopping distances and emergency/auxiliary brakes, checking that handrails run synchronously with step-band, the escalator running direction is in line with the switch position, and that safety devices and auxiliary equipment operate correctly and in sequence.

Following the successful completion of these activities, you will be responsible for handing over the equipment to the appropriate people, but this is the subject of another unit.

Your responsibilities will require you to comply with organisational policy and procedures for the commissioning activities undertaken, and to report any problems with these activities or the tools and equipment used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You must ensure that all tools, equipment, and materials used in the commissioning activities are removed from the work area on completion of the activities, and that all necessary documentation is completed accurately and legibly.

Your underpinning knowledge will provide a good understanding of your work, and will provide an informed approach to applying commissioning procedures for escalator equipment. You will understand the commissioning methods, techniques and procedures used, and their application. You will know how the equipment functions, the purpose of the individual units/components and any associated defects, in adequate depth to provide a sound basis for carrying out the commissioning activities, correcting faults and solving functional problems, ensuring that the escalator equipment performs to the required specification.

You will understand the safety precautions required when carrying out the commissioning activities, especially those for the safe isolation of services. You will be required to demonstrate safe working practices throughout, and will understand your responsibility for taking the necessary safeguards to protect yourself and others in the workplace.

Note: Fault Diagnosis on Escalator Installations is the subject of another unit

Performance statements:

You must:

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow all relevant setting up and operating specifications for the products or assets being configured
- c. Follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
- d. Deal promptly and effectively with problems within your control and report those that cannot be solved
- e. Check that the configuration is complete and that the equipment operates to specification
- f. Complete all relevant documentation accurately and legibly

Scope of the unit:

The numbers of scope items specified (below) indicate the minimum requirements for this Occupational Standard.

You must:

1. Carry out **all** of the following during the commissioning activities:
 - plan the commissioning activities to minimise disruption to normal working
 - ensure the currency of all documentation used in the commissioning activities
 - adhere to risk assessment, COSHH and other relevant safety standards
 - ensure that all tools and equipment used are within current calibration dates
 - ensure the safe isolation of equipment during commissioning (such as mechanical, electricity, gas, air, fluids)
 - obtain clearance to carry out the commissioning activities
 - provide safe access and working arrangements for the commissioning area
 - dispose of any waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe condition and free from foreign object debris
2. Gather all the information required to undertake the commissioning, to include **five** of the following:
 - customer requirements
 - equipment specifications
 - manufacturer's manuals/settings
 - regulations and guidelines
 - installation data
 - installation standards
 - commissioning procedures
3. Prior to initial start-up of the escalator, carry out **all** the following checks:
 - the escalator is free from obstructions/hazards, and safety/environmental conditions have been met
 - check for damage to escalator assemblies following the installation
 - the escalator has been installed and positioned according to specification
 - all connections have been made correctly (mechanical, electrical)
 - all lubricants and grease have been applied before start-up
 - all moving parts are clear of obstructions
 - all fluid levels are correct before start up
 - safety and warning signs are placed in the correct locations
 - all barriers and safety systems are in position and operable
 - working clearances between combs, steps and skirtings are correct
 - machinery access covers are fitted correctly
4. Use **all** of the following checking techniques, methods and procedures:
 - carry out start-up procedures and confirm that the escalator equipment meets specifications
 - run the equipment at operating speed
 - check for leaks during operations
 - make sensory checks (sight, sound, smell, touch)
 - run through the escalator operating sequence and check for correct functioning
 - identify any functional problems
 - shut down the escalator to a safe condition
5. Use **two** of the following instruments/devices when checking the escalator installation:
 - linear measuring devices
 - multimeter
 - specific diagnostic aids

6. Make final adjustments to **all** of the following:
 - handrail tension
 - chain assemblies
 - skirting clearances
 - safety devices
 - guiding systems
 - gearbox backlash

7. Carry out functional checks and, where appropriate, adjust **all** of the following to meet the specification:
 - stopping distances
 - emergency and auxiliary brakes
 - handrails run synchronously with step-band
 - escalator running direction is in line with the key position switch
 - safety devices operate correctly and in the correct sequence
 - auxiliary equipment (such as fire alarms, fire shutters and power management systems) are connected and operate correctly
 - electrical continuity is confirmed

8. Rectify faults as part of the commissioning process, to include carrying out **all** of the following:
 - identifying the source of the fault
 - dismantling the equipment to unit, sub-assembly or component level
 - proofmarking/labelling components to aid re-assembly
 - replacing or repairing damaged or defective components
 - setting, aligning and adjusting replaced components
 - tightening fastenings to the required torque
 - replenishing oils and greases (where appropriate)
 - re-running the commissioning checks to confirm that correct operation is now achieved

9. Check that the escalator installation complies with **two** or more of the following quality and accuracy standards:
 - British Standard BSEN 115
 - customer standards and requirements
 - company standards and procedures
 - specific system requirements

10. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
 - commissioning log/report
 - corrective action report
 - job sheet
 - customer specific documentation
 - handover report

Knowledge statements:

You must have knowledge and understanding of:

1. The specific safety practices and procedures that you need to observe when checking escalator installations (including any specific legislation, regulations or codes of practice for the activities)
2. The procedures to be carried out before checking the escalator installation (such as obtaining permits to work, obtaining and complying with risk assessments and other health and safety requirements)
3. The specific health and safety precautions to be applied during the commissioning procedure, and their effects on others
4. Hazards associated with carrying out checks on escalator installations (handling oils, greases, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down checking procedures), and how to minimise them
5. The importance of wearing appropriate personal protective equipment (PPE) during the commissioning process, and where it can be obtained
6. How to obtain and interpret drawings, specifications, manufacturers' manuals, instructions, and other documents needed in the commissioning process
7. The principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
8. The checks to be carried out prior to starting up the escalator (including installation damage, escalator obstructions, mechanical and electrical connections, working clearances, gearbox oil levels, lubrication points)

9. The functional checks that need to be carried out at operational speed (including stopping distances, brake function, handrail synchronisation with step-band, running direction is in line with the switch position, safety devices and auxiliary equipment operate correctly)
10. The equipment operating and control procedures to be applied during the commissioning activity
11. The importance of running the equipment at operational speed to ensure satisfactory performance
12. How to make adjustments to escalator components/assemblies to ensure that they function correctly
13. The fault diagnostic techniques that can be used to help identify problems with the running of the escalator
14. The measuring equipment used when checking escalator installations (such as linear measuring devices, electrical measuring instruments and self-diagnostic aids)
15. How to check that tools and equipment are free from damage or defects, and are in a safe and usable condition
16. The importance of completing all documentation following the commissioning activity, and how to generate them
17. The types of problem associated with the commissioning activity, and how they can be overcome
18. The organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
19. The extent of your own authority, and whom you should report to if you have a problem that you cannot resolve

Unit No 45: Commissioning Escalator Installations

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
Carry out all the following during the commissioning activities (ALL)				
plan activities and minimise disruption				
ensure currency of documentation				
adhere to risk assessment and safety standards				
ensure tools and equipment are within current dates				
ensure safe isolation of services				
obtain clearance				
provide safe access				
dispose of waste correctly				
leave work area in a safe and clean condition				
Gather all the information required to undertake the commissioning to include five of the following (FIVE)				
customer requirements				
equipment specifications				
manufacturers manuals/settings				
regulations and guidelines				
installation data				
installation standards				
commissioning procedures				
Prior to initial start up of the escalator carry out all of the following checks (ALL)				
escalator free from obstructions and meets safety and environmental conditions				
check for escalator damage				
escalator installed and secured to specification				
connections correctly made				
lubricants, grease applied				
moving parts clear of obstructions				
fluid levels correct				
safety/warning signs correctly located				
barriers/safety systems in position and operable				
correct working clearances between combs/steps/skirting				
machinery access covers correctly fitted				
Use all of the following commissioning methods, techniques and procedures (ALL)				
carry out start up and confirm equipment meets specifications				
run equipment at operating				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
speeds				
check for leaks				
make sensory checks				
run operating sequence to carry out function checks				
identify functional problems				
shut down safely				
Use two of the following instruments/devices during the escalator installation (TWO)				
linear measuring devices				
multimeter				
specific diagnostic aids				
Make final adjustments to all of the following (ALL)				
handrail tension				
chain assemblies				
skirting clearances				
safety devices				
guiding systems				
gearbox backlash				
Carry out functional checks and where appropriate adjust all of the following to meet the specification (ALL)				
stopping distances				
emergency and auxiliary brakes				
handrail/step band synchronous movement				
escalator direction aligns with key position switch				
safety devices operate correctly and in sequence				
auxiliary equipment operates correctly				
electrical continuity correct				
Rectify faults as part of the commissioning process to include carrying out all of the following (ALL)				
identify the fault				
dismantling equipment				
labelling for reassembly				
replace/repair damaged or defective items				
setting/aligning adjusting replaced components				
tightening to required torque				
replenishing oils/grease				
re-commission to confirm correct operation				
Check that the escalator installation complies with two or more of the following standards (TWO)				
BSEN 115				
customer standards				
company standards				
specific system requirements				
Complete the relevant paperwork to include one of the following and pass to the appropriate people (ONE)				

evidence record sheet	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
commissioning log/report				
corrective action report				
job sheet				
customer specific documentation				
handover report				

Knowledge and understanding reference:

Candidate:

Date:

Assessor:

Date:

Level 3 NVQ in Installation and commissioning

Opportunities for generation of Key Skills evidence:

The Level 3 award in Installation and commissioning has been contextualised by SEMTA from the National Engineering Competency Standards (ECS). The following table lists the opportunities for generation of Key Skills evidence for each unit in the award and also gives reference to the ECS unit it has been derived from.

Installation and commissioning Unit	ECS Unit	Key Skills Reference		
		Communication	Application of Number	Problem Solving
Unit 1: Complying with Statutory Regulations and Organisational Safety Requirements	N/A			
Unit 2: Using Engineering Drawings and Documents in Installation and Commissioning Activities	1.13	C2.1a C2.2	N2.1	PS1.1 PS1.2 PS1.3
Unit 3: Working Efficiently and Effectively in Engineering	N/A			
Unit 4: Handing Over and Confirming Completion of Installation or Commissioning Activities	7.01	C2.1a C2.2		
Unit 5: Installing Mechanical Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 6: Installing Electrical/Electronic Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 7: Installing Equipment to Produce an Engineered System	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 8: Installing Instrumentation and Control Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 9: Installing Fluid Power Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 10: Installing Process Controller Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 11: Installing Emergency Electrical Power Generation Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 12: Installing Environmental Pollution Control Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 13: Installing Workplace Environmental Control Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 14: Installing Heating and Ventilation Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 15: Installing Air Conditioning and Ventilation Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3

Installation and commissioning Unit	ECS Unit	Key Skills Reference		
		Communication	Application of Number	Problem Solving
Unit 16: Installing Compressed Air Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 17: Installing Waste/Foul Water Distribution Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 18: Installing Fresh Water Distribution Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 19: Installing Refrigeration Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 20: Commissioning Mechanical Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 21: Commissioning Electrical/Electronic Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 22: Commissioning Engineered Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 23: Commissioning Process Controller Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 24: Commissioning Instrumentation and Control Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 25: Commissioning Fluid Power Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 26: Commissioning Emergency Electrical Power Generation Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 27: Commissioning Environmental Pollution Control Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 28: Commissioning Workplace Environmental Control Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 29: Commissioning Heating and Ventilation Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 30: Commissioning Air Conditioning and Ventilation Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 31: Commissioning Compressed Air Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 32: Commissioning Waste/Foul Water Distribution Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 33: Commissioning Fresh Water Distribution Equipment and Systems	4.01	C2.1a C2.2		PS2.1 PS2.2

Installation and commissioning Unit	ECS Unit	Key Skills Reference		
		Communication	Application of Number	Problem Solving
		C2.3		PS2.3
Unit 34: Commissioning Refrigeration Equipment and Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 35: Carrying Out Fault Diagnosis on Lift Installations	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 36: Measuring and Setting Out Lift Installations	2.04	C2.1a	N2.1	PS1.1 PS1.2 PS1.3
Unit 37: Installing Lift Well and Ancillary Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 38: Installing Traction Lift Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 39: Installing Lift Ropes and Chains	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 40: Installing Lift Doors, Frames and Ancillary Components	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 41: Checking and Setting Lift Installations	6.01	C1.1 C1.3 C2.2	N2.1	PS1.1 PS1.2 PS1.3
Unit 42: Installing Hydraulic Lift Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 43: Carrying Out Fault Diagnosis on Escalator Installations	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 44: Installing Escalator Equipment	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 45: Commissioning Escalator Installations	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3

[This page is intentionally blank]

Further information

Further information regarding centre/scheme approval or any aspect of assessment of the NVQs should be referred to the relevant City & Guilds regional/national office:

Region	Telephone	Facsimile
City & Guilds Scotland	0131 226 1556	0131 226 1558
City & Guilds North East	0191 402 5100	0191 402 5101
City & Guilds North West	01925 897900	01925 897925
City & Guilds Yorkshire	0113 380 8500	0113 380 8525
City & Guilds Wales	02920 748600	02920 748625
City & Guilds West Midlands	0121 359 6667	0121 359 7734
City & Guilds East Midlands	01773 842900	01773 833030
City & Guilds South West	01823 722200	01823 444231
City & Guilds London and South East	020 7294 2820	020 7294 2419
City & Guilds Southern	020 7294 2724	020 7294 2412
City & Guilds East	01480 308300	01480 308325
City & Guilds Northern Ireland/ Ireland	028 9032 5689	028 9031 2917
City & Guilds Head Office – Customer Relations Unit	020 7294 2800	020 7294 2400

Website <http://www.cityandguilds.com>.

The National Occupational Standards have been produced by SEMTA who can provide advice on learning, apprenticeships and careers within the industry.

SEMTA
14 Upton Street
Watford
WD18 0JT

Email: infodesk@semta.org.uk

Web: www.semta.org.uk

SP-03-1684