

# Level 2 NVQ in Engineering Maintenance and Installation

Scheme Handbook

1688



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## Foreword

This guide aims to provide information to centres and candidates for the administration and assessment of The Level 2 National Vocational Qualification (NVQ) in Fabrication and Welding Engineering. It provides details of the requirements specific to this N/SVQ qualification which includes the requirements for occupational competence for all those involved in assessing and verifying performance and the specific assessment requirements. The National Occupational Standards are included in this Scheme Handbook. There are three sections to the Guide.

- Section 1 Scheme information
- Section 2 Assessment requirements
- Section 3 National occupational standards and Evidence profiles

The first section contains information on who will benefit from the awards and the structure and scope of the NVQs. The second section sets out the requirements for assessment and quality assurance and the third section provides the specific information on assessment and evidence requirements for the units.

This document is designed to be used in conjunction with:  
the *N/SVQ Candidate Guide* (stock reference TS-11-0001)  
and  
the *N/SVQ Centre Guide* (stock reference EN-11-0001)

Check the City & Guilds website: [www.city-and-guilds.co.uk](http://www.city-and-guilds.co.uk), for latest version.

Packs of multiple copies of the recording forms are also available from Publications Sales (Recording forms for N/SVQs, stock reference TS-22-0001).

In the case of any inconsistency between the *N/SVQ Centre Guide* or the *N/SVQ Candidate Guide* and this N/SVQ specific document, this document shall prevail.

For details of centre and scheme approval refer to 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 (details in *Further information* section of this document).

Details of general regulations, administrative, registration and certification procedures and fees appear on City & Guilds web site <http://www.city-and-guilds.co.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.

## **Specific evidence profile forms**

Specific evidence profile forms have been designed for these awards. There is a separate form for each unit. The forms provide a convenient method of ensuring candidates have all the necessary evidence to achieve a unit.

## Level 2 NVQ in Engineering Maintenance and Installation

### 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 2 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 fabrication and welding organisations.

### National Occupational Standards and Key Skills

The full National Occupational Standards and Key Skills mapping are 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 2 NVQ in Engineering Maintenance and Installation consists of 61 units. All candidates must take the THREE core units plus a specified number of optional units from **one** of the **eleven** 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 2 NVQ in Engineering Maintenance and Installation (Mechanical maintenance)**
- Level 2 NVQ in Engineering Maintenance and Installation (Electrical maintenance)**
- Level 2 NVQ in Engineering Maintenance and Installation (Electronic maintenance)**
- Level 2 NVQ in Engineering Maintenance and Installation (Fluid power maintenance)**
- Level 2 NVQ in Engineering Maintenance and Installation (Services maintenance)**
- Level 2 NVQ in Engineering Maintenance and Installation (Communication-electronics maintenance)**
- Level 2 NVQ in Engineering Maintenance and Installation (Servicing stairlifts)**
- Level 2 NVQ in Engineering Maintenance and Installation (Servicing service lifts)**
- Level 2 NVQ in Engineering Maintenance and Installation (Installing stairlifts)**
- Level 2 NVQ in Engineering Maintenance and Installation (Installing service lifts)**
- Level 2 NVQ in Engineering Maintenance and Installation (Equipment installation)**

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

## Qualification Structure

### **Mandatory units for all pathways** *(All three units must be covered)*

Unit 1: Complying with Statutory Regulations and Organisational Safety Requirements

Unit 2: Using and Interpreting Engineering Data and Documentation

Unit 3: Working Efficiently and Effectively in Engineering

### **Pathways:**

#### **Mechanical Maintenance**

*Must complete the following units:*

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

Unit 5: Carrying Out Fault Location on Mechanical Equipment

Unit 6: Carrying Out Maintenance Activities on Mechanical Equipment

*Plus **one** of the following units:*

Unit 7: Restoring Mechanical Components to Usable Condition by Repair

Unit 8: Carrying Out Scheduled Maintenance Activities on Mechanical Equipment

#### **Electrical Maintenance**

*Must complete the following units:*

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

Unit 9: Carrying Out Fault Location on Electrical Equipment and Circuits

Unit 10: Carrying Out Maintenance Activities on Electrical Equipment

*Plus **one** of the following units:*

Unit 11: Carrying Out Modifications or Rewiring Electrical Circuits

Unit 12: Carrying Out Scheduled Maintenance Tasks on Electrical Equipment

#### **Electronic Maintenance**

*Must complete **all** of the following units:*

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

Unit 13: Carrying Out Fault Location on Electronic Equipment and Circuits

Unit 14: Carrying Out Tests on Electronic Equipment and Circuits

Unit 15: Carrying Out Repairs to Electronic Equipment

#### **Fluid power Maintenance**

*Must complete **all** the following units:*

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

Unit 16: Carrying Out Fault Location on Fluid Power Equipment and Circuits

Unit 17: Carrying Out Maintenance Activities on Fluid Power Equipment

Unit 18: Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment



## Services Maintenance

*Must complete the following units:*

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

Unit 19: Carrying Out Fault Location on Service Systems and Equipment

Unit 20: Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment

*Plus one of the following units:*

Unit 21: Carrying Out Maintenance on Water Distribution Systems and Equipment

Unit 22: Carrying Out Maintenance on Emergency Power Generation Equipment

Unit 23: Carrying Out Maintenance on Workplace Environmental Control Equipment

Unit 24: Carrying Out Maintenance on Heating and Ventilation Equipment

Unit 25: Carrying Out Maintenance on Air Conditioning and Ventilation Equipment

Unit 26: Carrying Out Maintenance on Gas Distribution Equipment

Unit 27: Carrying Out Maintenance on Compressed Air Equipment

Unit 28: Carrying Out Maintenance on Process Control Equipment

Unit 29: Carrying Out Maintenance on Instrumentation and Control Equipment

Unit 30: Carrying Out Maintenance on Industrial Refrigeration Equipment

Unit 31: Carrying Out Maintenance on Environmental Control Equipment

## Communication-Electronics Maintenance

*Must complete the following units:*

Unit 32: Carrying Out Fault Location on Communication-Electronic Systems

Unit 33: Carrying Out Scheduled Maintenance on Communication-Electronic Systems

*Plus one of the following units:*

Unit 34: Carrying Out Repairs to Communication-Electronic Systems

Unit 35: Carrying Out Modifications to Communication-Electronic Systems

Unit 36: Carrying Out Tests on Communication-Electronic Systems

Unit 37: Carrying Out the Configuration of Communication-Electronic Systems

Unit 38: Assisting in the Installation of Communication-Electronic Systems

## Servicing Stairlifts

*Must complete all of the following units:*

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

Unit 39: Carrying Out Fault Location on Stairlift Equipment

Unit 40: Carrying Out Servicing Activities on Stairlift Equipment

Unit 41: Restoring Stairlifts to Service by Replacing or Repairing Components

## Servicing Service Lifts

*Must complete all of the following units:*

Unit 42: Carrying Out Fault Location on Service Lifts

Unit 43: Carrying Out Servicing of Service Lift Equipment

Unit 44: Restoring Service Lifts to Service by Replacing or Repairing Components

## Installing Stairlifts

*Must complete all of the following units:*

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

Unit 39: Carrying Out Fault Location on Stairlift Equipment

Unit 45: Installing Stairlifts

## Installing Service Lifts

*Must complete all of the following units:*

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

Unit 42: Carrying Out Fault Location on Service Lifts

Unit 46: Installing Service Lifts

## **Equipment Installation**

*Must complete **one** of the following units:*

- Unit 47: Assisting in the Installation of Mechanical Equipment
- Unit 48: Assisting in the Installation of Electrical/Electronic Equipment
- Unit 49: Assisting in the Installation of Equipment to Produce an Engineered System
- Unit 50: Assisting in the Installation of Instrumentation and Control Equipment
- Unit 51: Assisting in the Installation of Fluid Power Equipment
- Unit 52: Assisting in the Installation of Process Controller Equipment
- Unit 53: Assisting in the Installation of Emergency Electrical Power Generation Equipment
- Unit 54: Assisting in the Installation of Environmental Pollution Control Equipment
- Unit 55: Assisting in the Installation of Workplace Environmental Control Equipment
- Unit 56: Assisting in the Installation of Heating and Ventilation Equipment
- Unit 57: Assisting in the Installation of Air Conditioning and Ventilation Equipment
- Unit 58: Assisting in the Installation of Compressed Air Equipment
- Unit 59: Assisting in the Installation of Waste/Foul Water Distribution Equipment
- Unit 60: Assisting in the Installation of Fresh Water Distribution Equipment
- Unit 61: Assisting in the Installation of Refrigeration Equipment

# 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 11.

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 later.

## **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 (e.g., 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 2 N/SVQ Engineering maintenance and installation**

### **Scope of the Award**

This qualification is for people who are occupied in maintenance or installation activities in an engineering environment, and who have more than an intermediate level of technical skill and knowledge in either of those types of activity. They will be expected to demonstrate safe working practices and procedures at all times and work to instructions, either alone or in conjunction with others, taking personal responsibility for the quality and accuracy of the work they carry out.

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

### **Specific Technical Requirements for Assessors**

Assessors of this qualification should have a minimum of three years' relevant skills experience, and must have a thorough working knowledge of the processes, techniques and procedures that are used within engineering maintenance or installation (as appropriate). 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 e.g. *Page 6* – could refer to the position in the portfolio of the inspection sheet covering 'Weld Quality B and C and Dimensional Accuracy'. *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 – e.g. 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 e.g. 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 e.g. items 8 and 9 of this unit.

### **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. e.g. 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.

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.

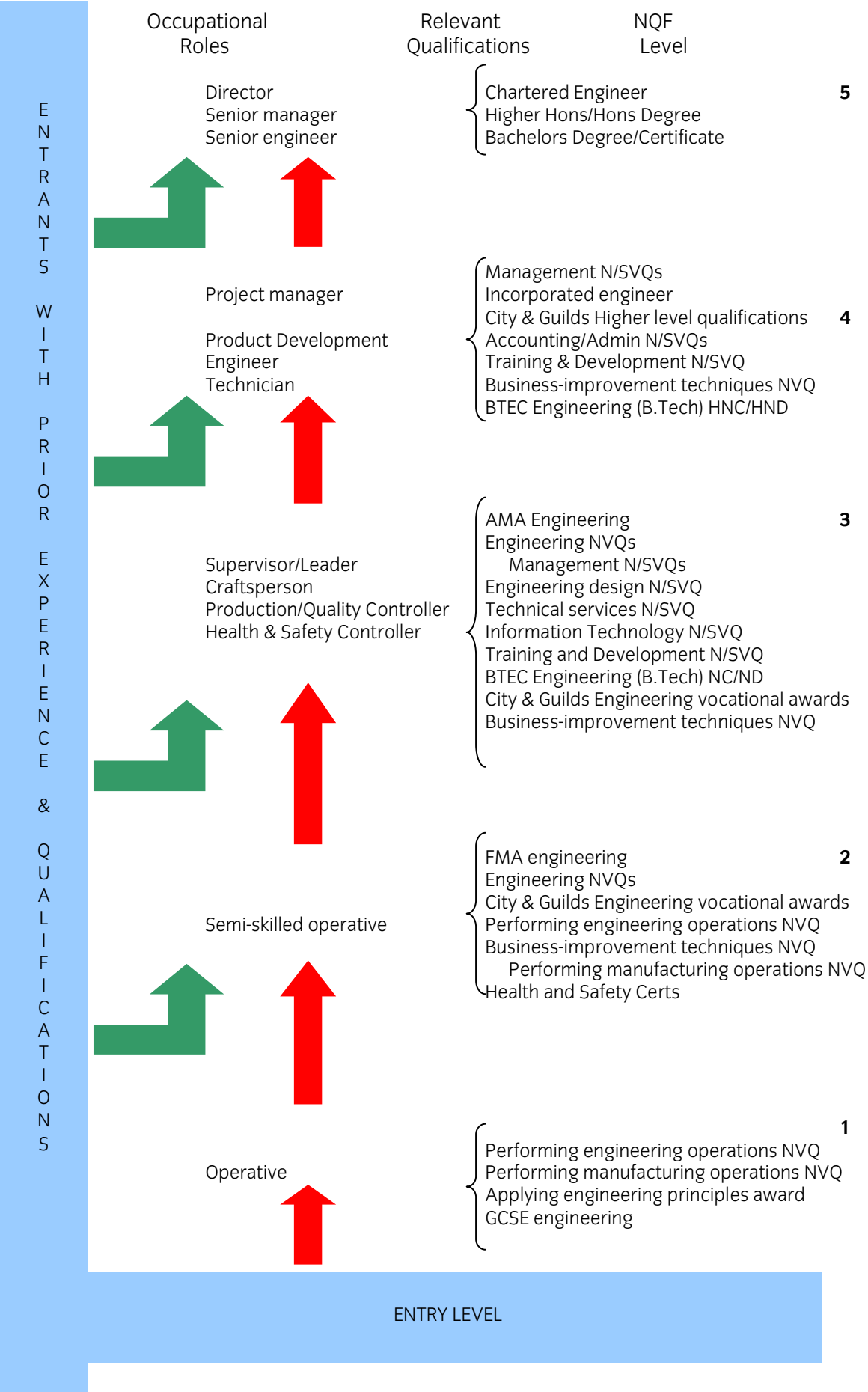
The knowledge evidence should be referenced in a similar fashion to that used for performance evidence.

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

### **Further guidance**

Further guidance to general procedures for the assessment of NVQs and sample recording forms is found in the *N/SVQ Centre Guide* (stock reference EN-11-0001)

# Engineering Sector Progression Routes



**Level 2 NVQ in Engineering maintenance and installation 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							

Name

Signature

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

# National Occupation Standards – Level 2 Engineering Maintenance and Installation

Supplied by *SEMTA*

# Unit 1 Complying with Statutory Regulations and Organisational Safety Requirements

## Unit Summary

This unit identifies the competences you need to deal with statutory regulations and organisational safety requirements, in accordance with approved 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 must also 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 for the evacuation of premises.

You will 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, 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 these activities 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 way in which you carry out the required engineering activities.

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

### 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:
  - Applying, 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 yourself or others
  - following organisational procedures in the event of fire and for the evacuation of premises/work area
  - 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 (such as working at height, in confined spaces, hot work)
  - 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** of the following 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 kept 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 resulting from any work you are carrying out

## **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 and other current legislation (such as 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, Reporting of Injuries, Diseases and Dangerous Occurrences 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. 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. 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. The first aid facilities that 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 constitute dangerous occurrences and hazardous malfunctions, and why these must be reported even if nobody 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. The organisational policy with regard to fire fighting procedures; the common causes of fire and what you can do to help prevent them
12. The personal protective equipment (PPE) and protective clothing that is available for your areas of activity
13. How to lift and carry loads safely, 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**

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>health &amp; safety-understanding application of duties and equipment (all)</b>				
H & S at Work Act				
PPE				
COSHH				
risk assessments				
hazardous substances				
statutory regulations				
<b>emergency requirements (all)</b>				
first aider/facilities				
injury procedures				
fire procedures				
danger/hazard procedures				
<b>environmental hazards/risks (all)</b>				
working environment				
tools & equipment				
materials and substances				
bad working practices				
<b>manual lifting &amp; carrying techniques (two)</b>				
lifting alone				
with assistance of others				
with mechanical assistance				
<b>safe working practices (all)</b>				
tidy workplace				
tools & equipment				
safety/hazard warnings				
protect others				

Knowledge and understanding reference:

Candidate: .....  
 Assessor: .....

Date: .....  
 Date: .....



# Unit 2 Using and Interpreting Engineering Data and Documentation

## Unit Summary

This unit identifies the competences you need to make effective use of text, numeric and graphical information, by interpreting and using technical information extracted from engineering drawings, technical manuals, reference tables, specifications, charts or electronic displays, in accordance with approved procedures. You will be required to extract the necessary data from the various specifications and related documentation, in order to establish and carry out the work requirements, and to make valid decisions about the quality and accuracy of the work produced.

Your responsibilities will require you to comply with organisational policy and procedures for obtaining and using the documentation applicable to the activity. You will be expected to report any problems with the use and interpretation of the data 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 types of documentation available for use, and will provide an informed approach to applying engineering instructions and procedures. You will be able to read and interpret the documentation available, and will know about the conventions, symbols and abbreviations, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

## 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 data and related specifications, and carry out **all** of the following:

- check the currency and validity of the data and documentation 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
- deal with or report any problems found with the data
- make valid decisions based on the evaluation of the engineering information
- return all documentation to the approved location on completion of the work
- complete all necessary production documentation

2. Use information extracted from mechanical and/or electrical/electronic documentation, to include **one** or more types from the following:

- detailed component drawings
- general assembly drawings
- repair drawings
- fluid power drawings
- wiring/circuit diagrams
- installation drawings
- approved sketches
- illustrations
- visual display screens
- modification drawings
- sub-assembly drawings
- schematic diagrams
- fabrication drawings
- welding drawings
- casting drawings
- operational diagrams
- physical layouts
- manufacturers' manuals/drawings
- photographic representations

3. Use information extracted from related documentation, to include **two** from the following:

- job instructions
- drawing instructions
- test schedules
- manufacturers' instructions
- weld procedure specifications
- metal specifications
- reference tables/charts
- national, international and organisational standards
- planning documentation
- quality control documents
- operation sheets
- process specifications

4. Extract information that includes **three** of the following:

- materials or components required
- dimensions
- tolerances
- build quality
- installation requirements
- surface texture requirements
- location/orientation of parts

- process or treatments required
- assembly sequence
- inspection requirements
- weld type and size
- operations required
- connections to be made
- surface finish required
- circuit characteristics (such as pressure, flow, current, voltage, speed)

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The information sources for the data and documentation that you use in your work activities
2. How the required documents are obtained, and how to check that they are current and valid
3. How to use other sources of information to support the data (such as electronic component pin configuration specifications, standard reference charts for limits and fits, tapping drill reference charts, bend allowances required for material thickness, electrical conditions required for specific welding rods, mixing ratios for bonding and finishing materials, metal specifications and inspection requirements)
4. The procedures for reporting discrepancies in the data or documents, and for reporting lost or damaged drawings/documents
5. Care and control procedures for the documents, the importance of returning them to the designated location on completion of the work activities, and how damage or graffiti on them can lead to scrapped work
6. Imperial and metric systems of measurement, tolerancing and fixed reference points
7. The meaning of the different symbols and abbreviations found on the documents that you use (such as surface finish, electronic components, weld symbols, linear and geometric tolerances, pressure and flow characteristics, torque values)
8. 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 and Interpreting Engineering Data and Documentation

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Obtain the necessary data and related specifications (all)</b>				
check currency and validity				
exercise care and control				
extract Data				
additional Data				
report Problems				
make Valid Decisions				
return Documentation				
complete Documentation				
<b>Use information extracted from mechanical/electrical/electronic documentation (one)</b>				
detailed component drawings				
general assembly drawings				
repair drawings				
fluid power diagrams				
installation drawings				
approved sketches				
illustrations				
visual display screens				
modification drawings				
sub-assembly drawings				
schematic diagrams				
fabrication drawings				
welding drawings				
casting drawings				
operational diagrams				
physical layouts				
manufacturers manual/drawing				
photographic representations				
<b>Use information extracted from related documentation (two)</b>				
job instructions				
drawing instructions				
test schedules				
manufacturers' instructions				
weld procedure specifications				
metal specifications				
reference tables/charts				
organisational standards				
planning documentation				
quality control documents				
operation sheets				
process specifications				
<b>Extract information from the following (three)</b>				
materials or components				
dimensions				
tolerances				
build quality				
installation requirements				
surface texture requirements				
location/orientation of parts				
process or treatments required				
assembly sequence				

inspection requirements				
weld type and size				
operations required				
connections to be made				
surface finish required				
circuit characteristics				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 3 Working Efficiently and Effectively in Engineering

## Unit Summary

This unit identifies the competences 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, ensuring that it is in a safe condition to carry out the intended activities, ensuring that you have the appropriate job specifications and instructions, and ensuring 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 working area to an acceptable condition before undertaking 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.

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, and to review objectives and targets for your personal development.

Your responsibilities will require you to comply with organisational policy and procedures for the engineering activities undertaken, and to report any problems with these activities, or with 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 to instructions, with a minimum of supervision, and 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 be sufficient to 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 aspects you need to consider when preparing and tidying up the work area, how to 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 your 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.

## 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. Maintain effective working relationships with colleagues
- h. Review personal training and development as 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 to carry out the engineering activity, taking into consideration **all** of the following, as applicable to the work to be undertaken:
  - the work area is free from hazards and suitably prepared for the activities to be undertaken
  - any required safety procedures are implemented
  - any necessary personal protection equipment is obtained and is in a usable condition
  - the required tools and equipment are obtained, and checked that they are in a safe and useable condition
  - all necessary drawings, specifications and associated documents are obtained
  - job instructions are obtained and understood
  - the correct materials or components are obtained
  - storage arrangements for work are appropriate
  - appropriate authorisation to carry out the work is obtained
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 the safe disposal of waste materials
3. 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
4. Maintain effective working relationships, to include **two** of the following:
  - colleagues within own working group
  - people outside your normal working group
  - line management
  - external contacts
5. 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

## **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 area
2. The correct use of any equipment used to protect the health and safety of yourself 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 that all tools and equipment are available prior to undertaking the activity
6. The checks to be carried out to ensure that 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 order
8. The checks to be carried out to ensure that all materials required are correct and complete, prior to undertaking the activity
9. The action to be taken if materials do not meet the requirements of the activity
10. Whom to inform when the work activity has been completed
11. The information and/or documentation required to confirm that the activity has been completed
12. The materials, equipment and tools that 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 maintaining effective working relationships within the workplace
16. The procedures to deal with and report any problems that can affect working relationships
17. The difficulties that can occur in working relationships, and how to resolve them
18. The regulations that affect how you should be treated at work (such as Equal Opportunities Act, Race and Sex Discrimination, Working Time Regulations, Disabilities Discrimination Act)
19. The benefits of continuous personal development
20. The training opportunities that are available in the workplace
21. The importance of reviewing your training and development
22. With whom to discuss training and development issues
23. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve



### Unit 3 Working Efficiently and Effectively in Engineering

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Prepare for engineering activity (all)</b>				
work area free of hazards				
safety procedures				
PPE				
tools/equipment				
drawings/specs/docs				
job instructions				
materials/components				
storage				
authorisation				
<b>complete work activities (all)</b>				
necessary docs				
return tools/equipment				
return drawings				
unusable tools/components				
waste materials				
<b>Deal with problems affecting the engineering process (two)</b>				
materials				
tools and equipment				
drawings				
job specification				
quality				
people				
timescales				
safety				
activities or procedures				
<b>Maintain working relationships (two)</b>				
materials				
tools and equipment				
drawings				
job specification				
<b>Review personal development objectives and targets (two)</b>				
dual or multi-skilling				
training on new equipment/technology				
increased responsibility				
understanding of company working practices etc				
other specific requirements				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 4 Handing Over and Confirming Completion of Maintenance or Installation Activities

## Unit Summary

This unit identifies the competences you need to hand over maintained and/or installed equipment, and to confirm that the equipment is now ready to run. Following the maintenance and/or installation activity, you will be required to ensure that the equipment is in a safe and operable condition. This will involve checking that all guards/covers and safety devices have been fitted, and that the equipment functions to the required specification.

On handing over the equipment, you will be expected to highlight any new, current or changed operating features of the equipment, and to inform the appropriate person of any future maintenance requirements. You must also ensure that you receive confirmation that everyone involved in the handover accepts that the maintained and/or installed equipment functions to the agreed specification.

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

Your underpinning knowledge will be sufficient to provide a sound understanding of your work, and will provide an informed approach to applying maintenance and/or installation handover procedures. 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 to be observed when handing over the maintained and/or installed equipment. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to yourself and others in the workplace/area.

## 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 to operate, by carrying out **all** of the following checks:
  - the maintenance and/or installation activity has been completed, and the equipment functions correctly
  - all safety systems are functioning correctly
  - any waste materials, safety barriers and warning signs have been removed
  - any auxiliary systems or equipment involved are connected and operable
  - any environmental controls are operable (where appropriate)
  - others involved in using the equipment are aware of impending start-up
2. Carry out correct handover procedures for **one** type of equipment/service from the following:
  - mechanical equipment
  - electrical equipment
  - electronic equipment
  - fluid power equipment
  - process control/instrumentation and control equipment
  - engineering services
  - industrial refrigeration equipment
  - lift equipment
  - other specific equipment
3. Carry out **all** of the following during the handover procedures:
  - run the maintained and/or installed equipment in the presence of the appropriate person(s)
  - confirm that the other person/party accepts that the equipment functions satisfactorily
  - highlight to the appropriate person any changes in the operating procedure (where appropriate)
  - inform the appropriate person of any future maintenance activities that may be required
  - obtain agreement from the other person(s) that they now accept responsibility for the equipment to be returned to service
  - complete any necessary handover documentation
4. Carry out handover procedures to **one** of the following:
  - production/process operator
  - supervisor of production/process
  - maintenance supervisor
  - customer
  - other specific person
5. Carry out the handover, **either** following **two** of the following maintenance activities:
  - breakdown
  - preventative maintenance activity

**Or**

  - scheduled servicing
  - modification to equipment
  - on completion of the installation activities
6. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate people:
  - job card
  - maintenance log or report
  - other handover paperwork

## **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 specific health and safety precautions to be applied during the handover procedure, and their effects on others
3. The importance of wearing protective clothing and other appropriate safety equipment whilst running the equipment during the handover operations
4. The checking process to be followed before handing over the equipment (such as all guards/covers have been fitted on moving or rotating parts, the equipment functions correctly)
5. The correct procedure to be followed when handing over maintained and/or installed equipment
6. The procedure for involving the appropriate people when starting up the equipment
7. The need to highlight, where appropriate, any new, current or changed operating features of the maintained or installed equipment
8. The importance of informing the appropriate person of any future maintenance requirements
9. The need to confirm that the other person understands the equipment operating procedures before leaving them to operate the equipment
10. The need to ensure that the person you are handing over the equipment to accepts that it is in a satisfactory condition
11. The organisational documentation procedures with regard to handover
12. How to create and maintain effective working relationships with appropriate people (such as encouraging, helping, politeness, open discussions both ways)
13. The problems that can occur during handover, and how they can be overcome
14. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 4 Handing Over and Confirming Completion of Maintenance or Installation Activities

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Confirm that the equipment is ready to operate, by checking (all)</b>				
the maintenance activity completed and equipment functions to specification				
all safety systems are functioning correctly				
any waste materials/safety barriers/warning signs removed				
any auxiliary systems or equipment connected and operable				
environmental controls are operable				
others involved are aware of impending restart				
<b>Carry out handover procedures for equipment/service (one)</b>				
mechanical equipment				
electrical equipment				
electronic equipment				
fluid power equipment				
process control/instrumentation and control equipment				
engineering services				
industrial refrigeration equipment				
lift equipment				
other specific equipment				
<b>Carry out the following during handover procedure (one)</b>				
run the maintained and/or installed equipment in the presence of the appropriate person(s)				
confirm that the other person/party accepts that the equipment functions satisfactorily				
highlight to the appropriate person any changes in the operating procedure (where appropriate)				
inform the appropriate person of any future maintenance activities that may be required				
obtain agreement from the other person(s) that they now accept responsibility for the equipment to be returned to service				
complete any necessary				

handover documentation				
<b>Carry out handover procedures (one)</b>				
production/process operator				
supervisor of production/process				
maintenance supervisor				
customer				
other specific person				
<b>Carry out the handover of either (two) of the following maintenance activities</b>				
breakdown				
preventative maintenance activity				
<b>or</b>				
scheduled servicing				
modification to equipment on completion of the installation activities				
<b>Complete relevant paperwork and pass to appropriate people (one)</b>				
job card				
maintenance log or report				
other handover paperwork				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 5 Carrying Out Fault Location on Mechanical Equipment

## Unit Summary

This unit identifies the competences you need to locate faults on mechanical equipment, in accordance with approved procedures. You will be required to locate faults on equipment such as machine tools, gearboxes, portable tools, engines, pumps, process control valves, compressors, process plant, conveyers and elevators, lifting and handling devices, transfer equipment, mechanical structures, workholding devices and other company-specific equipment. You will be expected to use a variety of fault location methods and procedures, such as gathering information from the person who reported the fault, using recognised fault finding techniques and diagnostic aids, measuring, inspecting and operating the equipment.

Your responsibilities will require you to comply with organisational policy and procedures for the fault location activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking full responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying fault location procedures on mechanical equipment. You will have an understanding of the basic fault location methods and techniques used, and their application. You will also know how to interpret information obtained from fault finding aids and equipment, in adequate depth to provide a sound basis for carrying out the activities.

You will understand the safety precautions required when carrying out the fault location 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. 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 locating activity:
  - plan the fault location methods and procedures in conjunction with others
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for in the fault finding area
  - carry out the fault location activities, using approved procedures
  - identify the fault, and consider appropriate corrective action
  - in conjunction with others, take actions to resolve the problem
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
2. Carry out fault location on **two** of the following types of mechanical equipment:
  - gearboxes
  - machine tools
  - lifting and handling devices
  - transfer equipment
  - portable power tools
  - engines
  - pumps
  - process control valves
  - compressors
  - process plant
  - workholding devices
  - conveyers and elevators
  - mechanical structures
  - company-specific equipment
3. Use **four** of the following diagnostic techniques, tools and aids to assist in locating the fault:
  - information gathered from the person that reported the fault
  - fault finding techniques (such as six point, half-split, input/output, unit substitution, emergent sequence)
  - diagnostic aids (such as manuals, flow charts, troubleshooting guides, maintenance records)
  - inspecting (such as checking for breakages, wear/deterioration, overheating, missing parts, loose fittings)
  - operating (such as manual switching off and on, running equipment, condition of end product)
4. Use **two** of the following types of instruments to assist in locating faults:
  - measuring instruments/devices
  - dial test indicators
  - torque measuring devices
  - flow meters
  - alignment devices
  - self-diagnostic equipment
  - pressure/force indicators
  - other specific test/measurement instruments
5. Locate faults that have resulted in **two** of the following breakdown categories:
  - intermittent problem
  - partial failure/out-of-specification output
  - complete breakdowns



6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
- scheduled maintenance report
  - corrective maintenance report
  - other company-specific report

### **Knowledge statements:**

#### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. The importance of wearing protective clothing and other appropriate safety equipment during fault location activities
4. Hazards associated with carrying out fault location on mechanical equipment (such as moving machinery, handling oils and greases, stored pressure/force, misuse of tools), and how they can be minimised
5. The procedure to be adopted to establish the background of the fault
6. How to use the various diagnostic aids to help identify the location of the fault
7. The various fault location techniques that can be used, and how they are applied (such as half-split, input-to-output, function testing, unit substitution, and equipment self-diagnostics)
8. How to evaluate sensory information (such as sight, sound, smell, touch)
9. How to assess evidence and evaluate the possible causes of faults/problems
10. How to use a range of fault diagnostic equipment to investigate the problem
11. The care, handling and application of mechanical measuring/test equipment (such as measuring instruments, dial test indicators, flow meters, torque measuring devices, pressure/force detectors)
12. How to check that mechanical measuring/test equipment is within calibration, and that it is free from damage and defects
13. How to obtain and interpret information from job instructions and other documents needed in the fault location process (such as drawings, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical symbols)
14. The basic principles of how the mechanical equipment functions, its operating sequence, the purpose of individual units/components and how they interact
15. The problems that can occur during the fault location activity, and how they can be minimised
16. How to evaluate the likely risk to yourself and others, and the effects the fault could have on the overall process or system
17. The importance of completing the correct documentation following the fault locating activity
18. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 5 Carrying out fault location on mechanical equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out during fault location (all)</b>				
plan the fault location methods /procedures				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements				
carry out the fault location using approved procedures				
identify the fault, and consider appropriate corrective action				
in conjunction with others, take actions to resolve the problem				
dispose of waste				
leave the work area in a safe and tidy condition				
<b>Carry out fault location on two of the following types of mechanical equipment (two)</b>				
gearboxes				
machine tools				
lifting and handling devices				
transfer equipment				
portable power tools				
engines				
pumps				
process control valves				
compressors				
process plant				
workholding devices				
conveyers and elevators				
mechanical structures				
company-specific equipment				
<b>Use four of the following diagnostic techniques, tools and aids to assist in locating the fault (four)</b>				
information gathered from the person that reported the fault				
fault finding techniques (such as six point etc..)				
diagnostic aids (such as manuals etc..)				
inspecting (such as checking for breakages etc..)				
operating (such as manual switching off etc..)				
<b>Use two of the following types of instruments to assist in locating faults (two)</b>				
measuring instruments/devices				
dial test indicators				
torque measuring devices				
flow meters				

alignment devices				
self-diagnostic equipment				
pressure/force indicators				
other specific instruments				
<b>Locate faults that have resulted in two of the following breakdown categories (two)</b>				
intermittent problem				
partial failure/out-of-specification output				
complete breakdowns				
<b>Complete maintenance record and pass to appropriate person (one)</b>				
scheduled maintenance report				
corrective maintenance report				
other company-specific report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 6 Carrying Out Maintenance Activities on Mechanical Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on mechanical equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing or repairing faulty components, in line with company procedures, on a variety of different types of mechanical equipment such as machine tools, gearboxes, portable tools, engines, pumps, process control valves, compressors, process plant, conveyers and elevators, lifting and handling devices, transfer equipment, mechanical structures, workholding devices and other company-specific equipment.

You will be expected to cover a range of maintenance activities, such as labelling/proof marking to aid reassembly, dismantling components to the required level, setting, aligning and adjusting components, replacing 'lived' items, replenishing oils, greases or other fluids, torque loading components and making 'off-load' checks before testing and starting up the maintained equipment, using appropriate techniques and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying mechanical maintenance procedures. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any maintenance, repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance 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 the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
2. Carry out maintenance activities on **two** of the following types of equipment:
  - gearboxes
  - machine tools
  - lifting and handling devices
  - process plant
  - portable power tools
  - engines
  - pumps
  - transfer equipment
  - process control valves
  - compressors
  - conveyers and elevators
  - mechanical structures
  - workholding devices
  - company-specific equipment
3. Maintain and/or replace **six** of the following types of components:
  - hoses and connectors
  - pulleys and belts/wires
  - chains and sprockets
  - levers and links
  - rollers
  - bearings
  - seals, and gaskets
  - shafts
  - couplings
  - gears
  - cams
  - other specific components
  - springs
  - sub-assemblies/replacement units
  - structural components (such as guards, fences, supports, housings)
  - locking and retaining devices (such as keys, pins, screw fasteners)
4. Carry out **all** of the following maintenance activities:
  - dismantling equipment to the required level
  - labelling/proof marking of components
  - checking components for serviceability
  - replacing all 'lived' items (such as seals, gaskets)
  - replacing or repairing damaged/defective components
  - setting, aligning and adjusting components
  - tightening fastenings to the required torque
  - making 'off-load' checks before starting up
  - replenishing oils, greases or other fluids
  - functionally testing the maintained equipment

5. Maintain mechanical equipment, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - BS and/or ISO standards
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - permit to work/formal risk assessment
  - maintenance log or report

### **Knowledge statements:**

#### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. The hazards associated with carrying out mechanical maintenance activities (handling oils, greases, stored pressure/force, 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 protective clothing and other appropriate safety equipment during maintenance process
6. How to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, symbols and terminology)
7. The methods and techniques used to dismantle/assemble mechanical equipment (such as release of pressures/force, proof marking, extraction, pressing, alignment)
8. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as seals and gaskets)
9. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
10. The uses of measuring equipment (such as micrometers, verniers, run-out devices and other measuring devices)
11. How to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel, setting backlash in gears, preloading bearings)
12. The importance of making 'off-load' checks before running the equipment under power
13. 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 the intended purpose
14. The importance of maintenance documentation and/or reports following the maintenance activity, and how to generate them
15. The equipment operating and control procedures to be applied during the maintenance activity
16. How to use lifting and handling equipment in the maintenance activity
17. The things that can go wrong when carrying out routine maintenance, and what to do if they occur
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 6 Carrying Out Maintenance Activities on Mechanical Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all maintenance activities (all)</b>				
plan maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access/working arrangements				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on two of the following types of equipment (two)</b>				
gearboxes				
machine tools				
lifting and handling devices				
process plant				
portable power tools				
engines				
pumps				
transfer equipment				
process control valves				
compressors				
conveyers and elevators				
mechanical structures				
workholding devices				
company-specific equipment				
<b>Maintain and/or replace six of the following types of components (six)</b>				
hoses and connectors				
pulleys and belts/wires				
chains and sprockets				
levers and links				
rollers				
bearings				
seals, and gaskets				
shafts				
couplings				
gears				
cams				
other specific components				
springs				
sub-assemblies/replacement units				
structural components				
locking and retaining devices				
<b>Carry out all of the following maintenance activities (all)</b>				
dismantling equipment				

labelling/proof marking of components				
checking components for serviceability				
replacing all 'lived' items				
replacing or repairing damaged components				
setting, aligning and adjusting components				
tightening fastenings				
making 'off-load' checks before starting up				
replenishing oils, greases or other fluids				
functionally testing the maintained equipment				
<b>Maintain mechanical equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....



# Unit 7 Restoring Mechanical Components to Usable Condition by Repair

## Unit Summary

This unit identifies the competences you need to restore mechanical components to usable condition by repair, in accordance with approved procedures. You will be required to restore a range of mechanical components and equipment to operational condition, by repairing assemblies/sub-assemblies and components, by reworking the surface, recutting threads, or by the replacement of worn parts. You will also be required to select the appropriate equipment to use, based on the nature of the repair, the operations that will need to be carried out and the accuracy to be achieved.

In producing the components, you will be expected to use a range of hand tools, machine tools, portable power tools, and shaping and fitting techniques, appropriate to the type of material and repair being performed. These activities will include such things as sawing (hand, band), drilling, reaming, grinding (hand or pedestal), filing, scraping or lapping, threading (internal or external), machining (turning, milling) and thermal processes.

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

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying component repair procedures. You will have an understanding of the function and operating conditions of the components being repaired, in sufficient depth to determine if a suitable repair can be made and to ensure that the repairs carried out are safe and practical in operation. You will also understand the organisational policy on repairing components, and its application.

You will understand the safety precautions required when carrying out the repairing 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 the relevant specifications for the component to be repaired
- c. Prepare the component for repair
- d. Carry out the repairs within agreed timescale using approved materials and components and methods and procedures
- e. Ensure that the repaired component meets the specified operating conditions
- f. Produce accurate and complete records of all repair work carried out

## 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 repairing activity:
  - undertake the repairing activities to cause minimal disruption to normal working
  - adhere to risk assessment, COSHH and other relevant safety standards
  - use the correct issue of drawings, job instructions and procedures
  - check that tools and equipment to be used are fit for purpose
  - use correct lifting techniques and equipment (where appropriate), in accordance with health and safety guidelines and procedures
  - ensure that repaired components are clean, and free from contamination and foreign objects
  - record the repair, using appropriate methods or documentation
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out **four** of the following types of repair:
  - recondition a unit by replacement of worn components
  - sleeving of worn components
  - make a temporary fix
  - bushing/plugging of worn holes
  - dressing internal/external threads
  - rework a fit (such as shimming, packing)
  - joining/bonding mating surfaces
  - other specific repair procedures
  - rework a component finish/shape (using techniques such as filing, scraping, grinding, lapping)
  
3. Carry out repairs on mechanical components, using **four** of the following methods
  - sawing (hand or band)
  - drilling
  - reaming
  - grinding (hand or pedestal)
  - filing
  - scraping or lapping
  - tapping/dieing threads
  - machining (turning, milling)
  - thermal processes (such as brazing, welding, metal spraying)
  
4. Carry out repairs to mechanical equipment, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - BS and/or ISO standards

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the repairing activity is to take place, and the responsibility these requirements place on you
2. The isolation procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the repairing procedure, and their effects on others
4. The importance of wearing protective clothing and other appropriate safety equipment during the repairing activities
5. The hazards associated with the repair/restoration operations being carried out (such as sawing (hand, band), drilling, reaming, grinding (hand or machine), filing, scraping or lapping, threading (internal or external), turning, milling and thermal processes), and how they can be minimised
6. How to obtain and interpret information from job instructions and other documentation used in the repairing activities (such as drawings, specifications, manufacturers' manuals, maintenance schedules symbols and terminology)
7. The methods, techniques and company procedures to be followed for repairing mechanical equipment
8. The types of repairs that can be made to components in order to prolong their useful life (such as bushing/plugging of worn holes, recutting threads, joining mating surfaces by thermal process)
9. How to use a range of hand tools (such as files, scrapers, threading devices)
10. How to select saw blades (for different materials and different operations)
11. The types and application of portable power tools that can be used for the repairing operations
12. How to confirm that portable power tools and extension cables are in a safe and usable condition
13. The operating requirements of the machine tools and accessories being used (such as guards, workholding devices, speeds and feeds, specific statutory regulations such as Abrasive Wheels Regulations)
14. How to handle and store tools and equipment, safely and correctly
15. The application of cutting fluids
16. The company recording procedures to be used following a repair, and how to apply them
17. The problems associated with repairing mechanical components, and how to resolve them
18. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 7 Restoring Mechanical Components to Usable Condition by Repair

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following activities during the repairing activity (all)</b>				
plan repair activities to cause minimal disruption				
adhere to relevant safety standards				
use the correct issue of drawings, job instructions etc				
check tools and equipment				
use correct lifting techniques and equipment				
ensure that repaired components are clean				
record the repair				
<b>Carry out four of the following types of repair (four)</b>				
recondition unit by replacing worn components				
sleeving of worn components				
make a temporary fix				
bushing/plugging of worn holes				
dressing internal/external threads				
rework a fit				
joining/bonding mating surfaces				
other specific repair procedures				
rework a component finish/shape				
<b>Carry out repairs on mechanical components, using four of the following methods (four)</b>				
sawing (hand or band)				
drilling				
reaming				
grinding (hand or pedestal)				
filing				
scraping or lapping				
tapping/dieing threads				
machining (turning, milling)				
thermal processes				
<b>Carry out repairs to mechanical equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and/or ISO standards				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 8 Carrying Out Scheduled Maintenance Activities on Mechanical Equipment

## Unit Summary

This unit identifies the competences you need to carry out scheduled maintenance activities on mechanical equipment, in accordance with approved procedures. You will be required to carry out scheduled maintenance on a range of mechanical equipment such as machine tools, gearboxes, portable tools, engines, pumps, process control valves, compressors, process plant, conveyers and elevators, lifting and handling devices, transfer equipment, mechanical structures, workholding devices and other company-specific equipment, in order to minimise downtime and ensure that equipment performs at the optimal level and functions to specification.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance tasks undertaken, and to report any problems with the maintenance process, 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying scheduled maintenance procedures to mechanical equipment. You will have an understanding of the process of implementing scheduled maintenance tasks, the importance of carrying them out at specific times, and of recording the outcomes and actions taken. In addition, you will be expected to report where the outcomes identify the need for further investigation or maintenance work.

You will understand the safety precautions required when carrying out the maintenance tasks, 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 the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 scheduled maintenance activities:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of drawings and maintenance documentation
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm with the authorised person that the equipment is ready for carrying out the scheduled maintenance
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - carry out the scheduled maintenance tasks, using appropriate techniques and procedures
  - dispose of waste items in a safe and environmentally acceptable manner,
  - leave the work area in a safe and tidy condition
2. Carry out scheduled maintenance activities on **two** of the following:
  - gearboxes
  - machine tools
  - lifting and handling devices
  - process plant
  - portable tools
  - engines
  - pumps
  - transfer equipment
  - process control valves
  - compressors
  - workholding devices
  - conveyers and elevators
  - mechanical structures
  - company-specific equipment
3. Carry out **ten** of the following scheduled maintenance activities:
  - removing excessive dirt and grime
  - making sensory checks (such as sight, sound, smell, touch)
  - checking equipment for leaks
  - replacing 'lived' consumables (such as fluids, gaskets and seals, hoses)
  - monitoring the condition/deterioration of components (such as bearings, chains, belts, gears, cams, couplings)
  - checking that any safety equipment or controls are operating correctly
  - checking the operation of instrumentation (such as gauges, sensors and indicators)
  - carrying out and/or checking equipment self-analysis data
  - making adjustments to components and connections
  - checking/tightening fastenings to the required torque
  - replenishing oils, greases or other fluids
  - reviewing and checking equipment operation and performance
  - recording the results of the scheduled maintenance activity
  - reporting or taking action with regard to any defects that require immediate attention (such as replacing non- 'lived' components)
4. Maintain mechanical equipment in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - BS and/or ISO standards
5. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - specific company documentation
  - permit to work/formal risk assessment

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the scheduled maintenance activities are to take place, and the responsibility these requirements place on you
2. The isolation procedure or permit-to-work procedure that applies to the equipment being maintained
3. The specific health and safety precautions to be applied during the scheduled maintenance activities, and their effects on others
4. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. The hazards associated with carrying out scheduled maintenance activities on mechanical equipment (such as handling oils/greases, stored pressure/force, misuse of tools), and how they can be minimised
6. How to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, servicing schedules, symbols and terminology)
7. The various checks to be carried out during the scheduled maintenance procedure
8. The procedure for obtaining the consumables to be used during the scheduled maintenance activity
9. Methods of checking that components are fit for purpose, and the need to replace 'lived' items
10. How to check that any replacement components meet the required specification/operating conditions
11. How to make appropriate sensory checks (such as sight, sound, smell and touch)
12. The appropriate testing instructions to be adopted during the maintenance activity
13. How to make adjustments to components/assemblies to ensure they function to specification
14. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
15. How to complete scheduled maintenance records/logs/reports, in accordance with company policy and procedures
16. The equipment operating and control procedures, and how to apply them in order to carry out scheduled maintenance
17. The problems that can occur whilst carrying out the scheduled maintenance tasks, and how they can be avoided
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 problems that you cannot resolve

## Unit 8 Carrying out scheduled maintenance activities on mechanical equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the scheduled maintenance activities (all)</b>				
plan maintenance to cause minimum disruption				
use the correct issue of drawings etc				
adhere to relevant safety standards				
confirm with the authorised person that the equipment is ready				
ensure the safe isolation of equipment				
provide safe access and working area for maintenance				
carry out using appropriate techniques/procedures				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out scheduled maintenance activities on <b>two</b> of the following (two)</b>				
gearboxes				
machine tools				
lifting and handling devices				
process plant				
portable tools				
engines				
pumps				
transfer equipment				
process control valves				
compressors				
workholding devices				
conveyers and elevators				
mechanical structures				
company-specific equipment				
<b>Carry out ten of the following scheduled maintenance activities (ten)</b>				
removing excessive dirt and grime				
making sensory checks)				
checking equipment for leaks				
replacing 'lifer' consumables				
monitoring the condition of components				
checking that any safety equipment or controls are operating correctly				
checking the operation of instrumentation				
carrying out and/or checking equipment self-analysis data				
making adjustments to components and connections				



checking/tightening fastenings				
replenishing oils, greases or other fluids				
reviewing and checking equipment operation				
recording the results of the scheduled maintenance activity				
reporting or taking action with regard to any defects				
<b>Maintain mechanical equipment in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
specific company documentation				
permit to work/formal risk assessment				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 9 Carrying Out Fault Location on Electrical Equipment and Circuits

## Unit Summary

This unit identifies the competences you need to locate faults on electrical equipment and circuits, in accordance with approved procedures. You will be required to locate faults on electrical equipment, using single, three-phase or direct current power supplies, and which will include control systems, motors and starters, switchgear and distribution panels, control systems, electrical equipment, wiring enclosures and luminaires. You will be expected to use a variety of methods and procedures to assist in locating the fault, including gathering information from the person that reported the fault, using recognised fault finding techniques and diagnostic aids, measuring, inspecting and operating the equipment.

Your responsibilities will require you to comply with organisational policy and procedures for the fault location activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound understanding of your work, and will provide an informed approach to applying fault location procedures to electrical equipment and circuits. You will have an understanding of the basic fault location methods and techniques used, and their application. You will also know how to interpret information obtained from fault finding aids and equipment, in adequate depth to provide a sound basis for carrying out the activities.

You will understand the safety precautions required when carrying out the fault location 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. 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 locating activity:
  - plan the fault location methods and procedures in conjunction with others
  - use the correct issue of company drawings and maintenance documentation
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as electricity, mechanical, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - carry out the fault location activities, using approved procedures
  - identify the fault, and consider appropriate corrective action
  - in conjunction with others, take actions to resolve the problem
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out fault location on **one** of the following types of electrical circuit:
  - single phase power circuits
  - direct current power circuits
  - three-phase power circuits
  - single phase lighting circuitPlus **two** of the following types of electrical equipment:
  - switchgear and distribution panels
  - electrical plant
  - luminaires
  - portable appliances
  - motors and starters
  - control systems and components
  - other specific electrical equipment
  
3. Use **four** of the following diagnostic techniques, tools and aids to assist in locating the fault:
  - information gathered from the person that reported the fault
  - fault finding techniques (such as six point, half-split, input/output, unit substitution, emergent sequence)
  - diagnostic aids (such as manuals, flow charts, troubleshooting guides, electronic aids, equipment records)
  - inspecting (such as checking for breakages, wear/deterioration, overheating, missing parts, loose fittings)
  - operating (such as manually switching off and on, RCD test buttons, running the equipment)
  
4. Use **two** of the following types of instruments to assist in locating faults:
  - multimeter
  - insulation resistance tester
  - light meter
  - portable appliance tester
  - earth loop impedance tester
  - other specific test/measurement instruments
  
5. Locate faults that have resulted in **two** of the following breakdown categories:
  - intermittent fault
  - partial failure or reduced performance
  - complete breakdown
  
6. Complete **one** of the following maintenance records and pass it to the appropriate person:
  - scheduled maintenance report
  - corrective maintenance report
  - other company specific report

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. 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)
4. The importance of wearing protective clothing and other appropriate safety equipment during fault location activities
5. The hazards associated with carrying out fault location activities on electrical equipment (live electrical components, stored energy, misuse of tools), and how they can be minimised
6. The procedure to be adopted to establish the background of the fault
7. How to use the various diagnostic aids to help identify the location of the fault
8. The various fault location techniques that can be used, and how they are applied (such as half-split, input-to-output, function testing, unit substitution, and equipment self-diagnostics)
9. How to evaluate sensory information (such as by sight, sound, smell, touch)
10. How to assess evidence and evaluate the possible causes of faults/problems
11. How to use a range of fault diagnostic equipment to investigate the problem
12. The care, handling and application of electrical test equipment (such as multimeter, portable appliance tester, earth loop impedance tester, insulation resistance tester)
13. How to check that electrical test equipment is within calibration, and that it is free from damage and defects
14. How to use and extract information from drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations, and other documents needed in the fault location process
15. The basic principles of how the circuit functions, its operating sequence, the purpose of individual units/components and how they interact
16. How to evaluate the likely risk to yourself and others, and the effects the fault could have on the overall process or system
17. The problems that can occur during the fault location activity, and how they can be minimised
18. The importance of completing the correct documentation following the maintenance activity
19. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 9 Carrying Out Fault Location on Electrical Equipment and Circuits

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during fault location (all)</b>				
plan fault location methods /procedures in conjunction with others				
use the correct issue of company drawings				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working are for maintenance				
carry out the fault location activities, using approved procedures				
identify the fault, and consider appropriate corrective action				
in conjunction with others, take actions to resolve the problem				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out fault location on one of the following types of electrical circuit (two)</b>				
single phase power circuits				
direct current power circuits				
three-phase power circuits				
<b>Plus two of the following types of electrical equipment (two)</b>				
switchgear & distribution panels				
electrical plant				
luminaires				
portable appliances				
motors and starters				
control systems & components				
other specific electrical equipment				
<b>Use four of the following diagnostic techniques, tools and aids to assist in locating the fault (four)</b>				
information gathered from the person that reported the fault				
fault finding techniques				
diagnostic aids				
inspecting				
operating				
<b>Use two of the following types of instruments to assist in locating faults (two)</b>				
multimeter				
insulation resistance tester				
light meter				
portable appliance tester				
earth loop impedance tester				
other specific test/measurement instruments				

<b>Locate faults that have resulted in two of the following breakdown categories (two)</b>				
intermittent fault				
partial failure or reduced performance				
complete breakdown				
<b>Complete one of the following maintenance records and pass it to the appropriate person (one)</b>				
scheduled maintenance report				
corrective maintenance report				
other company specific report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

## Unit 10 Carrying Out Maintenance Activities on Electrical Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on electrical equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing or repairing faulty components, in line with company procedures, on electrical equipment that uses single, three-phase or direct current power supplies, and includes equipment such as control systems, motors and starters, switchgear and distribution panels, electrical plant, wiring enclosures and luminaires, portable appliances and other specific electrical equipment.

You will be expected to cover a range of maintenance activities, such as isolating and locking off, disconnecting, removing and reconnecting electrical components, wires and cables, attaching cable identification markers, replacing damaged or defective components, cables and wires, setting and adjusting components, and making 'off-load' checks before testing and starting up the equipment, using appropriate techniques and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying electrical maintenance procedures. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the electrical equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any maintenance, repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance 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 the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activities:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
2. Carry out maintenance activities on **one** of the following types of circuit:
  - single phase power supplies
  - three-phase power supplies
  - direct current power supplies
  - single phase lighting circuits
3. Carry out maintenance activities on **two** of the following types of electrical equipment:
  - electrical plant
  - wiring enclosures
  - portable appliances
  - motors and starters
  - luminaires
  - switchgear and distribution panels
  - control systems and components
  - other specific electrical equipment
4. Carry out **all** of the following maintenance activities:
  - isolating and locking-off equipment
  - disconnecting and reconnecting wires and cables
  - attaching suitable cable identification markers
  - removing electrical units/components
  - checking components for serviceability
  - replacing damaged/defective components
  - removing and replacing damaged wires and cables
  - setting and adjusting replaced components
  - making 'off-load' checks before powering up
  - functionally testing the maintained equipment
5. Maintain and/or replace a range of electrical components, to include **six** of the following:
  - cables and connectors
  - locking and retaining devices
  - overload protection devices
  - inverter and servo controllers
  - relay components
  - rectifiers
  - capacitors
  - circuit boards
  - lighting fixtures
  - switches or sensors
  - contactors
  - encoders or resolvers
  - batteries
  - transformers
  - solenoids
  - thermistors or thermocouples



- other specific components
6. Maintain electrical equipment, in accordance with **one** or more of the following:
- organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards
7. Complete **one** of the following maintenance records, and pass it to the appropriate person:
- job cards
  - company specific documentation
  - permit to work/formal risk assessment
  - maintenance logs or reports

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies to maintenance activities (to include electrical isolation, locking off switchgear, removal of fuses, placing of maintenance warning notices, proving that isolation has been achieved and secured)
3. 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)
4. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. How to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
6. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components
7. The different types of cabling used in the maintenance activities, and their method of termination
8. The care, handling and application of electrical measuring instruments
9. The techniques used to dismantle/assemble electrical equipment (such as unplugging, de-soldering, removal of screwed, clamped and crimped connections)
10. Methods of removing and replacing cables and wires in wiring enclosures without causing damage to existing cables
11. The use of IEE wiring, and other, regulations when selecting wires and cables and when carrying out tests on systems
12. Methods of attaching identification markers/labels to removed components or cables, to assist with re-assembly
13. The tools and equipment used in the maintenance activities (such as the use of cable stripping tools, crimping tools, soldering irons and torches, gland connecting tools)
14. Methods of checking that components are fit for purpose, and the need to replace 'lifer' items (such as seals and gaskets overload protection devices)
15. How to make adjustments to components/assemblies to ensure that they function correctly
16. 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 the intended purpose
17. The importance of making 'off-load' checks before proving the equipment with the electrical supply on
18. The equipment operating and control procedures to be applied during the maintenance activity
19. How to use appropriate lifting and handling equipment in the maintenance activity
20. The problems that can occur during the maintenance activity, and how they can be overcome
21. The organisational procedure(s) 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 you cannot resolve

**Unit 10 Carrying Out Maintenance Activities on Electrical Equipment**

	<b>performance evidence 1</b>	<b>performance evidence 2</b>	<b>performance evidence 3</b>	<b>additional performance evidence (if</b>
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				<b>required)</b>
evidence type				
date				
<b>Carry out all of the following during the maintenance activities (all)</b>				
undertake the maintenance activities to cause minimal disruption to normal working				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
ensure that safe access and working arrangements have been provided for the maintenance area				
re-connect and return the equipment to service on completion of the maintenance activities				
dispose of waste items in a safe and environmentally acceptable manner				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on one of the following types of circuit (one)</b>				
single phase power supplies				
three-phase power supplies				
direct current power supplies				
single phase lighting circuits				
<b>Carry out maintenance activities on two of the following types of electrical equipment (two)</b>				
electrical plant				
wiring enclosures				
portable appliances				
motors and starters				
luminaires				
switchgear and distribution panels				
control systems and components				
other specific electrical equipment				
<b>Carry out all of the following maintenance activities (all)</b>				
isolating and locking-off equipment				
disconnecting and reconnecting wires and cables				
attaching suitable cable identification markers				
removing electrical units/components				
checking components for serviceability				
replacing damaged/defective components				
removing and replacing damaged wires and cables				
setting and adjusting replaced components				

making 'off-load' checks before powering up				
functionally testing the maintained equipment				
<b>Maintain and/or replace a range of electrical components, to include six of the following (six)</b>				
cables and connectors				
locking and retaining devices				
overload protection devices				
inverter and servo controllers				
relay components				
rectifiers				
capacitors				
circuit boards				
lighting fixtures				
switches or sensors				
contactors				
encoders or resolvers				
batteries				
transformers				
solenoids				
thermistors or thermocouples				
other specific components				
<b>Maintain electrical equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
company specific documentation				
permit to work/formal risk assessment				
maintenance logs or reports				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 11 Carrying Out Modifications or Rewiring Electrical Circuits

## Unit Summary

This unit identifies the competences you need to modify or rewire electrical circuits and equipment, in accordance with approved procedures. This will involve modifying or rewiring electrical circuits on equipment such as control systems, motors and starters, switchgear and distribution panels, electrical plant, wiring enclosures and luminaires, portable appliances and other specific electrical equipment.

You will be expected to carry out a range of rewiring or modification processes, such as removing and replacing cables, adding new cables, changing or adding components to panels or sub-assemblies, changing breakout points and changing the routing of cables. You will need to show ability in using various tools and equipment for cutting, stripping, crimping and soldering, bending and forming conduit, and for the installation of the various wires, cables and components that make up the electrical system and circuits.

Your responsibilities will require you to comply with organisational policy and procedures for the modification or rewiring activities undertaken, and to report any problems with the activities, components or equipment 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 modification activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying modification/rewiring procedures to electrical circuits. You will have an understanding of the function and operating conditions of the circuits being modified or rewired, in sufficient depth to determine if suitable alterations can be made, and to ensure that these are carried out in a safe and practical manner. You will also understand the organisational policy on modifying/rewiring electrical circuits, and its application.

You will understand the safety precautions required when carrying out modification 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. Obtain and follow the relevant modification specifications and job instructions
- c. Confirm and agree what modifications are to be carried out to meet the specification
- d. Prepare the electrical system for the required modification
- e. Carry out the system modification using approved materials, methods and procedures
- f. Complete the modification within the agreed timescale
- g. Ensure the modified electrical system meets the specified operating conditions
- h. Produce accurate and complete records of all modification work carried out
- i. Deal promptly and effectively with problems within your control and report those that cannot be solved

## 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 modification or rewiring activities:
  - undertake the modification/rewiring activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other safety standards
  - ensure the safe isolation of equipment (such as electricity, mechanical, gas, air or fluids)
  - provide safe access and working arrangements for the modification area
  - modify/rewire electrical circuits, using approved techniques and procedures
  - apply safe working practices and procedures at all times
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out modification or rewiring activities on **one** of the following types of circuit:
  - single phase power supplies
  - three-phase power supplies
  - direct current power supplies
  - single phase lighting circuits
  
3. Carry out modification or rewiring activities on **three** of the following types of electrical equipment:
  - electrical plant
  - wiring enclosures
  - portable appliances
  - motors and starters
  - luminaires
  - switchgear and distribution panels
  - control systems and components
  - other specific electrical equipment
  
4. Carry out **four** of the following, using appropriate methods and procedures:
  - replacing cables of different size or length
  - changing or adding components to panels or sub-assemblies
  - changing the position or angle of breakout points
  - adding or removing components from circuits
  - making changes to looms or mains circuits
  - changing the route of cables
  - changing position of electrical units
  - removing cables
  - adding cables to existing circuits
  
5. Carry out **four** of the following, using appropriate methods and procedures
  - terminating mineral and 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
  - heat shrinking (such as devices and boots)
  - crimping (such as tags and pins)
  - stripping cable insulation/protection
  - removing cable end fittings
  - extracting/inserting components
  - allocating identification markings

6. Carry out modifications or rewiring to electrical circuits, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturers' operation range
  - IEE wiring regulations
  - BS and/or ISO standards
7. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - company specific documentation
  - permit to work/formal risk assessment
  - maintenance logs or reports

### **Knowledge statements:**

#### ***You must have knowledge and understanding of:***

1. The specific safety precautions and procedures to be observed whilst carrying out the modifications of the electrical circuit (including any specific legislation, regulations or codes of practice relating to the activities, equipment or materials)
2. The health and safety requirements of the work area in which you are carrying out the modification activities, and the responsibility these requirements place on you
3. The hazards associated with carrying out modifications of electrical circuits, and how they can be minimised
4. 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)
5. The personal protective equipment and clothing to be worn during the modification activities
6. How to obtain and interpret information from job instructions and other documentation used in the rewiring or modification activities (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principles of how the system functions, its operating sequence, the working purpose of individual units/components, and how they interact
8. The different types of cabling (such as multicore cables, single core cables, steel wire armoured (SWA) cables, mineral insulated (MI) cables, screened cables), their fittings and their application
9. The different types of electrical components (such as plugs, switches, lighting and fittings, junction boxes, consumer units)
10. Preparations to be undertaken on the equipment, prior to the modification
11. How to extract and insert new cables in wiring enclosures (such as conduit, trunking and traywork), without causing damage to other cables or components
12. The methods and techniques used for soldering and de-soldering, and the importance of adhering to these procedures
13. The methods and techniques used for crimping and heat shrinking, and the importance of adhering to these procedures
14. The importance of ensuring that the completed circuit is free from foreign objects, and that all terminations are electrically sound and mechanically secure
15. How to conduct any necessary checks to ensure that the completed modification complies with all appropriate standards
16. How to check that tools and equipment are free from damage or defect, are in a safe and usable condition, and are configured correctly for their intended purpose
17. The problems that can occur with the modification operations, and how these can be overcome
18. The recording documentation to be completed for the activities undertaken
19. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 11 Carrying Out Modifications or Rewiring Electrical Circuits

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the modification or rewiring activities (all)</b>				
undertake the modification/rewiring activities to cause minimal disruption to normal working				
use the correct issue of maintenance documentation				
adhere to safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the modification area				
modify/rewire electrical circuits, using approved techniques and procedures				
apply safe working practices and procedures at all times				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out modification or rewiring activities on one of the following types of circuit (one)</b>				
single phase power supplies				
three-phase power supplies				
direct current power supplies				
single phase lighting circuits				
<b>Carry out modification or rewiring activities on of the following types of electrical equipment (three)</b>				
electrical plant				
wiring enclosures				
portable appliances				
motors and starters				
luminaires				
switchgear and distribution panels				
control systems and components				
other specific electrical equipment				
electrical plant				
<b>Carry out four of the following, using appropriate methods and procedures (four)</b>				
replacing cables of different size or length				
changing or adding components to panels or sub-assemblies				
changing the position or angle of breakout points				
adding or removing components from circuits				
making changes to looms or mains circuits				
changing the route of cables				

changing position of electrical units				
removing cables				
adding cables to existing circuits				
<b>Carry out four of the following, using appropriate methods and procedures (four)</b>				
terminating mineral and armoured cables				
bending and forming conduit				
bending and forming trunking and trays				
sealing and protecting cable connections				
mechanical/screwed/clamped connections				
soldering and de-soldering				
heat shrinking (such as devices and boots)				
crimping (such as tags and pins)				
stripping cable insulation/protection				
removing cable end fittings				
extracting/inserting components				
allocating identification markings				
<b>In accordance with the following carry out modifications or rewiring to electrical circuits, (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturers' operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
company specific documentation				
permit to work/formal risk assessment				
maintenance logs or reports				

Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....



# Unit 12 Carrying Out Scheduled Maintenance Tasks on Electrical Equipment

## Unit Summary

This unit identifies the competences you need to carry out scheduled maintenance tasks on electrical equipment, in accordance with approved procedures. You will be required to carry out maintenance on electrical equipment such as control systems, motors and starters, switchgear and distribution panels, electrical plant, wiring enclosures and luminaires, portable appliances and other specific electrical equipment, in order to minimise downtime, and ensure that the equipment performs at optimal levels and functions to specification.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with the tools and equipment that are 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying scheduled maintenance procedures to electrical equipment. You will have an understanding of the process of implementing scheduled maintenance tasks, the importance of carrying them out at specific times, and of recording their outcomes and actions taken. In addition, you will be expected to report where the outcomes identify the need for further investigation or maintenance work.

You will understand the safety precautions required when carrying out the maintenance 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 the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 scheduled maintenance activities:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm with the authorised person that the equipment is ready for carrying out the scheduled maintenance ac
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - carry out the scheduled maintenance tasks, using appropriate techniques and procedures
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
2. Carry out scheduled maintenance tasks on **two** of the following groups of electrical equipment:
  - electrical plant
  - wiring enclosures
  - portable appliances
  - motors and starters
  - luminaires
  - switchgear and distribution panels
  - control systems and components
  - other specific electrical equipment
3. Carry out **ten** of the following scheduled maintenance activities:
  - removing excessive dirt and grime
  - making sensory checks (such as sight, sound, smell, touch)
  - replacing 'lived' consumables (such as gaskets, seals, batteries, light bulbs)
  - monitoring the condition/deterioration of components (such as cables, connectors switches, contactors, safety devices)
  - checking that any safety equipment or controls are operating correctly
  - checking the operation of test/measuring equipment (such as instrumentation, sensors and indicators)
  - carrying out and/or checking equipment self-analysis data
  - making adjustments to components and/or connections
  - checking/tightening fastenings to the required torque
  - checking the integrity and security of earth bonding
  - reviewing and checking equipment operation and performance
  - recording the results of the scheduled maintenance activity
  - reporting or taking action with regard to any defects that require immediate attention (such as replacing 'non- lived' components)
4. Maintain electrical equipment, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - BS and/or ISO standards
  - IEE wiring regulations
5. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - specific company documentation
  - permit to work/formal risk assessment

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the scheduled maintenance tasks are to take place, and the responsibility these requirements place on you
2. The isolation procedure or permit-to-work procedure that applies to the equipment being maintained
3. The specific health and safety precautions to be applied during the scheduled maintenance tasks, and their effects on others
4. 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)
5. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
6. The hazards associated with carrying out scheduled maintenance tasks on electrical equipment (such as live electrical components, stored energy, misuse of tools), and how they can be minimised
7. How to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
8. The various checks to be carried out during the scheduled maintenance procedure
9. The procedure for obtaining the consumables to be used during the scheduled maintenance activity
10. Methods of checking that components are fit for purpose, and the need to replace 'lived' items
11. How to check that any replacement components meet the required specification/operating conditions
12. How to make appropriate sensory checks (such as sight, sound, smell and touch)
13. The appropriate testing instructions to be adopted during the maintenance activity
14. How to make adjustments to components/assemblies to ensure they function to specification
15. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components, and how they interact
16. How to complete scheduled maintenance records/logs/reports, in accordance with company policy and procedures
17. The equipment operating and control procedures, and how to apply them in order to carry out scheduled maintenance
18. The problems that can occur whilst carrying out the scheduled maintenance tasks, and how they can be avoided
19. The organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
20. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 12 Carrying Out Scheduled Maintenance Tasks on Electrical Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the scheduled maintenance activities (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
confirm with the authorised person that the equipment is ready for carrying out the scheduled maintenance ac				
ensure the safe isolation of equipment				
provide safe access / working arrangements for maintenance area				
carry out the scheduled maintenance tasks				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out scheduled maintenance tasks on two of the following groups of electrical equipment (two)</b>				
electrical plant				
wiring enclosures				
portable appliances				
motors and starters				
luminaires				
switchgear and distribution panels				
control systems and components				
other specific electrical equipment				
<b>Carry out ten of the following scheduled maintenance activities (ten)</b>				
removing excessive dirt and grime				
making sensory checks				
replacing 'lived' consumables				
monitor component condition/deterioration				
check safety equipment or controls are operating correctly				
checking the operation of test/measuring equipment				
carrying out and/or checking equipment self-analysis data				
adjust components/connections				
checking/tightening fastenings				
checking the integrity and security of earth bonding				
reviewing equipment operation and performance				

recording the results of the scheduled maintenance activity				
report/respond to defects that require immediate attention				
<b>Maintain electrical equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and/or ISO standards				
IEE wiring regulations				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
specific company documentation				
permit to work/formal risk assessment				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 13 Carrying Out Fault Location on Electronic Equipment and Circuits

## Unit Summary

This unit identifies the competences you need to locate faults on electronic equipment/circuits, in accordance with approved procedures. You will be required to investigate faults on a range of electronic equipment such as power supplies, motor control systems, sensors and actuators circuits, digital circuits and systems, analogue circuits and systems, and hybrid circuits and systems, at assembly or component level. You will be expected to use a variety of fault location methods and procedures, such as gathering information from the person who reported the fault, using recognised fault finding techniques and diagnostic aids, measuring, inspecting and operating the equipment. You will be expected to take care that you do not damage the equipment/circuit during the maintenance activities and, where appropriate, the application of electrostatic discharge procedures will be a critical part of your role.

Your responsibilities will require you to comply with organisational policy and procedures for the fault location activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying fault location procedures to electronic equipment and circuits. You will have an understanding of the basic fault location methods and techniques used, and their application. You will also know how to interpret the information obtained from diagnostic aids and equipment, in adequate depth to provide a sound basis for carrying out the activities.

You will understand the safety precautions required when carrying out the fault location 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. 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 location activity:
  - plan fault location methods and procedures in conjunction with others
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as electricity, mechanical, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - use grounded wrist straps and other electrostatic discharge (ESD) precautions, where appropriate
  - disconnect or isolate components or parts of the circuit to confirm the diagnosis, where appropriate
  - carry out the fault location activities using approved procedures
  - identify the fault, and consider appropriate corrective action
  - in conjunction with others, take actions to resolve the problem
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
2. Carry out fault location on **two** of the following types of equipment:
  - power supply systems (such as switched mode, series regulation, shunt regulation)
  - motor control systems (such as closed-loop servo/proportional, inverter control)
  - sensors and actuators (such as linear, rotational, temperature, level, photo-optic, pressure, flow)
  - digital circuits and systems (such as programmable controller, microprocessor, ROM/RAM, logic gates)
  - analogue circuits and systems (such as frequency modulation/demodulation, amplifiers, filters, oscillators)
  - hybrid circuits and systems (such as analogue to digital converters (ADC), d-to-a converters (DAC))
3. Use **four** of the following diagnostic techniques, tools and aids to assist in locating the fault:
  - information gathered from the person who reported the fault
  - fault finding techniques (such as six point, half-split, input/output, unit substitution, emergent sequence)
  - diagnostic aids (such as manuals, flow charts, troubleshooting guides, electronic aids, equipment records)
  - inspecting (such as checking for breakages, wear/deterioration, overheating, missing parts, poor joints)
  - operating (such as manually switching off and on, test buttons, running the equipment)
4. Use **two** of the following types of instruments to assist in locating faults:
  - multimeter
  - signal generator
  - oscilloscope
  - logic probe
  - signal tracer
  - other specific test/measurement instruments
5. Locate faults that have resulted in **two** of the following breakdown categories:
  - intermittent action or circuit failure
  - partial failure or reduced performance
  - complete breakdown
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - scheduled maintenance report
  - corrective maintenance report
  - other company specific report

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. 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)
4. The importance of wearing protective clothing and other appropriate safety equipment during fault location activities
5. The hazards associated with carrying out fault location activities on electronic equipment (live electrical components, stored energy, misuse of tools), and how they can be minimised
6. The procedure to be adopted to establish the background of the fault
7. How to use the various diagnostic aids to help identify the location of the fault
8. The various fault location techniques that can be used, and how they are applied (such as half-split, input-to-output, function testing, unit substitution, and equipment self-diagnostics)
9. How to evaluate sensory information (such as sight, sound, smell, touch)
10. How to assess evidence and evaluate the possible causes of faults/problems
11. How to use a range of fault diagnostic equipment to investigate the problem
12. The care, handling and application of electrical test equipment (such as multimeter, signal generator, logic probe, signal tracer and oscilloscope)
13. The precautions to be taken to prevent electrostatic discharge (ESD) damage to electronic circuits and components (such as the use of wrist straps, special packaging and handling areas)
14. How to use a range of fault diagnostic equipment to investigate the problem
15. How to check that electronic test equipment is within calibration and that it is free from damage and defects
16. How to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, history/maintenance reports manufacturers' manuals, IEE regulations, symbols and terminology)
17. The functions of different types of electronic components (analogue or digital), and their operation
18. How to evaluate the likely risk to yourself and others, and the effects the fault could have on the overall process or system
19. The problems that can occur during the fault location activity, and how they can be minimised
20. The importance of completing the correct documentation, following the maintenance activity
21. The extent of your own authority and whom you should report to if you have problems that you cannot resolve



## Unit 13 Carrying Out Fault Location on Electronic Equipment and Circuits

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the fault location activity (all)</b>				
plan fault location methods and procedures in conjunction with others				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for maintenance area				
use grounded wrist straps and other electrostatic discharge (ESD) precautions				
disconnect or isolate components or parts of the circuit to confirm the diagnosis,				
carry out the fault location activities using approved procedures				
identify the fault, and consider appropriate corrective action				
in conjunction with others, take actions to resolve the problem				
dispose of waste				
leave the work area in a safe and tidy condition				
<b>Carry out fault location on two of the following types of equipment (two)</b>				
power supply systems				
motor control systems				
sensors and actuators				
digital circuits and systems				
analogue circuits and systems				
hybrid circuits and systems				
<b>Use four of the following diagnostic techniques, tools and aids to assist in locating the fault (four)</b>				
information gathered from the person who reported the fault				
fault finding techniques (such as six point, half-split, etc)				
diagnostic aids (such as manuals, flow charts etc)				
inspecting (such as checking for breakages, wear/deterioration)				
operating (such as manually switching off and on, test buttons)				
<b>Use two of the following types of instruments to assist in locating faults (two)</b>				
multimeter				
signal generator				
oscilloscope				

logic probe				
signal tracer				
other specific test/measurement instruments				
<b>Locate faults that have resulted in two of the following breakdown categories (two)</b>				
intermittent action or circuit failure				
partial failure or reduced performance				
complete breakdown				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
scheduled maintenance report				
corrective maintenance report				
other company specific report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 14 Carrying Out Tests on Electronic Equipment and Circuits

## Unit Summary

This unit identifies the competences you need to carry out inspections and tests on electronic equipment and circuits, in accordance with approved procedures. You will be required to carry out defined and documented tests on a range of electronic equipment such as power supplies, alarm and protection circuits, motor control systems, sensors and actuator circuits, digital circuits and systems, analogue circuits and systems, and hybrid circuits and systems, in order to assess their functionality and performance in relationship to the specification.

You will be required to carry out inspections and tests, which will include voltage and current levels, resistance values, waveform, clock/timer switching, pulse width/rise time, open/short circuit, logic state, frequency modulation and demodulation, and signal-to-noise ratio/interference levels. You will be expected to take care that you do not damage the equipment/circuit during the maintenance activities and, where appropriate, the application of electrostatic discharge procedures will be a critical part of your role.

Your responsibilities will require you to comply with organisational policy and procedures for carrying out the testing activities, and to report any problems with these activities that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work of carrying out the defined inspections and tests, and will provide an informed approach to applying the necessary test procedures. You will know how the equipment functions, the test equipment to be used, and the testing procedures to be applied, in adequate depth to provide a sound basis for carrying out the activities. In addition, you will be expected to record the outcomes of the tests, to compare the results with appropriate specifications, and to record/report the results in the appropriate format to the relevant people.

You will understand the safety precautions required when carrying out the inspection and testing activities, especially those for isolating the equipment, and for taking the necessary safeguards to protect yourself and others against direct and indirect electric shock. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to 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 the appropriate procedures for use of tools and equipment to carry out the required tests
- c. Set up and carry out the tests using the correct procedures and within agreed timescales
- d. Record the results of the tests in the appropriate format
- e. Review the results and carry out further tests if necessary

## 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 testing activities:
  - plan the testing methods and procedures in conjunction with others, prior to beginning the testing
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment
  - ensure that safe access and working arrangements have been provided for the test area
  - carry out the testing activities, using appropriate techniques and procedures
  - ensure that test equipment is within calibration dates
  - take electrostatic discharge (ESD) precautions when handling sensitive components and circuit boards
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
2. Carry out tests on **two** of the following types of electronic equipment:
  - power supplies (such as switched mode, series regulation, shunt regulation)
  - motor control systems (such as closed loop servo/proportion control, inverter control)
  - sensor/actuator circuit (such as linear, rotational, temperature, photo-optic, flow, level, pressure)
  - digital circuit (such as process control, microprocessor, logic devices, display devices)
  - signal processing circuit (such as frequency modulating/demodulating, amplifiers, filters)
  - alarms and protection circuits
  - ADC and DAC hybrid circuits
3. Carry out tests using a range of tools and test equipment, to include **two** of the following:
  - oscilloscope
  - ammeter
  - logic analyser
  - logic probe
  - signal tracer
  - signal generator
  - multimeter
  - automatic test equipment
  - computer-aided diagnostic equipment
  - special purpose testing equipment
  - temperature measuring devices
4. Carry out **eight** of the following tests/measurements, as applicable to the equipment being tested:
  - logic states
  - dc voltage/current levels
  - ac voltage/current levels
  - clock/timer switching
  - pulse width/rise time
  - open/short circuit
  - resistance
  - heat dissipation
  - frequency modulation/demodulation
  - performance of circuit
  - condition of assemblies and components
  - signal noise/interference levels
5. Carry out tests on electronic equipment and components, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's specifications
  - customer requirements
  - BS and/or ISO standards

6. Complete **one** of the following records, and pass it to the appropriate person:
- job cards
  - maintenance logs or reports
  - company specific test documentation

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the testing activity is to take place, and the responsibility these requirements place on you
2. Your responsibilities under regulations relevant to the electronic testing activities being undertaken
3. The isolation and lock-off procedure or permit-to-work procedure that applies to the testing activities (electrical isolation, locking off switchgear, removal of fuses, placing of warning notices, proving that isolation has been achieved and secured)
4. The specific safety precautions to be taken when carrying out formal inspection, safety and circuit testing of electronic equipment
5. The hazards associated with testing electronic equipment and circuits, and with the equipment that is used, and how these hazards can be minimised
6. The importance of wearing protective clothing, and other appropriate safety equipment, during the testing activities
7. The importance of keeping the work area clean, tidy and free from waste and surplus materials
8. How the testing activities may affect the work of others, and the procedure for informing them of the work to be carried out
9. The procedures and precautions to be adopted to eliminate/protect against electrostatic discharge (ESD)
10. How to obtain and interpret information from job instructions, drawings, circuit diagrams, specifications, manufacturers' manuals, test procedures and other documents needed to carry out the tests
11. The basic principles of how the electronic circuit functions, its operating sequence, the function/purpose of individual units/components, and how they interact
12. How to set up and apply the appropriate test equipment
13. How to check that tools and equipment are free from damage or defects, are in a safe and usable condition, and have been configured correctly for their intended purpose
14. How to ensure the test equipment has been correctly calibrated
15. The various testing methods and procedures
16. How to assess test results, and make comparison with the specification
17. The environmental control requirements and company operating procedures relating to functional testing
18. The documentation required, and the procedures to be followed, at the conclusion of the testing
19. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 14 Carrying Out Tests on Electronic Equipment and Circuits

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the testing activities (all)</b>				
plan the testing methods and procedures in conjunction with others				
use the correct issue of maintenance documentation				
adhere relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements have been provided for the test area				
carry out the testing activities,				
ensure that test equipment is within calibration dates				
take (ESD) precautions when handling sensitive components and circuit boards				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out tests on two of the following types of electronic equipment (two)</b>				
power supplies				
motor control systems				
sensor/actuator circuit (digital circuit)				
signal processing circuit				
alarms and protection circuits				
ADC and DAC hybrid circuits				
<b>Carry out tests using a range of tools and test equipment, to include two of the following (two)</b>				
oscilloscope				
ammeter				
logic analyser				
logic probe				
signal tracer				
signal generator				
multimeter				
automatic test equipment				
computer-aided diagnostic equipment				
special purpose testing equipment				
temperature measuring devices				
<b>Carry out eight of the following tests/measurements, to the equipment being tested (eight)</b>				
logic states				
dc voltage/current levels				
ac voltage/current levels				
clock/timer switching				
pulse width/rise time				
open/short circuit				

resistance				
heat dissipation				
frequency modulation/demodulation				
performance of circuit				
condition of assemblies and components				
signal noise/interference levels				
<b>Carry out tests on electronic equipment and components, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's specifications				
customer requirements				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
maintenance logs or reports				
company specific test documentation				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 15 Carrying Out Repairs to Electronic Equipment

## Unit Summary

This unit identifies the competences you need to carry out repairs on electronic equipment, in accordance with approved procedures. You will be required to carry out repairs on a range of electronic equipment, such as power supplies, motor control systems, alarm and protection circuits, sensors and actuator circuits, digital circuits and systems, analogue circuits and systems, and hybrid circuits and systems. This will involve dismantling, removing and replacing faulty items at board and component level, on a variety of different types of electronic assemblies and sub-assemblies.

You will be expected to apply a range of dismantling and reassembly methods and techniques, such as soldering, de-soldering, crimping, harnessing, and securing cables and components. You will be expected to take care that you do not cause further damage to the equipment/circuit during the repair activities and, therefore, the application of electrostatic discharge (ESD) procedures will be a critical part of your role.

Your responsibilities will require you to comply with organisational policy and procedures for carrying out the repair activities, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying electronic repair procedures. You will have an understanding of the function and operating conditions of the electronic equipment being repaired, and will know about the tools and techniques to be used, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

You will understand the safety precautions required when carrying out the repair activities, especially those for isolating the equipment, and for taking the necessary safeguards to protect yourself, and others, against direct and indirect electric shock. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to 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 the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed timescale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 repair activities:
  - confirm the type and level of repair to be carried out
  - undertake the repair activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment
  - ensure that safe access and working arrangements have been provided in the work area
  - take electrostatic discharge (ESD) precautions when handling sensitive components and circuit boards
  - leave the work area in a safe and tidy condition
2. Carry out repair activities on **two** of the following types of electronic equipment:
  - power supplies (such as switched mode, series regulation, shunt regulation)
  - motor control systems (such as closed loop servo/proportional control, inverter control)
  - sensor/actuator circuit (such as linear, rotational, temperature, photo-optic, flow, level, pressure)
  - digital circuit (such as process control, microprocessor, logic devices, display devices)
  - signal processing circuit (such as frequency modulating/demodulating, amplifiers, filters)
  - alarms and protection circuits
  - ADC and DAC hybrid circuits
3. Carry out **all** of the following maintenance techniques and procedures during the repair activities:
  - removing excessive dirt and grime
  - dismantling/disconnecting equipment to the required level
  - checking the condition/deterioration of components
  - making adjustments to components and/or connections
  - re-assembling of units or sub-assemblies
  - reviewing and checking the equipment operation and/or performance
  - reporting or actioning any other defects that require immediate attention
4. Repair and/or replace a range of electronic components, to include **six** of the following:
  - cables and connectors
  - printed circuit boards
  - transformers
  - fixed resistors
  - variable resistors
  - capacitors
  - rectifiers
  - thermistors
  - transistors
  - diodes
  - sensors
  - heat sinks
  - protection devices
  - decoders
  - regulators
  - encoders or resolvers
  - inverters or servo controllers
  - analogue or digital integrated circuits
5. Use the correct joining/connecting techniques to deal with **three** of the following types of connection:
  - push-fit connectors
  - soldering or desoldering
  - clip assemblies
  - threaded connections
  - crimped connections

- zero insertion force (zif) connectors
  - adhesive joints/assemblies
  - edge connectors
6. Carry out repairs to electronic equipment, in accordance with **one** or more of the following:
- organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - BS and ISO standards
7. Complete **one** of the following records, and pass it to the appropriate person:
- job cards
  - repair log/report
  - company specific documentation

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the repair activity is to take place, and the responsibility these requirements place on you
2. Your responsibilities under regulations that apply to the electronic repair activities being undertaken
3. The isolation and lock-off procedure or permit-to-work procedure that applies to the repair activities and the electronic equipment or circuits being worked on (electrical isolation, locking off switchgear, removal of fuses, placing maintenance warning notices, proving that isolation has been achieved and secured)
4. The importance of wearing protective clothing and other appropriate safety equipment during the repair activities
5. The hazards associated with repairing electronic equipment, and with the materials, tools and equipment that are used (such as live electrical components, capacitor discharge), and how these can be minimised
6. The importance of keeping the work area clean and tidy, and free from waste and surplus materials
7. How the repair activities may affect the work of others, and the procedure for informing them of the work to be carried out
8. The procedures and precautions to be adopted to eliminate electrostatic discharge (ESD) hazards
9. How to obtain and extract information from job instructions, drawings and data (such as circuit diagrams, specifications, manufacturers' manuals, test procedures and other documents needed to carry out repairs)
10. The basic principles of how the electronic circuit functions, and its operating sequence
11. How to check that the replacement components meet the required specification/operating conditions (such as values, tolerance, current-carrying capacity, ambient temperatures)
12. Methods of removing and replacing the faulty components from the equipment (such as unplugging, de-soldering, removal of screwed, clamped, edge connected, zero insertion force, and crimped connections)
13. The importance of removing faulty components without causing damage to other components, wiring or the surrounding structure
14. Methods of attaching identification marks/labels to removed components or connections, in order to assist with re-assembly
15. The tools and equipment used in the repair activities (including the use of wire-stripping tools, crimping tools, soldering irons, insertion devices and connecting tools)
16. How to check that tools and equipment are free from damage or defects, that they are in a safe and usable condition, and that they are configured correctly for the intended purpose
17. The sequence for reconnecting the equipment, and the checks to be made prior to restoring power (such as checking components for correct polarity, ensuring that there are no exposed conductors, cable insulation is not damaged, all connections are mechanically and electrically secure, casings are free from loose screws, there are no wire ends or solder blobs that could cause short circuits, and all fuses/protection devices are installed)
18. The importance of making 'off-load' checks before proving the equipment with the electrical supply on
19. How to make adjustments to components/assemblies to ensure that they function correctly
20. The documentation and/or reports to be completed following the repair activity, and the importance of ensuring that these reports are completed accurately and legibly
21. The problems that can occur with the repair 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 15 Carrying Out Repairs to Electronic Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the repair activities (all)</b>				
confirm the type and level of repair to be carried out				
undertake the repair activities to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
ensure that safe access and working arrangements have been provided in the work area				
take (ESD) precautions when handling sensitive components and circuit boards				
leave the work area in a safe and tidy condition				
<b>Carry out repair activities on two of the following types of electronic equipment (two)</b>				
power supplies				
motor control systems				
sensor/actuator circuit				
digital circuit				
signal processing circuit				
alarms and protection circuits				
ADC and DAC hybrid circuits				
<b>Carry out all of the following maintenance techniques and procedures during the repair activities (all)</b>				
removing excessive dirt and grime				
dismantling/disconnecting equipment to the required level				
checking the condition/deterioration of components				
making adjustments to components and/or connections				
re-assembling of units or sub-assemblies				
reviewing and checking the equipment operation and/or performance				
reporting or actioning any other defects that require immediate attention				
<b>Repair and/or replace a range of electronic components, to include six of the following (six)</b>				
cables and connectors				
printed circuit boards				
transformers				
fixed resistors				

variable resistors				
capacitors				
rectifiers				
thermistors				
transistors				
diodes				
sensors				
heat sinks				
protection devices				
decoders				
regulators				
encoders or resolvers				
inverters or servo controllers				
analogue or digital integrated circuits				
<b>Use the correct joining/connecting techniques to deal with three of the following types of connection (three)</b>				
push-fit connectors				
soldering or desoldering				
clip assemblies				
threaded connections				
crimped connections				
zero insertion force (zif) connectors				
adhesive joints/assemblies				
edge connectors				
<b>Carry out repairs to electronic equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and ISO standards				
<b>Complete one of the following records, and pass it to the appropriate person (one)</b>				
job cards				
repair log/report				
company specific documentation				

Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 16 Carrying Out Fault Location on Fluid Power Equipment and Circuits

## Unit Summary

This unit identifies the competences you need to locate faults on fluid power equipment and circuits, in accordance with approved procedures. You will be required to investigate faults on fluid power equipment such as pneumatic, hydraulic and vacuum devices, both at unit and component level. You will be expected to use a variety of fault location methods and procedures, such as gathering information from the person who reported the fault, using recognised fault finding techniques and diagnostic aids, measuring, inspecting and operating the equipment.

Your responsibilities will require you to comply with organisational policy and procedures for the fault location activities, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking full responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying fault location procedures to fluid power equipment. You will have an understanding of the basic fault location methods and techniques used, and their application. You will also know how to interpret the information obtained from fault locating aids and equipment, in adequate depth to provide a sound basis for carrying out the activities.

You will understand the safety precautions required when carrying out the fault location 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. 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 location activity:
  - plan the fault location methods and activities in conjunction with others
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - carry out the fault location activities, using approved procedures
  - identify the fault, and consider appropriate corrective action
  - in conjunction with others, take actions to resolve the problem
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out fault location on **one** of the following types of fluid power system:
  - pneumatic system
  - hydraulic system
  - vacuum system

To include **seven** of the following fluid power components:

  - pumps
  - pistons
  - spools
  - valves
  - actuators
  - cylinders
  - bearings
  - reservoirs
  - accumulators
  - pressure intensifiers
  - compressors
  - receivers
  - gaskets and seals
  - pipework and hoses
  - switches
  - sensors
  - lubricators/filters
  - regulators
  - other specific components
  
3. Use **four** of the following diagnostic techniques, tools and aids to assist in locating the fault:
  - information gathered from the person who reported the fault
  - fault finding techniques (such as six point, half-split, input/output, unit substitution, emergent sequence)
  - diagnostic aids (such as manuals, flow charts, troubleshooting guides, maintenance records)
  - inspecting (such as checking for damage, wear/deterioration, leaks, loose fittings and connections)
  - operating (such as timing, sequence, movement )
  
4. Use **two** of the following types of instruments to assist in locating faults:
  - measuring devices
  - pressure indicators
  - flow indicators
  - self-diagnostic equipment
  
5. Find faults that have resulted in **two** of the following breakdown categories:
  - intermittent problem
  - partial failure or reduced performance
  - complete breakdown
  
- 6. Complete **one** of the following maintenance records, and pass it to the appropriate person:

- scheduled maintenance report
- other company specific report
- corrective maintenance report

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. The importance of wearing protective clothing and other appropriate safety equipment during fault location activities
4. Hazards associated with carrying out fault location activities on fluid power equipment (such as handling fluids, stored pressure/force, misuse of tools, using practices that do not follow laid-down procedures), and how they can be minimised
5. How to obtain and interpret information from job instructions and other documents needed in the fault location process (such as drawings, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical symbols)
6. The procedure to be adopted to establish the background of the fault
7. How to use the various diagnostic aids to help identify the location of the fault
8. The various fault location techniques that can be used, and how they are applied (such as half-split, input-to-output, function testing, unit substitution, and equipment self-diagnostics)
9. How to evaluate sensory information (sight, sound, smell, touch)
10. How to assess evidence and evaluate the possible causes of faults/problems
11. How to use a range of fault diagnostic equipment to investigate the problem
12. The care, handling and application of mechanical measuring/test equipment (such as measuring instruments, pressure and flow indicators and self-diagnostic equipment)
13. How to check that fluid power measuring/test equipment is within calibration, and that it is free from damage and defects
14. The basic principles of how the fluid power equipment functions, its operating sequence, the purpose of individual units/components and how they interact
15. The problems that can occur during the fault location activity, and how they can be minimised
16. How to evaluate the likely risk to yourself and others, and the effects the fault could have on the overall process or system
17. The importance of completing the correct documentation following the fault locating activity
18. The extent of your own authority and whom you should report to if you have problems that you cannot resolve



## Unit 16 Carrying Out Fault Location on Fluid Power Equipment and Circuits

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the fault location activity (all)</b>				
plan the fault location methods and activities in conjunction with others				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements have for the maintenance area				
carry out the fault location activities				
identify the fault, and consider appropriate corrective action				
in conjunction with others, take actions to resolve the problem				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out fault location on one of the following types of fluid power system (one)</b>				
pneumatic system				
hydraulic system				
vacuum system				
<b>To include seven of the following fluid power components</b>				
pumps				
pistons				
spools				
valves				
actuators				
cylinders				
bearings				
reservoirs				
accumulators				
pressure intensifiers				
compressors				
receivers				
gaskets and seals				
pipework and hoses				
switches				
sensors				
lubricators/filters				
regulators				
other specific components				
<b>Use four of the following diagnostic techniques, tools and aids to assist in locating the fault (four)</b>				
information gathered from the person who reported the fault				
fault finding techniques (such as				

six point, half-split, input/output, unit substitution, emergent sequence)				
diagnostic aids (such as manuals, flow charts, troubleshooting guides, maintenance records)				
inspecting (such as checking for damage, wear/deterioration, leaks, loose fittings and connections)				
operating (such as timing, sequence, movement )				
<b>Use two of the following types of instruments to assist in locating faults (two)</b>				
measuring devices				
pressure indicators				
flow indicators				
self-diagnostic equipment				
<b>Find faults that have resulted in two of the following breakdown categories (two)</b>				
intermittent problem				
partial failure or reduced performance				
complete breakdown				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
scheduled maintenance report				
other company specific report				
corrective maintenance report				

Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 17 Carrying Out Maintenance Activities on Fluid Power Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on fluid power equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing or repairing faulty components on hydraulic, pneumatic or vacuum equipment, and will include components such as pumps, valves, actuators, sensors, regulators, compressors, pipes and hoses, and other specific fluid power equipment.

You will be expected to cover a range of maintenance activities, such as draining and removing fluids, removing stored pressure, labelling/proof marking to aid reassembly, dismantling components to the required level, setting, checking components for serviceability, aligning and adjusting components, replacing 'lived' items, tightening fasteners to the required torque and making 'off-load' checks, before starting up and testing the maintained equipment, using appropriate techniques and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying maintenance procedures to fluid power equipment. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the equipment functions, and the purpose of the individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient depth of knowledge of these components, to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment, and for taking the necessary 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **one** of the following types of fluid power equipment:
  - pneumatic
  - hydraulic
  - vacuum
  
3. Maintain and/or replace **six** of the following fluid power system components:
  - pumps
  - pistons
  - spools
  - valves
  - actuators
  - cylinders
  - bearings
  - reservoirs
  - accumulators
  - pressure intensifiers
  - compressors
  - receivers
  - gaskets and seals
  - pipework and hoses
  - switches
  - sensors
  - lubricators/filters
  - regulators
  - other specific components
  
4. Carry out **eight** of the following maintenance activities, as applicable to the equipment being maintained:
  - chocking/supporting cylinders/rams/components
  - draining and removing fluids (as applicable)
  - disconnecting/removing hoses and pipes
  - proof marking/labelling of removed components
  - releasing stored pressure
  - checking components for serviceability
  - replacing all 'lived' items (such as seals, filters, gaskets)
  - tightening fastenings to the required torque
  - removing and replacing units/components
  - setting, aligning and adjusting replaced components
  - making 'off-load' checks before re-pressurising the system
  - functional testing of the maintained system
  
5. Maintain fluid power equipment, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturers' operation range
  - BS and/or ISO standards
  
6. Complete **one** of the following maintenance records and pass it to the appropriate person:

- job cards
- maintenance log or report
- permit to work/formal risk assessment

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on you
2. The isolation procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be taken during the maintenance activities, and their effects on others
4. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. The hazards associated with carrying out maintenance activities on fluid power equipment (handling fluids, stored pressure/force, misuse of tools), and how these can be minimised
6. Regulations and codes of practice that apply to working with fluid power equipment
7. How to obtain and interpret information from job instructions, drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process
8. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
9. Recognition of contaminants, the problems they can create, and the effects and likely symptoms of contamination in the system
10. The techniques used to dismantle/assemble fluid power equipment (release of pressures/force, proof marking, extraction)
11. How to make adjustments to components/assemblies to ensure that they function correctly
12. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
13. How to check that tools and equipment are free from damage or defect, are in a safe and usable condition, and are configured correctly for the intended purpose
14. The generation of documentation and/or reports following the maintenance activity
15. Equipment operating and control procedures to be applied during the maintenance activity
16. How to use lifting and handling equipment, safely and correctly in the maintenance activity
17. The problems associated with the maintenance activity, and how they can be overcome
18. The procedure to be adopted for the safe disposal of waste of all types of materials
19. The limit of your own authority and whom you should report to if you have a problem that you cannot resolve

## Unit 17 Carrying Out Maintenance Activities on Fluid Power Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activity (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on one of the following types of fluid power equipment (one)</b>				
pneumatic				
hydraulic				
vacuum				
<b>Maintain and/or replace six of the following fluid power system components (six)</b>				
pumps				
pistons				
spools				
valves				
actuators				
cylinders				
bearings				
reservoirs				
accumulators				
pressure intensifiers				
compressors				
receivers				
gaskets and seals				
pipework and hoses				
switches				
sensors				
lubricators/filters				
regulators				
other specific components				
<b>Carry out eight of the following maintenance activities, as applicable to equipment (eight)</b>				
chocking/supporting cylinders/rams/components				
draining and removing fluids				
disconnecting/removing hoses and pipes				
proof marking/labelling of removed components				
releasing stored pressure				
checking components for				

serviceability				
replacing all 'lived' items				
tightening fastenings to the required torque				
removing and replacing units/components				
setting, aligning and adjusting replaced components				
making 'off-load' checks before re-pressurising the system				
functional testing of the maintained system				
<b>Maintain fluid power equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturers' operation range				
BS and/or ISO standards				
<b>Complete one of the following maintenance records and pass it to the appropriate person (one)</b>				
job cards				
maintenance log or report				
permit to work/formal risk assessment				

Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 18 Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment

## Unit Summary

This unit identifies the competences you need to carry out scheduled maintenance tasks on fluid power equipment, in accordance with approved procedures. You will be required to carry out maintenance on pneumatic, hydraulic or vacuum equipment, which will include equipment and components such as pumps, cylinders, valves, actuators, pipework and hoses, switches and sensors, in order to minimise down time, and to ensure that the equipment performs at optimal levels and functions to specification.

Your responsibilities will require you to comply with organisational policy and procedures for the scheduled maintenance activities undertaken, and to report any problems with these activities, or with 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 the tools, equipment and materials used in the maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying scheduled maintenance procedures to fluid power equipment. You will have an understanding of the process of implementing scheduled maintenance tasks, the importance of carrying them out at specific times, and of recording their outcomes and the actions taken. In addition, you will be expected to report where the outcomes identify the need for further investigation or maintenance work.

You will understand the safety precautions required when carrying out the maintenance tasks, especially those for isolating the equipment, and for taking the necessary 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 scheduled maintenance tasks:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm with the authorised person that the equipment is ready for carrying out the scheduled maintenance
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - carry out the scheduled maintenance tasks, using appropriate techniques and procedures
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
2. Carry out scheduled maintenance tasks on **one** of the following types of fluid power equipment:
  - pneumatic equipment
  - hydraulic equipment
  - vacuum equipment
3. Carry out scheduled maintenance tasks on **four** of the following:
  - pumps
  - pipework and hoses
  - compressors
  - sensors/switches
  - storage devices (such as reservoirs, receivers, accumulators)
  - mechanical control devices (such as valves, actuators, cylinders)
  - other specific system components
4. Carry out **ten** of the following scheduled maintenance activities:
  - removing excessive dirt and grime
  - making sensory checks (such as sight, sound, smell, touch)
  - checking equipment for leaks
  - replacing 'lified' consumables (such as gaskets and seals, hoses)
  - monitoring the condition/deterioration of components (such as actuators, mechanical control devices, pipework)
  - checking that any safety equipment or controls are operating correctly (such as switches and sensors)
  - checking the operation of instrumentation (such as gauges and indicators)
  - carrying out and/or checking equipment self-analysis data
  - making adjustments to components and connections
  - checking/tightening fastenings to the required torque
  - replenishing oils, greases or other fluids
  - reviewing and checking the equipment operation and performance
  - recording the results of the scheduled maintenance activity
  - reporting or taking action with regard to any defects that require immediate attention (such as replacing non-'lified' components)
5. Maintain fluid power equipment, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - BS and/or ISO standards
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - specific company documentation
  - permit to work/formal risk assessment

### Knowledge statements:

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the scheduled maintenance tasks are to take place, and the responsibility these requirements place on you
2. The isolation procedure or permit-to-work procedure that applies to the equipment being maintained
3. The specific health and safety precautions to be applied during the scheduled maintenance tasks, and their effects on others
4. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. The hazards associated with carrying out scheduled maintenance on fluid power equipment (such as handling oils/greases, stored pressure/force, misuse of tools), and how they can be minimised
6. How to obtain and extract information from job instructions, drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process
7. The various checks to be carried out during the scheduled maintenance procedure
8. The procedure for obtaining the consumables to be used during the scheduled maintenance activity
9. Methods of checking that components are fit for purpose, and the need to replace 'lived' items
10. How to check that any replacement components meet the required specification/operating conditions
11. How to make appropriate sensory checks (such as sight, sound, smell and touch)
12. The appropriate testing instructions to be adopted during the maintenance activity
13. How to make adjustments to components/assemblies to ensure they function to specification
14. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components, and how they interact
15. How to complete scheduled maintenance records/logs/reports, in accordance with company policy and procedures
16. The equipment operating and control procedures, and how to apply them in order to carry out scheduled maintenance
17. The problems that can occur whilst carrying out the scheduled maintenance tasks, and how they can be avoided
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 problems that you cannot resolve

## Unit 18 Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the scheduled maintenance tasks (all)</b>				
undertake maintenance a to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
confirm with the authorised person that the equipment is ready for carrying out the scheduled maintenance				
ensure the safe isolation of equipment				
provide safe access and working arrangements have for the maintenance area				
carry out the scheduled maintenance tasks, using appropriate techniques and procedures				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out scheduled maintenance tasks on one of the following types of fluid power equipment (one)</b>				
pneumatic equipment				
hydraulic equipment				
vacuum equipment				
<b>Carry out scheduled maintenance tasks on four of the following (four)</b>				
pumps				
pipework and hoses				
compressors				
sensors/switches				
storage devices				
mechanical control devices				
other specific system components				
<b>Carry out ten of the following scheduled maintenance activities (ten)</b>				
removing excessive dirt and grime				
making sensory checks				
checking equipment for leaks				
replacing 'lified' consumables				
monitoring the condition/deterioration of components				
checking safety equipment or controls are operating correctly				
checking the operation of instrumentation				
carrying out and/or checking equipment self-analysis data				

making adjustments to components and connections				
checking/tightening fastenings to the required torque				
replenishing oils, greases or other fluids				
reviewing and checking the equipment operation and performance				
recording the results of the scheduled maintenance activity				
reporting or taking action with regard to any defects that require immediate attention				
<b>Maintain fluid power equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person</b>				
job cards				
specific company documentation				
permit to work/formal risk assessment				

Knowledge and understanding reference:

Candidate: \_\_\_\_\_  
Assessor: \_\_\_\_\_

Date: \_\_\_\_\_  
Date: \_\_\_\_\_

## Unit 19 Carrying Out Fault Location on Service Systems and Equipment

## Unit Summary

This unit identifies the competences you need to locate faults on services, and service equipment and systems, in accordance with approved procedures. You will be required to locate faults on service equipment and systems, such as fresh or foul water, environmental control, emergency power generation, heating and ventilation, gas distribution, process control, instrumentation control, and refrigeration, at sub-assembly and/or component level. You will be expected to use a variety of fault location methods and procedures, such as gathering information from the person who reported the fault, using recognised fault finding techniques and diagnostic aids, measuring, inspecting and operating the equipment.

Your responsibilities will require you to comply with organisational policy and procedures for the fault location activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying fault location procedures to service equipment and systems. You will have an understanding of the basic fault location methods and techniques used, and their application. You will also know how to interpret the information obtained from fault finding aids and equipment, in adequate depth to provide a sound basis for carrying out the activities.

You will understand the safety precautions required when carrying out the fault location 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 location activities:
  - plan fault location methods and procedures in conjunction with others, prior to beginning the work
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - provide safe access and working arrangements for the maintenance area
  - carry out the fault location activities, using approved procedures
  - disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis
  - identify the fault, and consider appropriate corrective action
  - in conjunction with others, take actions to resolve the problem
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out fault location on **one** of the following types of services equipment, to sub-assembly or component level:
  - fresh water
  - foul water
  - compressed air
  - refrigeration
  - environmental control
  - emergency power generation
  - gas distribution
  - instrumentation and control
  - heating and ventilation
  - air conditioning and ventilation
  - process control
  
3. Use **four** of the following diagnostic techniques, tools and aids to assist in locating the fault:
  - information gathered from the person who reported the fault
  - fault finding techniques (such as six point, half-split, input/output, unit substitution, emergent sequence)
  - diagnostic aids (such as manuals, flow charts, troubleshooting guides, maintenance records)
  - inspecting (such as checking for breakages, wear/deterioration, overheating, missing parts, loose fittings)
  - operating (such as manually switching off and on, running equipment, condition of end product)
  
4. Use **two** of the following types of instruments to assist in locating faults:
  - mechanical measuring equipment (such as measuring instruments, dial test indicators, torque instruments)
  - electrical/electronic measuring instruments (such as multimeter, logic probes, temperature meters, analysers)
  - fluid test equipment (such as flow testing devices/meters, pressure testers, contamination testers)
  
5. Locate faults that have resulted in **two** of the following breakdown categories:
  - intermittent problem
  - partial failure or reduced performance
  - complete breakdowns
  
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - scheduled maintenance report
  - corrective action report
  - company-specific documentation

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. The importance of wearing protective clothing and other appropriate safety equipment during fault location activities
4. The hazards associated with carrying out fault location activities on services and systems (such as such as handling fluids, stored pressure/force, 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
5. The procedure to be adopted to establish the background of the fault
6. How to use the various diagnostic aids to help identify the location of the fault
7. The various fault location techniques that can be used, and how they are applied (such as half-split, input-to-output, function testing, unit substitution, and equipment self-diagnostics)
8. How to evaluate sensory information (such as sight, sound, smell, touch)
9. How to assess evidence and evaluate the possible causes of faults/problems
10. How to use a range of fault diagnostic equipment to investigate the problem
11. The care, handling and application of measuring/test equipment (such as mechanical measuring instruments, electrical measuring instruments, test rigs and pressure and flow devices)
12. How to check that measuring/test equipment is within calibration and that it is free from damage and defects
13. How to obtain and interpret information from job instructions and other documents needed in the fault location process (such as drawings, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical symbols)
14. The basic principles of how the service equipment functions, its operating sequence, the purpose of individual units/components and how they interact
15. The problems that can occur during the fault location activity, and how they can be minimised
16. How to evaluate the likely risk to yourself and others, and the effects the fault could have on the overall process or system
17. The importance of completing the correct documentation, following the maintenance activity
18. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 19 Carrying Out Fault Location on Service Systems and Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the fault location activities (all)</b>				
plan fault location methods and procedures in conjunction with others				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
carry out the fault location activities				
disconnect or isolate components or parts of the system, when appropriate, to confirm the diagnosis				
identify the fault, and consider appropriate corrective action				
in conjunction with others, take actions to resolve the problem				
dispose of waste				
leave the work area in a safe and tidy condition				
<b>Carry out fault location on one of the following types of services equipment, to sub-assembly or component level (one)</b>				
fresh water				
foul water				
compressed air				
refrigeration				
environmental control				
emergency power generation				
gas distribution				
instrumentation and control				
heating and ventilation				
air conditioning and ventilation				
process control				
<b>Use four of the following diagnostic techniques, tools and aids to assist in locating the fault (four)</b>				
information gathered from the person who reported the fault				
fault finding				
diagnostic aids				
inspecting				
operating				
<b>Use two of the following types of instruments to assist in locating faults (two)</b>				
mechanical measuring equipment				
electrical/electronic measuring				



instruments				
fluid test equipment				
<b>Locate faults that have resulted in two of the following breakdown categories (two)</b>				
intermittent problem				
partial failure or reduced performance				
complete breakdowns				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
scheduled maintenance report				
corrective action report				
company-specific documentation				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 20 Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment

## Unit Summary

This unit identifies the competences you need to carry out scheduled maintenance tasks on service systems and equipment, such as water distribution, waste/foul water, environmental control, refrigeration, heating and ventilation, air conditioning and ventilation, gas distribution, compressed air, process control, and instrumentation and control, in order to minimise downtime, and to ensure that the equipment performs at optimal levels and functions to specification.

Your responsibilities will require you to comply with organisational policy and procedures for the scheduled maintenance tasks undertaken, and to report any problems with the maintenance 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying scheduled maintenance procedures to services systems and equipment. You will have an understanding of the process of implementing scheduled maintenance tasks, the importance of carrying them out at specific times, and of recording their outcomes and actions taken. In addition, you will be expected to report where the outcomes identify the need for further investigation or maintenance work.

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 scheduled maintenance activities:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm with the authorised person that the equipment is ready for carrying out the scheduled maintenance
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - carry out the scheduled maintenance tasks using appropriate techniques and procedures
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out scheduled maintenance tasks on **one** of the following services or systems:
  - fresh water distribution
  - waste water
  - environmental control
  - process control
  - gas distribution
  - refrigeration
  - compressed air
  - emergency power generation
  - heating and ventilation
  - air conditioning and ventilation
  - instrumentation and control
  
3. Carry out **ten** of the following scheduled maintenance activities:
  - removing excessive dirt and grime
  - making sensory checks (such as sight, sound, smell, touch)
  - checking equipment for leaks
  - replacing 'lified' consumables (such as fluids, gaskets and seals, hoses)
  - monitoring the condition/deterioration of components (such as bearings, pipework, cables, valves, sensors, couplings)
  - checking that any safety equipment or controls are operating correctly
  - checking the operation of instrumentation (such as gauges and indicators)
  - carrying out and/or checking equipment self-analysis data
  - making adjustments to components and connections
  - tightening fastenings to the required torque
  - replenishing oils, greases or other fluids
  - reviewing and checking equipment operation and performance
  - recording the results of the scheduled maintenance activity
  - reporting or taking action with regard to any defects that require immediate attention (such as replacing non-'lified' components)
  
4. Maintain services or systems equipment, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards
  
5. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - specific company documentation
  - permit to work/formal risk assessment

## **Knowledge statements:**

### ***You must have a knowledge and understanding of:***

1. The health and safety requirements of the area in which the scheduled maintenance tasks are to take place, and the responsibility these requirements place on you
2. The isolation procedure or permit-to-work procedure that applies to the equipment being maintained
3. The specific health and safety precautions to be applied during the scheduled maintenance tasks, and their effects on others
4. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. The hazards associated with carrying out scheduled maintenance tasks on services and systems (such as handling oils/greases, stored pressure/force, misuse of tools), and how they can be minimised
6. How to obtain and interpret information from job instructions and other documents needed in the maintenance process (such as drawings, specifications, manufacturers' manuals)
7. The various checks to be carried out during the scheduled maintenance procedure
8. The procedure for obtaining the consumables to be used during the scheduled maintenance activity
9. Methods of checking that components are fit for purpose, and the need to replace 'lived' items
10. How to check that any replacement components meet the required specification/operating conditions
11. How to make appropriate sensory checks (such as sight, sound, smell and touch)
12. The appropriate testing instructions to be adopted during the maintenance activity
13. How to make adjustments to components/assemblies to ensure they function to specification
14. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components, and how they interact
15. How to complete scheduled maintenance records/logs/reports, in accordance with company policy and procedures
16. The equipment operating and control procedures, and how to apply them in order to carry out scheduled maintenance
17. The problems that can occur whilst carrying out the scheduled maintenance tasks, and how they can be avoided
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 problems that you cannot resolve

**Unit 20 Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment**

	<b>performance evidence 1</b>	<b>performance evidence 2</b>	<b>performance evidence 3</b>	<b>additional performance evidence (if required)</b>
evidence type				
date				
<b>Carry out all of the following during the scheduled maintenance activities (all)</b>				
undertake maintenance activities to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
confirm with the authorised person that the equipment is ready for carrying out the scheduled maintenance				
ensure the safe isolation of equipment				
provide safe access and working arrangements have for the maintenance area				
carry out the scheduled maintenance tasks using appropriate techniques and procedures				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out scheduled maintenance tasks on one of the following services or systems (one)</b>				
fresh water distribution				
waste water				
environmental control				
process control				
gas distribution				
refrigeration				
compressed air				
emergency power generation				
heating and ventilation				
air conditioning and ventilation				
instrumentation and control				
<b>Carry out ten of the following scheduled maintenance activities (ten)</b>				
removing excessive dirt and grime				
making sensory checks)				
checking equipment for leaks				
replacing 'lifer' consumables				
monitoring the condition/deterioration of components				
checking safety equipment or controls are operating correctly				
checking the operation of instrumentation				
carrying out and/or checking				

equipment self-analysis data				
making adjustments to components and connections				
tightening fastenings to the required torque				
replenishing oils, greases or other fluids				
reviewing and checking equipment operation and performance				
recording the results of the scheduled maintenance activity				
reporting or taking action with regard to any defects that require immediate attention				
<b>Maintain services or systems equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
specific company documentation				
permit to work/formal risk assessment				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 21 Carrying Out Maintenance on Water Distribution Systems and Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on fresh/foul water distribution systems and equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing or repairing faulty or damaged components, in line with company procedures on water distribution systems, such as mains cold water (drinkable), hot water supplies, cold down service and non-mains supplies (river, well), waste/foul and storm water supplies.

You will be expected to cover a range of maintenance activities, such as marking/labelling of components to aid the reassembly, dismantling components to the required level, checking components for serviceability, replacing 'lifer' items, tightening fasteners to the required torque, setting, aligning and adjusting components, and making checks before re-connecting the supply, using appropriate techniques and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying procedures for fresh water distribution equipment. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the fresh water system equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any maintenance, repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **one** of the following types of water systems:
  - mains cold water (drinkable)
  - hot water supplies
  - cold down service
  - waste/foul
  - non-mains supplies
  - storm water
  
3. Carry out **all** of the following maintenance activities:
  - dismantling equipment to required level
  - labelling/proof marking of components
  - checking components for serviceability
  - replacing all 'lifer' items (such as seals, gaskets)
  - replacing or repairing damaged/defective components
  - setting, aligning and adjusting components
  - tightening fastenings to the required torque
  - making checks before re-connecting the supply
  - functionally testing the maintained equipment
  
4. Maintain and/or replace **six** of the following water distribution components:
  - valves
  - couplings/connectors
  - wet and dry risers
  - pumps
  - dosing plant
  - filters
  - motors
  - heaters
  - pump chambers
  - cylinders
  - tanks
  - gaskets and seals
  - gauges/indicators
  - manifolds
  - traps
  - sensors
  - switches
  - faucets
  - control devices
  - electrical wiring/connectors
  - ancillary equipment (such as sinks, toilets)
  - macerators
  - pipework (such as copper, lead, clay, iron, plastic)



5. Maintain water distribution systems, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - permits to work/formal risk assessment
  - maintenance log or report

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. 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)
4. The hazards associated with carrying out maintenance activities on water distribution equipment and systems, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
7. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance
8. The sequence to be adopted for the dismantling/reassembly of various types of assemblies
9. The methods and techniques used to dismantle/assemble water distribution equipment (such as release of water/pressures/force, bonding, extraction, pressing, alignment)
10. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as seals, gaskets, washers)
11. The basic principles of how the system functions, its operating sequence, the working purpose of individual units/components and how they interact
12. The applications of different types of pipework systems (such as copper, plastic, lead, iron and clay)
13. The different types of couplings and their fittings (such as tees, bends, branches)
14. The equipment and tools used to bend, form and thread pipework
15. The methods of treating water systems
16. The applications of the different pipework and equipment cleaning procedures (such as rod, water jet, solvents)
17. How to make adjustments to components/assemblies to ensure that they function correctly
18. How to check that tools and equipment are free from damage or defects, and are in a safe and usable condition
19. The generation of maintenance documentation and/or reports, following the maintenance activity
20. The problems associated with the maintenance activity, and how they can be overcome
21. The organisational procedure 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 problems that you cannot resolve

## Unit 21 Carrying Out Maintenance on Water Distribution Systems and Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activity (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service on completion of maintenance				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on one of the following types of water systems (one)</b>				
mains cold water (drinkable)				
hot water supplies				
cold down service				
waste/foul				
non-mains supplies				
storm water				
<b>Carry out all of the following maintenance activities (all)</b>				
dismantling equipment to required level				
labelling/proof marking of components				
checking components for serviceability				
replacing all 'lifer' items (such as seals, gaskets)				
replacing or repairing damaged/defective components				
setting, aligning and adjusting components				
tightening fastenings to the required torque				
making checks before re-connecting the supply				
functionally testing the maintained equipment				
<b>Maintain and/or replace six of the following water distribution components (six)</b>				
valves				
couplings/connectors				
wet and dry risers				
pumps				
dosing plant				

filters				
motors				
heaters				
pump chambers				
cylinders				
tanks				
gaskets and seals				
gauges/indicators				
manifolds				
traps				
sensors				
switches				
faucets				
control devices				
electrical wiring/connectors				
ancillary equipment				
macerators				
pipework				
<b>Maintain water distribution systems, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
permits to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 22 Carrying Out Maintenance on Emergency Power Generation Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on emergency power generation equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing faulty or damaged components, in line with company procedures, on a variety of emergency power generation equipment, including engine/primary power source, the generator, the electrical load connection, and the appropriate control equipment.

You will be expected to cover a range of maintenance activities, such as marking/labelling of components to aid the reassembly, aligning/adjusting of components, and dismantling components by mechanically dismantling, unplugging, de-soldering, and removal of screwed, clamped and crimped connections, using appropriate techniques and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying maintenance procedures to emergency power generation systems and equipment. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the emergency power generation system and equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **two** of the following types of emergency power generation equipment:
  - turbine alternator sets
  - piston engine alternator sets
  - generators
  - governors
  - control gear
  - voltage regulators
  - batteries and chargers
  - mechanical protection equipment
  - electrical protection equipment
  
3. Carry out **all** of the following maintenance activities:
  - testing the system for leaks
  - dismantling equipment to required level
  - tightening fasteners to the required torque
  - checking components for serviceability
  - replacing damaged/defective components
  - setting, aligning and adjusting replaced components
  - checking the correct operation of all safety devices
  - marking/labelling of components
  - making 'off-load' checks before starting up
  - replenishing oil, coolant or grease
  - replacing all 'lived' items (such as batteries, lamps)
  - functionally testing the completed system
  
4. Maintain and/or replace **six** of the following types of components:
  - engine components (such as valves, shell bearings)
  - turbine components
  - bearings and seals
  - clutches and brakes
  - drive mechanisms (such as gears, chains, pulleys and belts)
  - transmission items (such as shafts, couplings)
  - fuel supply components (such as pumps, injectors, pipes)
  - ignition (such as plugs, heaters, burners)
  - cooling equipment (such as radiators, pumps, hoses)
  - lubrication components (such as pumps, filters, pipes)
  - exhaust systems
  - speed governing components
  - control panel components (such as breakers, contactors)
  - annunciators/alarms
  - voltage regulators
  - relays and solenoids
  - sensors

- switches and switch gear
- electrical cables
- overload protection devices
- safety devices
- pressure relief valves
- meters/gauges (such as temperature, pressure, speed)
- test systems (manual or automatic)
- noise reduction/attenuation
- temperature control components (such as thermostat, thermocouples, thermistors)
- electronic components (such as circuit boards, timers, transducers)

5. Maintain emergency power generation equipment, in accordance with **one** or more of the following:

- organisational guidelines and codes of practice
- equipment manufacturer's guidelines
- IEE wiring regulations
- BS and/or ISO standards

6. Complete **one** of the following maintenance records, and pass it to the appropriate person:  
job cards

- permit to work/formal risk assessment
- maintenance log or report

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place
2. The isolation and lock-off procedure or permit-to-work procedure that applies to the equipment being maintained
3. The specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. The hazards associated with carrying out maintenance activities on emergency power generation equipment/systems (such as moving machinery, hot components, stored pressure/force, live electrical connections, handling oils and coolants, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how they can be minimised
5. The importance of wearing the correct personal and environmental protection equipment, and other appropriate safety equipment, during the maintenance process
6. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
7. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
8. Why electrical earthing and bonding is critical, and why it must be both mechanically and electrically secure
9. The sequence to be adopted for the dismantling/reassembly of various types of assemblies
10. The methods and techniques used to dismantle/assemble emergency power generation equipment (such as removing bolted components and assemblies, removing components requiring pressure, unplugging, de-soldering, removal of screwed, clamped and crimped connections)
11. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as batteries, lamps, seals and gaskets)
12. How to make adjustments to components/assemblies to ensure that they function correctly
13. Methods of removing and replacing components and units, without damaging the system and infrastructure
14. The use of electrical measuring equipment (such as multimeters and resistance testers)
15. Methods of testing the equipment and systems for leaks, and the tools and equipment that can be used
16. Types of coolants and antifreeze agents; quantities used; and methods of flushing and filling the system
17. How to check that tools and equipment are free from damage or defects, and are in a safe and usable condition
18. The importance of maintenance documentation and/or reports following the maintenance activity, and how to generate them
19. The equipment operating and control procedures to be applied during the maintenance activity
20. How to use lifting and handling equipment correctly and safely in the maintenance activity
21. The problems associated with the maintenance activity, and how they can be overcome
22. The organisational procedure 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 problems that you cannot resolve

**Unit 22**

**Carrying Out Maintenance on Emergency Power Generation Equipment**

	<b>performance evidence 1</b>	<b>performance evidence 2</b>	<b>performance evidence 3</b>	<b>additional performance evidence (if required)</b>
evidence type				
date				
<b>Carry out all of the following during the maintenance activity (all)</b>				
undertake maintenance a to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on two of the following types of emergency power generation equipment (two)</b>				
turbine alternator sets				
piston engine alternator sets				
generators				
governors				
control gear				
voltage regulators				
batteries and chargers				
mechanical protection equipment				
electrical protection equipment				
<b>Carry out all of the following maintenance activities (all)</b>				
testing the system for leaks				
dismantling equipment to required level				
tightening fasteners to the required torque				
checking components for serviceability				
replacing damaged/defective components				
setting, aligning and adjusting replaced components				
checking the correct operation of all safety devices				
marking/labelling of components				
making 'off-load' checks before starting up				
replenishing oil, coolant or grease				
replacing all 'lifer' items				
functionally testing the completed system				



<b>Maintain and/or replace six of the following types of components (six)</b>				
engine components)				
turbine components				
bearings and seals				
clutches and brakes				
drive mechanisms				
transmission items				
fuel supply components				
ignition				
cooling equipment				
lubrication components				
exhaust systems				
speed governing components				
control panel components				
annunciators/alarms				
voltage regulators				
relays and solenoids				
sensors				
switches and switch gear				
electrical cables				
overload protection devices				
safety devices				
pressure relief valves				
meters/gauges				
test systems				
noise reduction/attenuation				
temperature control components				
electronic components				
<b>Maintain emergency power generation equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's guidelines				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 23 Carrying Out Maintenance on Workplace Environmental Control Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on workplace environmental control equipment and systems, in accordance with approved procedures. This will involve dismantling, removing and replacing faulty components, in line with company procedures, on environmental control systems such as heating and ventilation, air conditioning and ventilation, chillers, lighting, lifts, building/room access, fire systems, intruder alarm and CCTV systems.

You will be expected to cover a range of maintenance activities, such as marking/labelling of components to aid the reassembly, dismantling components by unplugging, de-soldering, removal of screwed, clamped and crimped connections, and aligning and adjusting components, using appropriate techniques and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying maintenance procedures to workplace environmental control systems and equipment. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **one** of the following workplace environmental control systems:
  - heating and ventilation
  - air conditioning and ventilation
  - intruder/alarm systems
  - lighting
  - CCTV system
  - chillers
  - lift control
  - fire systems
  - building/room access
  - other specific system
  
3. Carry out **all** of the following maintenance activities:
  - dismantling equipment to the appropriate level
  - setting, aligning and adjusting replaced components
  - checking components for serviceability
  - replacing all 'lived' items (such as batteries, lamps)
  - replacing damaged/defective components
  - marking/labelling of components
  - tightening fasteners to the required torque
  - making 'off-line' checks before starting up
  - functionally testing the completed system
  
4. Maintain and/or replace **six** of the following environmental control equipment components:
  - relays
  - inverters
  - actuators
  - valves
  - sensors
  - switches
  - thermostats
  - dampers
  - motor starters
  - vents/diffuser
  - electrical cables
  - network cables
  - contactors
  - printers
  - solenoids
  - circuit boards
  - thermocouples
  - batteries
  - transformers
  - uninterruptible power supplies
  - timers

- interlocks
  - overload protection devices
  - PC and associated equipment
5. Maintain environmental control equipment, in accordance with **one** or more of the following:
- organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
- job cards
  - permit to work/formal risk assessment
  - maintenance log or report

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies to maintenance activities (electrical isolation, locking off switchgear, removal of fuses, placing of maintenance warning notices, proving that isolation has been achieved and secured)
3. 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)
4. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
6. The sequence to be adopted for the dismantling/reassembly of various types of assemblies
7. The methods and techniques used to dismantle/assemble workplace environmental control equipment (such as unplugging, de-soldering removal of screwed, clamped and crimped connections)
8. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as batteries, lamps, seals and gaskets)
9. How to make adjustments to components/assemblies to ensure that they function correctly
10. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
11. Methods of removing and replacing components and units, without damaging the system and infrastructure
12. 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
13. The generation of maintenance documentation and/or reports following the maintenance activity
14. The equipment operating and control procedures to be applied during the maintenance activity
15. How to use lifting and handling equipment correctly and safely in the maintenance activity
16. The problems associated with the maintenance activity, and how they can be overcome
17. The organisational procedure to be adopted for the safe disposal of waste of all types of materials
18. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

**Unit 23 Carrying Out Maintenance on Workplace Environmental Control Equipment**

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activity (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on one of the following workplace environmental control systems (one)</b>				
heating and ventilation				
air conditioning and ventilation				
intruder/alarm systems				
lighting				
CCTV system				
chillers				
lift control				
fire systems				
building/room access				
other specific system				
<b>Carry out all of the following maintenance activities (all)</b>				
dismantling equipment to the appropriate level				
setting, aligning and adjusting replaced components				
checking components for serviceability				
replacing all 'lived' items (such as batteries, lamps)				
replacing damaged/defective components				
marking/labelling of components				
tightening fasteners to the required torque				
making 'off-line' checks before starting up				
functionally testing the completed system				
<b>Maintain and/or replace six of the following environmental control equipment components (six)</b>				
relays				

inverters				
actuators				
valves				
sensors				
switches				
thermostats				
dampers				
motor starters				
vents/diffuser				
electrical cables				
network cables				
contactors				
printers				
solenoids				
circuit boards				
thermocouples				
batteries				
transformers				
uninterruptible power supplies				
timers				
interlocks				
overload protection devices				
PC and associated equipment				
<b>Maintain environmental control equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 24 Carrying Out Maintenance on Heating and Ventilation Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on a heating and ventilation system, in accordance with approved procedures. This will involve dismantling, removing and replacing faulty or damaged components, in line with company procedures, on heating and ventilation equipment, which will include one of the following primary heating sources: gaseous, liquid, solid fuel, electricity and renewable energy. You will be expected to apply a variety of dismantling and assembly methods and techniques, such as proof marking/labelling of components to aid the reassembly, dismantling components requiring pressure techniques, torque loading, and setting, aligning and adjusting components.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying heating and ventilation maintenance procedures. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the system functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **one** of the following types of primary energy heat source systems:
  - liquid
  - gaseous
  - solid fuel
  - renewable energy
  - electrical
  
3. Carry out **all** of the following maintenance techniques and procedures:
  - setting, aligning and adjusting components
  - dismantling equipment to the required level
  - proof marking/labelling of components
  - checking components for serviceability
  - replacing all 'lived' items (such as batteries and lamps)
  - tightening fastenings to the required torque
  - testing the system for leaks
  - making 'off-line' checks before starting up
  - lubricating components
  - functionally testing the maintained system
  
4. Maintain and/or replace a **six** of the following heating/ventilation components:
  - fans
  - blowers
  - pumps
  - calorifiers
  - ductwork
  - dampers
  - vents/diffuser
  - valves
  - motors
  - heat exchanger
  - couplings
  - condenser
  - manifolds/flanges
  - pipework
  - gaskets and seals
  - strainers/filters
  - gauges/indicators
  - insulation
  - switches
  - sensors
  - control devices
  - safety devices
  - silencers
  - heater batteries
  - electrical wiring/components



- local heating system (such as radiators, in-line duct heaters, skirting heating, fan coil, convectors, storage pipe heaters and air handling units)
5. Maintain heating and ventilation systems, in accordance with **one** or more of the following:
- organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
- job cards
  - permit to work/formal risk assessment
  - maintenance log or report

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. The hazards associated with carrying out maintenance activities on heating and ventilation equipment (such as stored pressure/force/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 protective clothing and other appropriate safety equipment during the maintenance process
6. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
7. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
8. The sequence to be adopted for the dismantling/reassembly of various types of assemblies
9. The methods and techniques used to dismantle/assemble heating and ventilation equipment (release of pressures/force/fluids, proof marking, extraction, pressing, alignment)
10. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as seals and gaskets)
11. How to make adjustments to components/assemblies to ensure that they function correctly
12. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
13. The typical building design temperatures (such as for offices, factories (light and heavy work) warehouses and canteens)
14. 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
15. The generation of maintenance documentation and/or reports following the maintenance activity
16. The equipment operating and control procedures to be applied during the maintenance activity
17. How to use lifting and handling equipment correctly and safely in the maintenance activity
18. The problems associated with the maintenance activity, and how they can be overcome
19. The organisational procedure to be adopted for the safe disposal of waste of all types of materials
20. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 24 Carrying Out Maintenance on Heating and Ventilation Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activity (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on one of the following types of primary energy heat source systems (one)</b>				
liquid				
gaseous				
solid fuel				
renewable energy				
electrical				
<b>Carry out all of the following maintenance techniques and procedures (all)</b>				
setting, aligning and adjusting components				
dismantling equipment to the required level				
proof marking/labelling of components				
checking components for serviceability				
replacing all 'lifer' items				
tightening fastenings to the required torque				
testing the system for leaks				
making 'off-line' checks before starting up				
lubricating components				
functionally testing the maintained system				
<b>Maintain and/or replace a six of the following heating/ventilation components (six)</b>				
fans				
blowers				
pumps				
calorifiers				
ductwork				
dampers				
vents/diffuser				
valves				

motors				
heat exchanger				
couplings				
condenser				
manifolds/flanges				
pipework				
gaskets and seals				
strainers/filters				
gauges/indicators				
insulation				
switches				
sensors				
control devices				
safety devices				
silencers				
heater batteries				
electrical wiring/components				
local heating system				
<b>Maintain heating and ventilation systems, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 25 Carrying Out Maintenance on Air Conditioning and Ventilation Equipment

## Unit Summary

This unit identifies the competencies you need to carry out corrective maintenance activities on air conditioning and ventilation equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing faulty or damaged components, in line with company procedures, on air conditioning equipment and ventilation systems such as air generation, distribution and control systems. You will be expected to apply a variety of dismantling and assembly methods and techniques, such as proof marking/labelling of components to aid the reassembly, dismantling components requiring pressure techniques, torque loading, and setting, aligning and adjusting components.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying air conditioning and ventilation maintenance procedures. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the system functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **two** of the following types of equipment:
  - remote air conditioning generation
  - local air conditioning distribution
  - air conditioning control
  
3. Carry out **all** of the following maintenance activities:
  - testing the system for leaks
  - dismantling equipment to the appropriate level
  - setting, aligning and adjusting components
  - checking components for serviceability
  - replacing damaged/defective components
  - marking/labelling of components
  - tightening fasteners to the required torque
  - making 'off-line' checks before starting up
  - functionally testing the completed system
  - replacing all 'lived' items (such as batteries, lamps)
  
4. Maintain and/or replace **six** of the following air conditioning components:
  - motors
  - chiller batteries
  - pumps
  - humidifiers
  - chilled beams
  - condensers
  - evaporators
  - ducting/trunking
  - dampers
  - vents/diffusers
  - valves
  - filters
  - pipework
  - couplings
  - fans
  - manifolds/flanges
  - silencers/attenuators
  - gaskets and sealants
  - gauges/indicators
  - sensors
  - switches
  - battery heaters
  - thermostats
  - insulation
  - electrical connectors
  - electrical components
  - wiring safety devices

5. Maintain air conditioning and ventilation systems, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - permit to work/formal risk assessment
  - maintenance log or report

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the maintenance process, and their effects on others (including the Prevention and Control of Legionellosis, and Safe Working in Confined Spaces)
4. The hazards associated with carrying out maintenance activities on air conditioning equipment (handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
7. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance
8. The sequence to be adopted for the dismantling/reassembly of various types of assemblies
9. The methods and techniques used to dismantle/assemble air conditioning equipment (such as release of pressures/force/fluid, proof marking, extraction, pressing, alignment)
10. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as seals and gaskets)
11. How to make adjustments to components/assemblies to ensure that they function correctly
12. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
13. The correct operating ranges (including temperature and pressure of secondary heating sources (air and water))
14. The typical building design temperatures (such as for offices, factories (light and heavy work) warehouses and canteens)
15. 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
16. The generation of maintenance documentation and/or reports following the maintenance activity
17. The equipment operating and control procedures to be applied during the maintenance activity
18. How to use lifting and handling equipment correctly and safely in the maintenance activity
19. The problems associated with the maintenance activity, and how they can be overcome
20. The organisational procedure 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 problems that you cannot resolve

## Unit 25 Carrying Out Maintenance on Air Conditioning and Ventilation Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activity (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on two of the following types of equipment (two)</b>				
remote air conditioning generation				
local air conditioning distribution				
air conditioning control				
<b>Carry out all of the following maintenance activities (all)</b>				
testing the system for leaks				
dismantling equipment to the appropriate level				
setting, aligning and adjusting components				
checking components for serviceability				
replacing damaged/defective components				
marking/labelling of components				
tightening fasteners to the required torque				
making 'off-line' checks before starting up				
functionally testing the completed system				
replacing all 'lifer' items				
<b>Maintain and/or replace six of the following air conditioning components (six)</b>				
motors				
chiller batteries				
pumps				
humidifiers				
chilled beams				
condensers				
evaporators				
ducting/trunking				
dampers				

vents/diffusers				
valves				
filters				
pipework				
couplings				
fans				
manifolds/flanges				
silencers/attenuators				
gaskets and sealants				
gaskets and sealants				
gauges/indicators				
sensors				
switches				
battery heaters				
thermostats				
insulation				
electrical connectors				
electrical components				
wiring safety devices				
<b>Maintain air conditioning and ventilation systems, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....



# Unit 26 Carrying Out Maintenance on Gas Distribution Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on gas distribution systems and equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing faulty or damaged components, in line with company procedures, on gas distribution systems such as mains, cylinder and tanked gases. You will be expected to cover a range of maintenance activities, such as labelling of components to aid the assembly, dismantling components requiring pressure techniques, torque loading, and setting, aligning and adjusting components, using appropriate techniques and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying gas distribution maintenance procedures. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the system functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
2. Carry out maintenance activities on **one** of the following types of gas distribution systems:
  - mains
  - tanks
  - cylinders
3. Carry out **all** of the following maintenance activities:
  - testing the system for leaks
  - dismantling equipment to the appropriate level
  - setting, aligning and adjusting components
  - checking components for serviceability
  - replacing all 'lived' items (such as batteries, filters)
  - marking/labelling of components
  - tightening fasteners to the required torque
  - making 'off-line' checks before starting up
  - functionally testing the completed system
  - replacing damaged/defective components
4. Maintain and/or replace **six** of the following gas distribution components:
  - motors
  - valves
  - pipework
  - gaskets and seals
  - boosters
  - filters
  - couplings
  - manifolds
  - storage devices
  - regulators
  - meters
  - gauges/indicators
  - switches
  - sensors
  - supporting devices
  - electrical wiring
  - safety devices
5. Maintain gas distribution systems, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards

6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
- job cards
  - permit to work/formal risk assessment
  - maintenance log or report

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place
2. The isolation and lock-off procedure or permit-to-work procedure that applies to the gas system being maintained
3. The specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. The hazards associated with carrying out maintenance activities on gas systems (such as fire, explosion, respiratory problems, stored pressure, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
7. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
8. The importance of following the correct procedures for purging and de-commissioning components
9. The sequence to be adopted for the dismantling/reassembly of various types of gas assemblies
10. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as seals and gaskets)
11. How to make adjustments to components/assemblies to ensure that they function correctly
12. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
13. The methods used to label and identify different pipework systems (including colour coding and warning signs)
14. The different types and applications of measuring and monitoring equipment used
15. 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
16. The generation of maintenance documentation and/or reports following the maintenance activity
17. The equipment operating and control procedures to be applied during the maintenance activity
18. How to use lifting and handling equipment correctly and safely in the maintenance activity
19. The problems associated with the maintenance activity, and how they can be overcome
20. The organisational procedure 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 problems that you cannot resolve

## Unit 26 Carrying Out Maintenance on Gas Distribution Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activity (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
Carry out maintenance activities on <b>one</b> of the following types of gas distribution systems:				
mains				
tanks				
cylinders				
<b>Carry out all of the following maintenance activities (all)</b>				
testing the system for leaks				
dismantling equipment to the appropriate level				
setting, aligning and adjusting components				
checking components for serviceability				
replacing all 'lifer' items (such as batteries, filters)				
marking/labelling of components				
tightening fasteners to the required torque				
making 'off-line' checks before starting up				
functionally testing the completed system				
replacing damaged/defective components				
<b>Maintain and/or replace six of the following gas distribution components (six)</b>				
motors				
valves				
pipework				
gaskets and seals				
boosters				
filters				
couplings				
manifolds				
storage devices				

regulators				
meters				
gauges/indicators				
switches				
sensors				
supporting devices				
electrical wiring				
safety devices				
<b>Maintain gas distribution systems, in accordance with one or more of the following:</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 27 Carrying Out Maintenance on Compressed Air Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on compressed air systems and equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing faulty or damaged components, in line with company procedures, on a variety of compressed air equipment, such as compressed air generation, distribution and control systems. You will be expected to cover a range of maintenance activities, such as proof marking/labelling of components to aid the assembly, dismantling components requiring pressure techniques, torque loading, and setting, aligning and adjusting components, using appropriate techniques and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying compressed air maintenance procedures. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the system functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **two** of the following types of equipment:
  - compressed air generation
  - compressed air distribution
  - compressed air control
  
3. Carry out **all** of the following maintenance activities:
  - testing the system for leaks
  - dismantling equipment to the appropriate level
  - setting, aligning and adjusting components
  - checking components for serviceability
  - replacing all 'lived' items (such as filters)
  - marking/labelling of components
  - tightening fasteners to the required torque
  - making 'off-line' checks before starting up
  - functionally testing the completed system
  - replacing damaged/defective components
  
4. Maintain and/or replace **six** the following compressed air equipment and components:
  - pumps
  - receivers
  - driers
  - motors
  - pistons
  - valves
  - reservoirs
  - couplings
  - rigid pipe
  - vanes
  - filters
  - regulators
  - compressors
  - silencers
  - manifolds
  - sensors
  - lubricators
  - separation units
  - flexible pipe/hoses
  - gauges/indicators
  - gaskets and sealants
  - control equipment
  - electrical connectors
  - monitoring equipment
  - switches
  - electrical wiring
  - safety devices

5. Maintain compressed air systems equipment, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards
6. Complete **one** of the following maintenance records and pass it to the appropriate person:
  - job cards
  - permit to work/formal risk assessment
  - maintenance log or report

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place
2. The isolation and lock-off procedure or permit-to-work procedure that applies to the compressed air equipment/system being worked on
3. The specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. The hazards associated with carrying out maintenance activities on compressed air equipment (handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
7. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
8. The sequence to be adopted for the dismantling/reassembly of various types of assemblies used on compressed air equipment
9. The methods and techniques used to dismantle/assemble compressed air equipment (release of pressures/force/fluid, proof marking, extraction, pressing, alignment)
10. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as seals and gaskets)
11. How to make adjustments to components/assemblies to ensure that they function correctly
12. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
13. 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
14. The generation of maintenance documentation and/or reports following the maintenance activity
15. The equipment operating and control procedures to be applied during the maintenance activity
16. How to use lifting and handling equipment correctly and safely in the maintenance activity
17. The problems associated with the maintenance activity, and how they can be overcome
18. The organisational procedure 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 problems that you cannot resolve



## Unit 27 Carrying Out Maintenance on Compressed Air Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activity (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on two of the following types of equipment (two)</b>				
compressed air generation				
compressed air distribution				
compressed air control				
<b>Carry out all of the following maintenance activities (all)</b>				
testing the system for leaks				
dismantling equipment to the appropriate level				
setting, aligning and adjusting components				
checking components for serviceability				
replacing all 'lived' items (such as filters)				
marking/labelling of components				
tightening fasteners to the required torque				
making 'off-line' checks before starting up				
functionally testing the completed system				
replacing damaged/defective components				
<b>Maintain and/or replace <b>six</b> the following compressed air equipment and components:</b>				
pumps				
receivers				
driers				
motors				
pistons				
valves				
reservoirs				
couplings				
rigid pipe				
vanes				

filters				
regulators				
compressors				
silencers				
manifolds				
sensors				
lubricators				
separation units				
flexible pipe/hoses				
gauges/indicators				
gaskets and sealants				
control equipment				
electrical connectors				
monitoring equipment				
switches				
electrical wiring				
safety devices				
<b>Maintain compressed air systems equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 28 Carrying Out Maintenance on Process Control Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities to process control equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing faulty peripheral components and process controller units, in line with company policy on process control equipment, such as fixed I/O, rack mount and modular systems. You will also need to be able to load and download process control programs, check them for errors, make authorised edits, and create and maintain back-up copies of completed programs.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with the process control system, tools or equipment used, that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying maintenance procedures to process control systems. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the process control system functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly. You will also know about the interaction of the other associated integrated technologies, and will have sufficient knowledge to carry out the dismantling and reassembly of the process control system, safely and effectively.

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activities:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
2. Carry out maintenance activities on **one** of the following types of process controller equipment:
  - fixed input/output (I/O)
  - modular
  - rack mount
3. Carry out **four** of the following program maintenance activities on the process control system:
  - use appropriate programming devices (such as terminals, hand-held programmers and personal computers)
  - edit programs by computer-based authoring (to include subroutines)
  - produce back-ups of completed programs
  - make approved edits to lines of logic
  - load, read and save programs
  - force contacts on and off
  - carry out on-line monitoring of programs
  - use 'on' and 'off-line' programming
  - use single-step mode of operation
4. Carry out **all** of the following maintenance activities:
  - take electrostatic discharge (ESD) precautions when handling components and circuit boards
  - proof mark or label removed wires and components
  - replace peripheral devices (such as sensors, actuators, relays, switches)
  - replace components (such as power supplies, circuit boards and controller units)
  - check components for serviceability
  - use program 'full-run' modes of operation
  - replace back-up batteries
  - functionally test the system
5. Maintain process control equipment, in accordance with **one** or more of the following:
  - IEE wiring regulations
  - BS and ISO standards
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - maintenance log or report
  - permit to work/formal risk assessment

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity 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 process control system being worked on
3. The specific health and safety precautions to be applied during the maintenance activity, and their effects on others
4. 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)
5. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities, and where this can be obtained
6. The procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
7. The hazards associated with carrying out maintenance activities on process control systems (electrical supplies, process controller interface, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how they can be minimised
8. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
9. The basic principles of how the system functions, and its operating sequence
10. The devices and systems for storing programmes
11. How to search the user program within the process controller for specific elements
12. The techniques involved in editing, and the procedure to be followed for 'on' and 'off-line' programming
13. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance process
14. The techniques used to dismantle/assemble equipment (release of pressures/force, proof marking to aid assembly, plugging exposed pipe/component openings, dealing with soldered joints, screwed, clamped and crimped connections)
15. Methods of attaching identification marks/labels to removed components or cables, to assist with reassembly
16. Methods of checking that components are fit for purpose, and the need to replace batteries, boards and other failed items
17. 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
18. The importance of making 'off-load' checks before proving the equipment with the electrical supply on
19. The generation of maintenance documentation and/or reports following the maintenance activity
20. The equipment operating and control procedures to be applied during the maintenance activity
21. How to use lifting and handling equipment correctly and safely in the maintenance activity
22. The problems that can occur during the maintenance of the process control system, and how they can be overcome
23. The organisational procedure to be adopted for the safe disposal of waste of all types of materials
24. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 28 Carrying Out Maintenance on Process Control Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activity (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on one of the following types of process controller equipment (one)</b>				
fixed input/output (I/O)				
modular				
rack mount				
<b>Carry out four of the following program maintenance activities on the process control system (four)</b>				
use appropriate programming devices				
edit programs by computer-based authoring				
produce back-ups of completed programs				
make approved edits to lines of logic				
load, read and save programs				
force contacts on and off				
carry out on-line monitoring of programs				
use 'on' and 'off-line' programming				
use single-step mode of operation				
<b>Carry out all of the following maintenance activities (all)</b>				
take (ESD) precautions when handling components and circuit boards				
proof mark or label removed wires and components				
replace peripheral devices				
replace components				
check components for serviceability				
use program 'full-run' modes of operation				
replace back-up batteries				

functionally test the system				
<b>Maintain process control equipment, in accordance with one or more of the following (one)</b>				
IEE wiring regulations				
BS and ISO standards				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
maintenance log or report				
permit to work/formal risk assessment				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 29 Carrying Out Maintenance on Instrumentation and Control Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities to instrumentation and control equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing instruments and faulty peripheral components on instrumentation and control equipment, such as pressure, flow, level and temperature instruments, fiscal monitoring equipment, fire and gas detection and alarm systems, industrial weighing systems, speed measurement and control systems, vibration monitoring equipment, nucleonics and radiation measurement, telemetry systems and emergency shutdown systems.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with the instrument system, tools or equipment used, that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying maintenance procedures to instrumentation and control equipment and systems. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly. You will also know about the interaction of the other associated integrated technologies, and will have sufficient knowledge to carry out the dismantling and reassembly of the instrumentation system safely and effectively.

You will understand the safety precautions required when carrying out the maintenance 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activities:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **one** of the following types of instrumentation and control systems:
  - fire detection and alarm system
  - gas detection and alarm system
  - emergency shutdown systems
  - speed measurement/control system
  - fluid measurement/control system
  - noise and vibration monitoring/control systems
  - nucleonic and radiation systems
  - telemetry systems
  - temperature measurement/control systems
  - weight measurement/control systems
  
3. Carry out **all** of the following maintenance activities:
  - making all required isolations (such as process, electrical, pneumatic)
  - taking electrostatic discharge (ESD) precautions (where appropriate)
  - disconnecting supply/signal connections
  - removing instruments from the system
  - dismantling equipment to the required level
  - labelling/markings of components
  - checking components for serviceability
  - replacing all 'lived' items (such as seals, gaskets)
  - setting, aligning and adjusting components
  - tightening fastenings to the required torque
  - re-connect instrumentation pipework and power supply
  - check signal transmission is satisfactory
  - functionally testing the maintained equipment
  - replacing or repairing damaged/defective components (such as electrical, mechanical and back-up batteries)
  
4. Use **two** of the following types of instrumentation test and calibration equipment:
  - 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

5. Maintain installation and control systems in accordance with **one** or more of the following:

- organisational guidelines and codes of practice
- equipment manufacturer's operation range
- IEE wiring regulations
- BS and ISO standards

6. Complete **one** of the following maintenance records and pass it to the appropriate person:

- job cards
- permits to work/formal risk assessment
- maintenance log or report

### **Knowledge statements:**

#### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity 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 system and instruments being worked on, and how to check that any stored energy in pipework and instruments has been released
3. The specific health and safety precautions to be applied during the maintenance process, and their effects on others
4. 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)
5. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities, and where this can be obtained
6. The procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
7. The hazards associated with carrying out maintenance activities on instrumentation and control systems (such as handling fluids, stored pressure/force, electrical supplies, process controller interface, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how they can be minimised
8. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
9. The basic principles of operation of the instrumentation being maintained, and its operating sequence
10. The reasons for making sure that control systems are isolated or put into manual control, and that appropriate trip locks or keys are inserted, before removing any sensors or instruments from the system
11. The correct way of fitting instruments to avoid faulty readings (such as caused by head correction, poor flow past the sensor, blockages, incorrect wiring, poor insulation or incorrect materials)
12. How to carry out visual checks of the instruments (such as security of joints and physical damage)
13. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance process
14. The techniques used to dismantle/assemble integrated equipment (such as release of pressures/force, proof marking to aid assembly, plugging exposed pipe/component openings, dealing with soldered joints, screwed, clamped and crimped connections)
15. Methods of attaching identification marks/labels to removed components or cables, to assist with reassembly
16. Methods of checking that components are fit for purpose, and the need to replace batteries, boards and other failed items
17. 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
18. The generation of maintenance documentation and/or reports following the maintenance activity
19. The equipment operating and control procedures to be applied during the maintenance activity
20. The problems that can occur during the maintenance of the instrumentation and control system, and how they can be overcome
21. The organisational procedure 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 problems that you cannot resolve

## Unit 29 Carrying Out Maintenance on Instrumentation and Control Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activities (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment (				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on one of the following types of instrumentation and control systems (one)</b>				
fire detection and alarm system				
gas detection and alarm system				
emergency shutdown systems				
speed measurement/control system				
fluid measurement/control system				
noise and vibration monitoring/control systems				
nucleonic and radiation systems				
telemetry systems				
temperature measurement/control systems				
weight measurement/control systems				
<b>Carry out all of the following maintenance activities (all)</b>				
making all required isolations				
taking (ESD) precautions				
disconnecting supply/signal connections				
removing instruments from the system				
dismantling equipment to the required level				
labelling/marking of components				
checking components for serviceability				
replacing all 'lived' items				
setting, aligning and adjusting components				
tightening fastenings to the required torque				

re-connect instrumentation pipework and power supply				
check signal transmission is satisfactory				
functionally testing the maintained equipment				
replacing or repairing damaged/defective components				
<b>Use two of the following types of instrumentation test and calibration equipment (two)</b>				
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				
<b>Maintain installation and control systems in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and ISO standards				
<b>Complete one of the following maintenance records and pass it to the appropriate person (one)</b>				
job cards				
permits to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

## Unit 30 Carrying Out Maintenance on Industrial Refrigeration Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on industrial refrigeration equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing faulty components, such as compressors, evaporative condensers, evaporators, safety control devices, valves, refrigerant metering devices, sensors, switches, thermostats, meters, thermocouples, timers, interlocks, electrical components and wiring.

You will be expected to cover a range of maintenance activities, to include marking/labelling of components to aid the assembly, dismantling components by unplugging, de-soldering, removal of screwed, clamped and crimped connections, and aligning and adjusting components, using appropriate techniques and procedures. You will also be expected to purge the system with the designated gases, to charge the system with the specified refrigerant and lubricant, and to bring the system back on line, following the recognised and safe procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying maintenance procedures on refrigeration systems and equipment. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating, charging and purging 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. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **one** of the following types of refrigeration equipment:
  - compression types using air cooled condensers
  - compression types using water cooled condensers
  - air conditioning cooling plant
  - compression types using secondary refrigerants
  
3. Carry out **all** of the following maintenance activities:
  - assisting in charging and evacuating the system
  - checking the system for leaks
  - dismantling equipment to the required level
  - marking/labelling of components
  - checking components for serviceability
  - replacing 'lived' items (such as lamps, seals, gaskets)
  - replacing damaged/defective components
  - setting, aligning and adjusting components
  - checking correct operation of all safety devices
  - checking the operation of all valves
  - tightening fasteners to the required torque
  - functionally testing the completed system
  
4. Maintain and/or replace **six** of the following refrigeration equipment components:
  - motors
  - evaporators
  - compressors
  - relays
  - sensors
  - switches
  - thermostats
  - thermocouples
  - vents/diffusers
  - electrical cables
  - overload protection devices
  - circuit boards
  - electronic components
  - safety devices
  - evaporative condensers
  - pressure relief valves
  - gauges (such as temperature, humidity, pressure)
  - transformers
  - uninterruptible power supplies
  - interlocks

5. Maintain industrial refrigeration equipment, in accordance with **one** or more of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
  - job cards
  - permit to work/formal risk assessment
  - maintenance log or report

### **Knowledge statements:**

#### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place
2. The isolation and lock-off procedure or permit-to-work procedure that applies to the refrigeration equipment being maintained
3. The specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. The hazards associated with carrying out maintenance activities on refrigeration equipment/systems (such as stored pressure/force, lack of good ventilation, live electrical connections, handling liquid or vapour refrigerants, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how they can be minimised
5. Handling and storing of gas cylinders and equipment; the safe handling, storing and disposal of refrigerants; methods of determining the contents in cylinders in order to allow complete charging
6. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
7. How to obtain and interpret information from job instructions and other documents needed for the maintenance activities (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE Regs.)
8. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
9. The sequence to be adopted for the dismantling/reassembly of various types of assemblies
10. The methods and techniques used to dismantle/assemble refrigeration equipment (unplugging, desoldering, removal of screwed, clamped and crimped connections, removing bolted components and assemblies)
11. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such lamps, seals and gaskets)
12. How to make adjustments to components/assemblies to ensure that they function correctly
13. The basic principles of how compression type refrigeration systems function, their operating sequence, the working purpose of individual units/components and how they interact
14. The system operating pressures and temperatures, and the relationship between refrigerant gas pressures and temperatures
15. Methods of removing and replacing components and units, without damaging the system and infrastructure
16. 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
17. Types and application of primary and secondary refrigerants, and methods of purging and charging the system using liquid and vapour refrigerants
18. The use of vacuum pumps, pressure gauges, compound gauges, flow gauges and indicators
19. 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
20. The generation of maintenance documentation and/or reports following the maintenance activity
21. The equipment operating and control procedures to be applied during the maintenance activity
22. How to use lifting and handling equipment correctly and safely in the maintenance activity
23. The problems associated with the maintenance activity, and how they can be overcome
24. The organisational procedure 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 problems that you cannot resolve

## Unit 30 Carrying Out Maintenance on Industrial Refrigeration Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activities (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on one of the following types of refrigeration equipment (one)</b>				
compression types using air cooled condensers				
compression types using water cooled condensers				
air conditioning cooling plant				
compression types using secondary refrigerants				
<b>Carry out all of the following maintenance activities (all)</b>				
assisting in charging and evacuating the system				
checking the system for leaks				
dismantling equipment to the required level				
marking/labelling of components				
checking components for serviceability				
replacing 'lifer' items				
replacing damaged/defective components				
setting, aligning and adjusting components				
checking correct operation of all safety devices				
checking the operation of all valves				
tightening fasteners to the required torque				
functionally testing				
<b>Maintain and/or replace six of the following refrigeration equipment components (six)</b>				
motors				
evaporators				
compressors				
relays				



sensors				
switches				
thermostats				
thermocouples				
vents/diffusers				
electrical cables				
overload protection devices				
circuit boards				
electronic components				
safety devices				
evaporative condensers				
pressure relief valves				
gauges (such as temperature, humidity, pressure)				
transformers				
uninterruptible power supplies				
interlocks				
<b>Maintain industrial refrigeration equipment, in accordance with one or more of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 31 Carrying Out Maintenance on Environmental Control Equipment

## Unit Summary

This unit identifies the competences you need to carry out corrective maintenance activities on fixed and portable environmental control equipment, in accordance with approved procedures. This will involve dismantling, removing and replacing or repairing faulty components, in line with company procedures, on environmental control equipment such as air pollution, effluent treatment, noise and vibration control, waste and used product storing or recycling equipment.

You will be expected to cover a range of maintenance activities, such as labelling/marketing to aid reassembly, dismantling components to the required level, setting, aligning and adjusting components, replacing 'lived' items, replenishing oils, greases or other fluids, torque loading components, and making 'off-load' checks before testing and starting up the maintained equipment, using appropriate techniques and procedures.

Your responsibilities will require you to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities, or with 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying maintenance procedures to environmental control equipment. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the environmental control equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the maintenance 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 the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activity:
  - undertake the maintenance activities to cause minimal disruption to normal working
  - use the correct issue of drawings, job instructions and procedures
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements have been provided for the maintenance area
  - re-connect and return the equipment to service on completion of the maintenance activities
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out maintenance activities on **one** of the following types of environmental control equipment:
  - air pollution control equipment (such as decarbonisation (CO<sub>2</sub> 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)
  
3. Carry out **all** of the following maintenance activities:
  - dismantling equipment to the required level
  - marking/labelling of components
  - checking components for serviceability
  - replacing 'lified' items (such as filters, seals, gaskets)
  - replacing damaged/defective components
  - setting, aligning and adjusting components
  - checking the correct operation of all safety devices
  - replenishing oils, greases or other fluids
  - tightening fasteners to the required torque
  - functionally testing the completed system
  
4. Maintain and/or replace **six** of the following environmental control **mechanical** components:
  - actuators
  - bearings
  - burners
  - pipework
  - couplings
  - geared drives
  - conveyor belts
  - dampers
  - chains and sprockets
  - levers and linkages
  - pulleys and belts
  - seals and gaskets
  - containment booms
  - enclosures and guards
  - exhaust components
  - lubrication components
  - mechanical isolators
  - mechanical overloads
  - flow measurement and control
  - pollution samplers
  - sorting screens

- noise attenuation devices
- filters (individual)
- safety devices
- pumps
- valves
- storage tanks
- fasteners
- gauges
- spill kits

**OR** Maintain and/or replace **six** of the following environmental control **electrical** components:

- wires and cables
- switches and contactors
- circuit boards
- electrical isolators
- electrical trips
- motor starters
- flow measurement devices
- infra-red monitoring devices
- interlocks
- inverters
- level floats and indicators
- meters
- relays
- pollution samplers
- resistors
- safety devices
- switchgear
- sensors solenoids
- switches
- thermistors
- thermocouples
- thermostats
- timers
- transducers
- transformers

5. Maintain environmental control equipment, in accordance with **one** or more of the following (as appropriate to the equipment being maintained):

- IEE regulations
- The Factories Act
- Gas Safety Regulations
- The Noise at Work Regulations
- Electricity at Work Regulations
- HS(G)37 Local Exhaust Ventilation
- equipment manufacturer's guidelines
- HSE EH0 Occupational Exposure Limits
- ISO 14000 Environmental Management
- HSC Control of Legionella Bacteria in Water Systems
- organisational (company) guidelines and codes of practice
- The Workplace (Health, Safety and Welfare) Regulations
- PPG2 Environmental agency Pollution Prevention Guidelines

6. Complete **one** of the following maintenance records, and pass it to the appropriate person:  
job cards

- permit to work/formal risk assessment
- maintenance log or report

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the maintenance activity is to take place
2. The isolation and lock-off procedure or permit-to-work procedure that applies to the environmental control equipment being maintained
3. The specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. The hazards associated with carrying out maintenance activities on environmental control equipment (including the use of lubricants, cleaning materials, power tools, the use and misuse of hand tools, and the consequences of not following laid-down good-practice maintenance procedures), and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. Associated hazardous substances, their monitoring and exposure limits
7. How to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
8. The procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
9. The sequence to be adopted for the dismantling/reassembly of various types of assemblies
10. The methods and techniques used to dismantle/assemble environmental control equipment (unplugging, de-soldering, removal of screwed, clamped and crimped connections, removing bolted components and assemblies)
11. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items (such as filters, seals and gaskets)
12. How to make adjustments to components/assemblies to ensure that they function correctly
13. The basic principles of how environmental control systems function, their operating sequence, the working purpose of individual units/components and how they interact
14. Methods of removing and replacing components and units, without damaging the system and infrastructure
15. 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
16. The generation of maintenance documentation and/or reports following the maintenance activity
17. The equipment operating and control procedures to be applied during the maintenance activity
18. How to use lifting and handling equipment correctly and safely in the maintenance activity
19. The problems associated with the maintenance activity, and how they can be overcome
20. The organisational procedure 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 problems that you cannot resolve

## Unit 31 Carrying Out Maintenance on Environmental Control Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activities (all)</b>				
undertake maintenance to cause minimal disruption				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment (				
provide safe access and working arrangements for the maintenance area				
re-connect and return the equipment to service				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out maintenance activities on one of the following types of environmental control equipment (one)</b>				
air pollution control equipment				
effluent treatment equipment				
noise and vibration equipment				
waste and used product handling, storing and recycling equipment				
<b>Carry out all of the following maintenance activities (all)</b>				
dismantling equipment to the required level				
marking/labelling of components				
checking components for serviceability				
replacing 'lived' items				
replacing damaged/defective components				
setting, aligning and adjusting components				
checking the correct operation of all safety devices				
replenishing oils, greases or other fluids				
tightening fasteners to the required torque				
functionally testing the completed system				
<b>Maintain and/or replace six of the following environmental control mechanical components (six)</b>				
actuators				
bearings				
burners				

pipework				
couplings				
geared drives				
conveyor belts				
dampers				
chains and sprockets				
levers and linkages				
pulleys and belts				
seals and gaskets				
containment booms				
enclosures and guards				
exhaust components				
lubrication components				
mechanical isolators				
mechanical overloads				
flow measurement and control				
pollution samplers				
sorting screens				
noise attenuation devices				
filters (individual)				
safety devices				
pumps				
valves				
storage tanks				
fasteners				
gauges				
spill kits				
<b>or maintain and/or replace six of the following environmental control electrical components (six)</b>				
wires and cables				
switches and contactors				
circuit boards				
electrical isolators				
electrical trips				
motor starters				
flow measurement devices				
infra-red monitoring devices				
interlocks				
inverters				
level floats and indicators				
meters				
relays				
pollution samplers				
resistors				
safety devices				
switchgear				
sensors solenoids				
switches				
thermistors				
thermocouples				
thermostats				
timers				
transducers				
transformers				
<b>Maintain environmental control equipment, in accordance with one or more of the following (one)</b>				
IEE regulations				
The Factories Act				
Gas Safety Regulations				
The Noise at Work Regulations				
Electricity at Work Regulations				

HS(G)37 Local Exhaust Ventilation				
equipment manufacturer's guidelines				
HSE EH0 Occupational Exposure Limits				
ISO 14000 Environmental Management				
HSC Control of Legionella Bacteria in Water Systems				
organisational (company) guidelines and codes of practice				
The Workplace (Health, Safety and Welfare) Regulations				
PPG2 Environmental agency Pollution Prevention Guidelines				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance log or report				

Knowledge and understanding reference:

Candidate: \_\_\_\_\_  
Assessor: \_\_\_\_\_

Date: \_\_\_\_\_  
Date: \_\_\_\_\_

## Unit 32 Carrying Out Fault Location on Communication-Electronic Systems

### Unit Summary



This unit identifies the competences you need to locate faults on communication-electronic systems, in accordance with approved procedures. You will be required to locate faults on a range of communication-electronic systems, sub-systems, assemblies or components at line replacement unit (LRU) level. You will be expected to use a variety of fault location methods and procedures, such as gathering information from the person who reported the fault, using recognised fault finding techniques and diagnostic aids, measuring, inspecting and operating the system. You will be expected to take care that you do not damage the system during the maintenance activities and, where appropriate, the application of electrostatic discharge (ESD) procedures will be a critical part of your role.

Your responsibilities will require you to comply with organisational policy and procedures for the fault location activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking full responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying fault location procedures on communication-electronic systems. You will have an understanding of the basic fault location methods and techniques used, and their application. You will also know how to interpret the information obtained from diagnostic aids and equipment, in adequate depth to provide a sound basis for carrying out the activities.

You will understand the safety precautions required when carrying out the fault location 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. 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 location activity:
  - plan fault location methods and procedures in conjunction with others
  - use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - ensure that safe access and working arrangements has been provided for the maintenance area
  - use grounded wrist straps and other electrostatic discharge (ESD) precautions, where appropriate
  - disconnect or isolate components or parts of the circuit to confirm diagnosis, where appropriate
  - carry out the fault location activities, using approved procedures
  - identify the fault, and consider appropriate corrective action
  - in conjunction with others, take actions to resolve the problem
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave work area in a safe and tidy condition

2. Carry out fault location on **two** communication-electronic systems, sub-systems, assemblies or components to LRU level (at least **one** of which must be selected from group **A**):

**Note:** Any of the items below can be identified as a system, sub-system or assembly in its own right

#### Group A - Communication electronics

- transmitters (such as HF, VHF, UHF, microwave)
- transceivers (such as HF, VHF, UHF, microwave)
- receivers (such as HF, VHF, UHF, microwave)
- signal processing (analogue) (such as radar anti-clutter, comms audio, and AGC stages)
- signal processing (digital) (such as digital MTI, multiplexers, AGC)
- aerial systems (such as phased arrays, long wire and parabolic reflectors)
- transmission lines (such as optical fibres, co-axial, baluns, twin wire, waveguide)
- display systems (such as CRT, Plasma, TFT, TV Tab)
- man-machine interface (such as IS/ICT equipment or peripherals: keypads, keyboards, microphones)
- electro-optical systems (such as cameras, thermal imaging, targeting systems)
- hydraulic-electrical systems (such as hydraulic motors, HSUs, and actuators)
- cryptographic systems (such as data encryption and de-encryption)
- built-in test equipment
- data network systems (such as LANs, WANs)
- data network interfaces (such as switch, router, bridging networks)
- any other identifiable electronic system, sub-system, assemblies or components to LRU level

#### Group B - Associated equipment

- environmental control systems (such as temperature, humidity, vibration, shock, alarm and protection)
- electro-mechanical systems (such as servos, motors, relays, complex switches)
- power generation systems (such as fixed/transportable AC/DC generators, batteries)
- power distribution systems (such as single phase/3-phase distribution panels)
- power supply control systems (such as voltage/current, series shunt regulator/stabiliser)
- hybrid systems (such as ADC, DAC)

3. Use **four** of the following methods and procedures to assist in locating the fault:
  - information gathered from the person who reported the fault
  - fault finding techniques (such as six point, half-split, input/output, unit substitution, emergent sequence, function testing)
  - diagnostic aids (such as manuals, flow charts, troubleshooting guides, electronic aids, equipment records, software based aids)
  - inspecting (such as checking for breakages, wear/deterioration, overheating, missing parts, poor joints, incorrect seating)
  - operating (such as manually switching off and on, test buttons, running equipment)
  - equipment self-diagnostics
4. Use **two** of the following types of instruments to assist in locating the faults:

- stabilised power supplies
  - oscilloscope
  - multimeter
  - logic probe
  - current tracer
  - signal generator
  - other specific test equipment
5. Locate faults that have resulted in **two** of the following breakdown categories:
- intermittent action or a system failure
  - partial failure or reduced performance
  - complete breakdown
6. Complete **one** of the following maintenance records, and pass it to the appropriate person:
- scheduled maintenance report
  - corrective maintenance report
  - other company specific report

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. 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)
4. The importance of wearing protective clothing and other appropriate safety equipment during fault location activities
5. The hazards associated with carrying out fault location activities on communication electronic equipment (such as live electrical components, stored energy, misuse of tools), and how they can be minimised
6. The procedure to be adopted to establish the background of the fault
7. How to use the various diagnostic aids to help identify the location of the fault
8. The various fault location techniques that can be used, and how they are applied (such as half-split, input-to-output, function testing, unit substitution, and equipment self-diagnostics)
9. How to evaluate sensory information (sight, sound, smell, touch)
10. How to assess evidence and evaluate the possible causes of faults/problems
11. The care, handling and application of electrical test equipment
12. The precautions to be taken to prevent electrostatic discharge (ESD) damage to electronic circuits and components (such as use of wrist straps, special packaging and handling areas)
13. How to use a range of fault diagnostic equipment to investigate the problem
14. How to check that the electronic test equipment is within calibration, and that it is free from damage and defects
15. How to obtain and interpret information from job instructions and other documents needed in the fault location process (such as drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, IEE wiring regulations)
16. The functions of different types of electronic components (analogue or digital), and their operation
17. The problems that can occur during the fault location activity, and how they can be minimised
18. The importance of completing the correct documentation, following the maintenance activity
19. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 32 Carrying Out Fault Location on Communication-Electronic Systems

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activities (all)</b>				
plan fault location methods and procedures in conjunction with others				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
use grounded wrist straps and other (ESD) precautions				
disconnect or isolate components or parts of the circuit to confirm diagnosis				
carry out the fault location activities				
identify the fault, and consider appropriate corrective action				
in conjunction with others, take actions to resolve the problem				
dispose of waste items				
leave work area in a safe and tidy condition				
Carry out fault location on <b>two</b> communication-electronic systems, sub-systems, assemblies or components to LRU level (at least <b>one</b> of which must be selected from group <b>A</b> ):				
<b>Group A - Communication electronics</b>				
transmitters)				
transceivers				
receivers				
signal processing (analogue)				
signal processing (digital)				
aerial systems				
transmission lines				
display systems				
man-machine interface				
electro-optical systems				
hydraulic-electrical systems				
cryptographic systems				
built-in test equipment				
data network systems				
data network interfaces				
any other identifiable electronic system, sub-system, assemblies or components to LRU level				
<b>Group B - Associated equipment</b>				
environmental control systems				
electro-mechanical systems				

power generation systems				
power distribution systems				
power supply control systems				
<b>Use four of the following methods and procedures to assist in locating the fault (four)</b>				
information gathered from the person who reported the fault				
fault finding techniques				
diagnostic aids				
inspecting				
operating				
equipment self-diagnostics				
<b>Use two of the following types of instruments to assist in locating the faults:</b>				
stabilised power supplies				
oscilloscope				
multimeter				
logic probe				
current tracer				
signal generator				
other specific test equipment				
<b>Locate faults that have resulted in two of the following breakdown categories (two)</b>				
intermittent action or a system failure				
partial failure or reduced performance				
complete breakdown				
<b>Complete one of the following maintenance records, and pass it to the appropriate person (one)</b>				
scheduled maintenance report				
corrective maintenance report				
other company specific report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 33 Carrying Out Scheduled Maintenance on Communication-Electronic Systems

## Unit Summary

This unit identifies the competences you need to carry out scheduled maintenance on communication-electronic systems, in accordance with approved procedures. You will be required to carry out scheduled maintenance tasks on a range of communication-electronic systems, sub-systems or assemblies. You will need to carry out the maintenance activities to minimise downtime, and to ensure that the maintained system performs at the required level and functions to specification.

Your responsibilities will require you to comply with organisational policy and procedures for the scheduled maintenance tasks undertaken, and to report any problems with these activities 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 maintenance activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying scheduled maintenance procedures to communication-electronic systems. You will have an understanding of the process of implementing scheduled maintenance tasks, the importance of carrying them out at specific times, and of recording their outcomes and actions taken. In addition, you will be expected to report where the outcomes identify the need for further investigation or maintenance work.

You will understand the safety precautions required when carrying out the scheduled maintenance activities, especially those for isolating the equipment, and for taking the necessary safeguards to protect yourself against direct or indirect electric shock. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to 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 the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 maintenance activities:

- undertake the maintenance activities to cause minimal disruption to normal working
- use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
- adhere to risk assessment, COSHH and other relevant safety standards
- confirm with the authorised person that the equipment is ready for carrying out the scheduled maintenance
- ensure the safe isolation of equipment
- ensure that safe access and working arrangements have been provided for the maintenance area
- carry out the scheduled maintenance tasks, using appropriate techniques and procedures
- re-connect and return the equipment to service on completion of the maintenance activities
- leave the work area in a safe and tidy condition

2. Carry out scheduled maintenance activities on **two** communication-electronic systems, sub-systems or assemblies (at least **one** of which must be selected from group **A**): **Note:** Any of the items below can be identified as a system, sub-system or assembly in its own right

#### Group A – Communication-electronic

- transmitters (such as HF, VHF, UHF, microwave)
- transceivers (such as HF, VHF, UHF, microwave)
- receivers (such as HF, VHF, UHF, microwave)
- signal processing (analogue) (such as radar anti-clutter, comms audio and AGC stages)
- signal processing (digital) (such as digital MTI, multiplexers, AGC)
- aerial systems (such as phased arrays, long wire and parabolic reflectors)
- transmission lines (such as optical fibres, co-axial, baluns, twin wire, waveguide)
- display systems (such as CRT, plasma, TFT, TV tab)
- man-machine interface (such as IS/ICT equipment or peripherals: keypads, keyboards, microphones)
- electro-optical systems (such as cameras, thermal imaging, targeting systems)
- hydraulic-electrical systems (such as hydraulic motors, HSUs and actuators)
- cryptographic systems (such as data encryption and de-encryption)
- built-in test equipment
- data network systems (such as LANs, WANs)
- data network interfaces (such as switch, router, bridging networks)
- any other identifiable electronic system, sub-system or assemblies

#### Group B - Associated equipment

- environmental control systems (such as temperature, humidity, vibration, shock, alarm and protection)
- electro-mechanical systems (such as servos, motors, relays, complex switches)
- power generation systems (such as fixed/transportable AC/DC generators, batteries)
- power distribution systems (such as single phase/3-phase distribution panels)
- power supply control systems (such as voltage/current series/shunt regulator/stabiliser)
- hybrid systems (such as ADC, DAC)

3. Carry out **ten** of the following scheduled maintenance activities:

- removing excessive dirt or grime
- making sensory checks (such as sight, sound, smell or touch)
- visual examination and testing of a system against the maintenance schedule
- replacing 'lified' consumables
- monitoring the condition/deterioration of components (such as connectors switches, contactors, safety devices)
- carrying out system self-analysis checks
- making routine adjustments
- carrying out leak checks on connections (where appropriate)
- testing the system operation
- recording the results of the maintenance activity, and reporting any identified or potential defects
- checking the condition of cables
- checking the integrity of connections

- making insulation resistance checks
  - recording the results of the scheduled maintenance activity
  - reporting or taking action with regard to any defects that require immediate attention (such as replacing non- 'lifer' components)
4. Ensure that the maintained system meets **one** or more of the following quality and accuracy standards:
- organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - BS and ISO standards
  - Ministry of Defence (MOD) standards
5. Complete **all** relevant paperwork, and pass it to the appropriate people:
- job cards
  - maintenance log or report
  - permit to work/formal risk assessment

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the scheduled maintenance activity 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 scheduled maintenance activities (electrical isolation, locking off switch gear, removal of fuses, placing maintenance warning notices, proving the isolation has been achieved and secured)
3. Isolation procedures unique to communication-electronic systems, sub-systems or assemblies
4. The specific health and safety precautions needed to be applied during the scheduled maintenance procedure and their effects on others
5. The hazards associated with carrying out scheduled maintenance activities on communication-electronic systems, sub-systems or assemblies (such as exposure to live conductors, misuse of tools), and how they can be minimised
6. The importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
7. How the maintenance activities may effect the work of others, and the procedure for informing them of the work to be carried out
8. The procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
9. How to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
10. The maintenance schedules and methods to be followed in order to comply with company procedures for scheduled maintenance
11. The various checks to be carried out during the scheduled maintenance procedure
14. How to make sensory checks (by sight, sound, smell or touch)
15. Company policy on repair/replacement of systems, sub-systems and assemblies during the scheduled maintenance process
16. Methods of checking that systems, sub-systems and assemblies are fit for purpose, and the need to replace 'lifer' items (such as batteries)
20. How to make adjustments to systems, sub-systems and assemblies to ensure they function correctly
21. The generation of maintenance documentation and/or reports following the maintenance activity
22. Simple problems that can occur during the scheduled maintenance activity, and how they can be overcome
23. The organisational procedure to be adopted for the safe disposal of waste of all types of materials
24. The extent of your authority and whom you should report to if you have problems that you cannot resolve



**Unit 33 Carrying Out Scheduled Maintenance on Communication-Electronic Systems**

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activities (all)</b>				
undertake maintenance to cause minimal disruption to normal working				
use the correct issue of maintenance documentation				
adhere to relevant safety standards				
confirm with the authorised person that the equipment is ready for carrying out the scheduled maintenance				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
carry out the scheduled maintenance tasks				
re-connect and return the equipment to service				
leave the work area in a safe and tidy condition				
<b>Carry out scheduled maintenance activities on two communication-electronic systems, sub-systems or assemblies (at least one of which must be selected from group A)</b>				
transmitters				
transceivers				
receivers				
signal processing (analogue)				
signal processing (digital)				
aerial systems				
transmission lines				
display systems				
man-machine interface				
electro-optical systems				
hydraulic-electrical systems				
cryptographic systems				
built-in test equipment				
data network systems				
data network interfaces				
any other identifiable electronic system, sub-system or assemblies				
<b>Group B - Associated equipment</b>				
environmental control systems				
electro-mechanical systems				
power generation systems				
power distribution systems				
power supply control systems				
hybrid systems				

<b>Carry out ten of the following scheduled maintenance activities (ten)</b>				
removing excessive dirt or grime				
making sensory checks				
visual examination and testing of a system against the maintenance schedule				
replacing 'lived' consumables				
monitor condition/deterioration of components				
carrying out system self-analysis checks				
making routine adjustments				
carrying out leak checks on connections				
testing the system operation				
recording the results of the maintenance activity, and reporting any identified or potential defects				
checking the condition of cables				
checking the integrity of connections				
making insulation resistance checks				
recording the results of the scheduled maintenance activity				
reporting or taking action with regard to any defects that require immediate attention				
<b>Ensure that the maintained system meets one or more of the following quality and accuracy standards (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and ISO standards				
Ministry of Defence (MOD) standards				
<b>Complete all relevant paperwork, and pass it to the appropriate people (all)</b>				
job cards				
maintenance log or report				
permit to work/formal risk assessment				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

## Unit 34 Carrying Out Repairs to Communication-Electronic Systems

## Unit Summary

This unit identifies the competences you need to carry out repairs on communication-electronic systems, in accordance with approved procedures. You will be required to carry out repairs on a range of communication-electronic systems, sub-systems, assemblies or components. This will involve dismantling equipment to unit level, making any required repairs, and removing and replacing faulty items on a variety of different types of electronic systems, sub-systems and assemblies.

You will be expected to apply a range of dismantling and reassembly methods and techniques, such as soldering, de-soldering, crimping, harnessing, and securing cables and components. You will be expected to take care that you do not cause further damage to the equipment/circuit during the repair activities, and the application of electrostatic discharge (ESD) procedures will be a critical part of your role.

Your responsibilities will require you to comply with organisational policy and procedures for carrying out the repair activities, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying electronic repair procedures. You will have an understanding of the function and operating conditions of the electronic equipment or circuit being repaired, and will know about the tools and techniques to be used, in adequate depth to provide a sound basis for carrying out the activities to the required specification.

You will understand the safety precautions required when carrying out the repair activities, especially those for isolating the equipment, and for taking the necessary safeguards to protect yourself and others against direct or indirect electric shock. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to 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 the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed timescale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 repair activities:
  - confirm the type and level of repair to be carried out
  - undertake the repair activities to cause minimal disruption to normal working
  - use the correct issue of company and/or manufacturers' drawings and documentation
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment
  - ensure that safe access and working arrangements have been provided in the work area
  - carry out the repair activities using appropriate techniques and procedures
  - take electrostatic discharge (ESD) precautions when handling sensitive components and circuit boards
  - leave the work area in a safe and tidy condition
2. Carry out repair and replacement activities on **three** of the following types of communication-electronic systems, sub-systems, assemblies or components to LRU level (at least **two** of which must be selected from group **A**):

**Note:** Any of the items below can be identified as a system, sub-system or assembly in its own right

### Group A – Communication-electronic

- transmitters (such as HF, VHF, UHF, microwave)
- transceivers (such as HF, VHF, UHF, microwave)
- receiver (such as HF, VHF, UHF, microwave)
- signal processing (analogue) (such as radar anti-clutter, comms audio and AGC stages)
- signal processing (digital) (such as digital MTI, multiplexers, AGC)
- aerial systems (such as phased arrays, long wire and parabolic reflectors)
- transmission lines (such as optical fibres, co-axial, baluns, twin wire, waveguide)
- display systems (such as CRT, Plasma, TFT, TV Tab)
- man-machine interface (such as IS/ICT equipment or peripherals: keypads, keyboards, microphones)
- electro-optical systems (such as cameras, thermal imaging, targeting systems)
- hydraulic-electrical systems (such as hydraulic motors, HSUs, and actuators)
- cryptographic systems (such as data encryption and de-encryption)
- built-in test equipment
- data network systems (such as LANs, WANs)
- data network Interfaces (such as switch, router, bridging networks)
- any other identifiable electronic system, sub-system or assemblies to LRU level

### Group B - Associated equipment

- environmental control systems (such as temperature, humidity, vibration, shock, alarm and protection)
  - electro/mechanical systems (such as servos, motors, relays, complex switches)
  - power generation systems (such as fixed/transportable AC/DC generators, batteries)
  - power distribution systems (such as single phase/3-phase distribution panels)
  - power supply control systems (such as voltage/current, series/shunt regulator/stabiliser)
  - hybrid systems (such as ADC, DAC)
3. Carry out **all** of the following repair/replacement activities:
    - applying electrostatic discharge (ESD) precautions
    - preparation of areas for repairing
    - disconnection/dismantling of required LRUs
    - replacement of faulty LRUs
    - carrying out all necessary repairs
    - re-assembly of LRUs in line with specification
    - functionally check the completed equipment
    - making any adjustments required

4. Use the correct joining/connecting techniques to deal with **three** of the following types of connection:
  - push-fit connectors
  - soldering or de-soldering
  - clip assemblies
  - threaded connections
  - crimped connections
  - zero insertion force (zif) connectors
  - adhesive joints/assemblies
  - edge connectors
  - insulation displacement connections (IDC)
  
5. Carry out repairs to communication-electronic systems, in accordance with **one** of the following:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - BS and ISO standards
  - Ministry of Defence (MoD)
  
6. Complete **one** of the following records, and pass it to the appropriate person:
  - job cards
  - permit to work/formal risk assessment
  - maintenance logs or reports

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the repair activity is to take place, and the responsibility these requirements place on you
2. Your responsibilities under regulations that apply to the electronic repair activities being undertaken
3. The isolation and lock-off procedure or permit-to-work procedure that applies to the repair activities (electrical isolation, locking off switchgear, removal of fuses, placing maintenance warning notices, proving that isolation has been achieved and secured)
4. The importance of wearing protective clothing and other appropriate safety equipment during the repair activities
5. The hazards associated with repairing electronic communication equipment, and with the materials, tools and equipment that are used (such as live electrical components, capacitor discharge), and how these can be minimised
6. The importance of keeping the work area clean and tidy, and free from waste and surplus materials
7. How the repair activities may affect the work of others, and the procedure for informing them of the work to be carried out
8. The procedures and precautions to be adopted to eliminate electrostatic discharge (ESD) hazards
9. How to obtain and interpret information from job instructions and other documents needed to carry out the repairs (such as drawings, circuit diagrams, specifications, manufacturers' manuals, test procedures)
10. The basic principles of how the electronic circuit functions
11. Organisational policy on the repair or replacement of faulty components during the repair process
12. How to check that the replacement units/components meet the required specification/operating conditions
13. Methods of removing and replacing the faulty units/components from the equipment (unplugging, desoldering, removal of screwed, clamped, edge connected, zero insertion force, and crimped connections)
14. The importance of removing faulty components, without causing damage to other components, wiring, or the surrounding structure
15. Methods of attaching identification marks/labels to removed components or connections, in order to assist with re-assembly
16. The tools and equipment used in the repair activities (including the use of wire-stripping tools, crimping tools, soldering irons, insertion devices and connecting tools)
17. How to check that tools and equipment are free from damage or defects, that they are in a safe and usable condition, and are configured correctly for the intended purpose
18. The sequence for reconnecting the equipment, and the checks to be made prior to restoring power (checking components for correct polarity, ensuring that there are no exposed conductors, cable insulation is not damaged, all connections are mechanically and electrically secure, casings are free from loose screws, there are wire ends or solder blobs that could cause short circuits, and that all fuses/protection devices are installed)
19. The importance of making 'off-load' checks before proving the equipment with the electrical supply on
20. How to make adjustments to components/assemblies to ensure that they function correctly
21. The documentation and/or reports to be completed following the repair activity, and the importance of ensuring that these reports are completed accurately and legibly
22. The problems that can occur with the repair activity, and how they can be overcome
23. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
24. The extent of your own authority and whom you should report to if you have a problem that you cannot resolve

## Unit 34 Carrying Out Repairs to Communication-Electronic Systems

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activities (all)</b>				
confirm the type and level of repair to be carried out				
undertake the repair activities to cause minimal disruption to normal working				
use the correct issue of company and/or manufacturers' drawings and documentation				
adhere to risk assessment, COSHH and other relevant safety standards				
ensure the safe isolation of equipment				
ensure that safe access and working arrangements have been provided in the work area				
carry out the repair activities using appropriate techniques and procedures				
take (ESD) precautions when handling sensitive components and circuit boards				
leave the work area in a safe and tidy condition				
<b>Carry out repair and replacement activities on three of the following types of communication-electronic systems, sub-systems, assemblies or components to LRU level (at least two of which must be selected from group A)</b>				
transmitters				
transceivers				
receiver				
signal processing (analogue)				
signal processing (digital)				
aerial systems				
transmission lines				
display systems				
man-machine interface				
electro-optical systems				
hydraulic-electrical systems				
cryptographic systems				
built-in test equipment				
data network systems				
data network Interfaces				
any other identifiable electronic system, sub-system or assemblies to LRU level				
<b>Group B - Associated equipment</b>				
environmental control systems				
electro/mechanical systems				
power generation systems				
power distribution systems				

power supply control systems				
hybrid systems				
<b>Carry out all of the following repair/replacement activities (all)</b>				
applying (ESD) precautions				
preparation of areas for repairing				
disconnection/dismantling of required LRUs				
replacement of faulty LRUs				
carrying out all necessary repairs				
re-assembly of LRUs in line with specification				
functionally check the completed equipment				
making any adjustments required				
<b>Use the correct joining/connecting techniques to deal with three of the following types of connection (three)</b>				
push-fit connectors				
soldering or de-soldering				
clip assemblies				
threaded connections				
crimped connections				
zero insertion force (zif) connectors				
adhesive joints/assemblies				
edge connectors				
insulation displacement connections (IDC)				
<b>Carry out repairs to communication-electronic systems, in accordance with one of the following (one)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and ISO standards				
Ministry of Defence (MoD)				
<b>Complete one of the following records, and pass it to the appropriate person (one)</b>				
job cards				
permit to work/formal risk assessment				
maintenance logs or reports				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....



# Unit 35 Carrying Out Modifications to Communication-Electronic Systems

## Unit Summary

This unit identifies the competences you need to modify communication-electronic systems, sub-systems or assemblies, in accordance with approved procedures. You will be required to carry out defined and documented modifications to communication-electronic systems, sub-systems or assemblies, in accordance with modification leaflets, latest issue drawings and standards. You will be expected to remove and replace cables, add new cables and change the route of cables. You will also be expected to modify LRUs (line replacement units) within communication-electronic systems.

Your responsibilities will require you to comply with organisational policy and procedures for the modification activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to modification of communication-electronic systems. You will have an understanding of the modification, and its application, and will know about the modification requirements and methods, in adequate depth to provide sound basis for carrying out the activities and ensuring that the completed modification is to the required specification.

You will understand the safety precautions required when carrying out the modification 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 the relevant modification schedule to carry out the required work
- c. Carry out the modification activities within the limits of your personal authority
- d. Carry out the modification activities in the specified sequence and in an agreed timescale
- e. Report any instances where the modification activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant modification records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 modification activity:
  - use the correct issue of company and/or manufacturers' documentation
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment
  - ensure that safe access and working arrangements for the work area have been provided
  - modify ground electronic systems, using approved techniques and procedures
  - apply safe working practices and procedures at all times
  - leave the work area in a safe and tidy condition
2. Carry out modification activities on **two** communication-electronic systems, sub-systems or assemblies to LRU level (at least **one** of which must be selected from group **A**): **Note:** *Any of the items below can be identified as a system, sub-system or assembly in its own right*

### Group A – Communication-electronic

- transmitters (such as HF, VHF, UHF, microwave)
- transceivers (such as HF, VHF, UHF, microwave)
- receivers (such as HF, VHF, UHF, microwave)
- signal processing (analogue) (such as radar anti-clutter, comms audio and AGC stages)
- signal processing (digital) (such as digital MTI, multiplexers, AGC)
- aerial systems (such as phased arrays, long wire and parabolic reflectors)
- transmission lines (such as optical fibres, co-axial, baluns, twin wire, waveguide)
- display systems (such as CRT, plasma, TFT, TV tab)
- man-machine interface (such as IS/ICT equipment or peripherals: keypads, keyboards, microphones)
- electro-optical systems (such as cameras, thermal imaging, targeting systems)
- hydraulic-electrical systems (such as hydraulic motors, HSUs and actuators)
- cryptographic systems (such as data encryption and de-encryption)
- built-in test equipment
- data network systems (such as LANs, WANs)
- data network interfaces (such as switch, router, bridging networks)
- any other identifiable electronic system, sub-system or assemblies

### Group B - Associated equipment

- environmental control systems (such as temperature, humidity, vibration, shock, alarm and protection)
- electro-mechanical systems (such as servos, motors, relays, complex switches)
- power generation systems (such as fixed/transportable AC/DC generators, batteries)
- power distribution systems (such as single phase/3-phase distribution panels)
- power supply control systems (such as voltage/current series/shunt regulator/stabiliser)
- hybrid systems (such as ADC, DAC)

3. Carry out **four** of the following types of modification:

- removing cables
- adding cables
- changing routes of cables
- making changes to looms
- making changes to LRUs
- adding or removing LRUs
- altering settings
- upgrading mechanical systems
- upgrading electrical systems
- upgrading electronic systems
- upgrading information technology systems
- improving equipment safety
- improving personal safety
- improving equipment performance

4. Carry out **four** of the following processes during the modification activities:
  - soldering and de-soldering
  - heat shrinking (devices or boots)
  - crimping
  - stripping
  - removing cable end fittings
  - changing components (including software)
  - repositioning units
  - removing cable protection
  - making mechanical/screwed/clamped connections
  - allocating identification markings
  - changing LRUs
  
5. Produce modifications which comply with **one** or more of the following standards:
  - customer standards and requirements
  - company standards and requirements
  - BS and ISO standards and procedures
  - Ministry of Defence (MoD)
  - manufacturers' standards and requirements
  
6. Complete the relevant paperwork, to include **one** of the following, and pass it to the appropriate person:
  - job cards
  - maintenance log or report
  - modification record
  - permit to work/formal risk assessment

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The specific safety precautions and procedures to be observed whilst carrying out the modification to ground communication-electronic systems (including any specific regulations or codes of practice related to the activities, equipment or materials)
2. The health and safety requirements of the area in which the modification is to take place, and the responsibility these requirements place on you
3. Personal protective equipment and clothing to be worn during the modification activities
4. The hazards associated with carrying out fault location activities on communication-electronic systems (live electrical components, stored energy, misuse of tools), and how they can be minimised
5. How to obtain and interpret information from job instructions and other documents needed in the modification activities (such as drawings, specifications, physical layouts, charts, manufacturers' manuals, history/maintenance reports, graphical electrical symbols)
6. How to identify the components to be used; component identification systems (codes and component orientation indicators)
7. Preparations to be undertaken on the system, prior to carrying out the modification
8. The methods and techniques to be used for soldering and de-soldering, and the importance of adhering to them
9. The methods and techniques to be used for crimping and heat shrinking, and the importance of adhering to them
10. The procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
11. The basic operation of the communication-electronic system, sub-system and assembly being modified
12. The different types of cable protection, and reasons for using each type
13. The various mechanical fasteners that will be used, and their method of installation
14. The importance of using the specified fasteners for the modification, and why you must not use substitutes
15. The quality control procedures to be followed during the modification operations
16. How to conduct any necessary checks to ensure the accuracy and quality of the modification
17. How to recognise defects (such as misalignment, ineffective fasteners, foreign object damage or contamination)
18. The problems that can occur with the modification operations, and how these can be overcome
19. The organisational procedures to be adopted for the safe disposal of waste of all types of materials
20. The documentation and/or reports to be completed following the modification activity, and the importance of ensuring that these reports are completed accurately and legibly
21. The organisational policy on modification and how the process should be undertaken
22. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 35 Carrying Out Modifications to Communication-Electronic Systems

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activities (all)</b>				
use the correct issue of company and/or manufacturers' documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the work area				
modify ground electronic systems, using approved techniques and procedures				
apply safe working practices and procedures at all times				
leave the work area in a safe and tidy condition				
<b>Carry out modification activities on two communication-electronic systems, sub-systems or assemblies to LRU level (at least one of which must be selected from group A)</b>				
<b>Group A – Communication-electronic</b>				
transmitters				
transceivers				
receivers				
signal processing (analogue)				
signal processing (digital)				
aerial systems				
transmission lines				
display systems				
man-machine interface				
electro-optical systems				
hydraulic-electrical systems				
cryptographic systems				
built-in test equipment				
data network systems				
data network interfaces (				
any other identifiable electronic system, sub-system or assemblies				
<b>Group B - Associated equipment</b>				
environmental control systems				
electro-mechanical systems				
power generation systems				
power distribution systems				
power supply control systems				
hybrid systems				
<b>Carry out four of the following types of modification (four)</b>				
removing cables				
adding cables				
changing routes of cables				

making changes to looms				
making changes to LRUs				
adding or removing LRUs				
altering settings				
upgrading mechanical systems				
upgrading electrical systems				
upgrading electronic systems				
upgrading information technology systems				
improving equipment safety				
improving personal safety				
improving equipment performance				
<b>Carry out four of the following processes during the modification activities (four)</b>				
soldering and de-soldering				
heat shrinking (devices or boots)				
crimping				
stripping				
removing cable end fittings				
changing components (including software)				
repositioning units				
removing cable protection				
making mechanical/screwed/clamped connections				
allocating identification markings				
changing LRUs				
<b>Produce modifications which comply with one or more of the following standards (one)</b>				
customer standards and requirements				
company standards and requirements				
BS and ISO standards and procedures				
Ministry of Defence (MoD)				
manufacturers' standards and requirements				
<b>Complete the relevant paperwork and pass to appropriate person to include one of the following (one)</b>				
job cards				
maintenance log or report				
modification record				
permit to work/formal risk assessment				

Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 36 Carrying Out Tests on Communication-Electronic Systems

## Unit Summary

Your responsibilities will require you to comply with organisational policy and procedures for carrying out the testing activities, and to report any problems with these activities that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

This unit identifies the competences you need to carry out checks and tests on communication-electronic systems, in accordance with approved procedures. You will be required to carry out defined and documented tests on a range of communication-electronic systems, sub-systems, assemblies or components, at line replacement unit (LRU) level, to assess their functionality and performance in relationship to the specification. You will be required to carry out checks and tests, which will include voltage and current levels, resistance values, waveform, clock/timer switching, pulse width/rise time, open/short circuit, logic state, frequency modulation/demodulation, and signal-to-noise ratio/interference levels. You will be expected to take care that you do not damage the systems during the maintenance activities and, where appropriate, the application of electrostatic discharge (ESD) procedures will be a critical part of your role.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying the necessary test procedures. You will have an understanding of how the equipment functions, the test equipment to be used, and the testing procedures to be applied, in adequate depth to provide a sound basis for carrying out the activities safely and correctly. In addition, you will be expected to record the outcomes of the tests, compare the results with appropriate specifications, and record/report the results in the appropriate format, to the relevant people.

You will understand the safety precautions required when carrying out the inspection and testing activities, especially those for isolating the equipment and for taking the necessary safeguards to protect yourself and others against direct and indirect electric shock. You will be required to demonstrate safe working practices throughout, and will understand the responsibility you owe to 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 the appropriate procedures for use of tools and equipment to carry out the required tests
- c. Set up and carry out the tests using the correct procedures and within agreed timescales
- d. Record the results of the tests in the appropriate format
- e. Review the results and carry out further tests if necessary

### 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 testing activities:
  - plan the testing methods and procedures in conjunction with others, prior to undertaking the work
  - use the correct issue of company and/or manufacturers' testing documentation
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment
  - ensure that safe access and working arrangements have been provided for the test area
  - carry out the testing activities, using appropriate techniques and procedures
  - ensure that all test equipment is within calibration date
  - take electrostatic discharge (ESD) precautions when handling sensitive components
  - leave the work area in a safe and tidy condition
2. Carry out tests on **two** of the following types of communication-electronic systems, sub-systems, assemblies or components, to LRU level (at least **one** of which must be selected from group **A**):  
**Note:** Any of the items below can be identified as a system, sub system or assembly in its own right

### Group A – Communication-electronic

- transmitters (such as HF, VHF, UHF, microwave)
- transceivers (such as HF, VHF, UHF, microwave)
- receivers (such as HF, VHF, UHF, microwave)
- signal processing (analogue) (such as radar anti-clutter, comms audio and AGC stages)
- signal processing (digital) (such as digital MTI, multiplexers, AGC)
- aerial systems (such as phased arrays, long wire and parabolic reflectors)
- transmission lines (such as optical fibres, co-axial, baluns, twin wire, waveguide)
- display systems (such as CRT, Plasma, TFT, TV Tab)
- man-machine interface (such as IS/ICT equipment or peripherals: keypads, keyboards, microphones)
- electro-optical systems (such as cameras, thermal imaging, targeting systems)
- hydraulic-electrical systems (such as hydraulic motors, HSUs, actuators)
- cryptographic systems (such as data encryption and de-encryption)
- built-in test equipment
- data network systems (such as LANs, WANs)
- data network interfaces (such as switch, router, bridging networks)
- any other identifiable electronic system, sub-system or assemblies to LRU level

### Group B - Associated equipment

- environmental control systems (such as temperature, humidity, vibration, shock, alarm and protection)
  - electro/mechanical systems (such as servos, motors, relays, complex switches)
  - power generation systems (such as fixed/transportable AC/DC generators, batteries)
  - power distribution systems (such as single phase/3-phase distribution panels)
  - power supply control systems (such as voltage/current, series/shunt regulator/stabiliser)
  - hybrid systems (such as ADC, DAC)
3. Carry out tests using a range of tools and test equipment, to include **four** of the following:
    - oscilloscope
    - ammeter
    - logic analyser
    - Q meter
    - current tracer
    - signal generator
    - multimeter
    - computer aided diagnostic equipment
    - special-purpose testing equipment
    - other specific test equipment
    - temperature testing devices
    - power meters
    - valve tester
    - spectrum analyser



- time domain reflectometer
  - frequency counter
  - protocol analyser
  - breakout box
  - automatic test equipment
4. Carry out **six** of the following testing activities, as applicable to the equipment being tested:
- logic states
  - DC voltage/current levels
  - AC voltage/current levels
  - clock/timer switching
  - pulse width/rise time
  - open/short circuit
  - resistance
  - heat dissipation
  - frequency modulation/demodulation
  - performance of system, sub-system or assembly
  - conditions of assemblies and components
  - signal noise/interference levels
5. Carry out **all** of all the following checks to ensure the accuracy and quality of the tests carried out:
- the test equipment is correctly calibrated
  - test equipment used is appropriate for the tests being carried out
  - test procedures to be used are up to date and follow laid-down procedures
  - test equipment is operated within its specification range
6. Provide a record/report of the test outcomes, using **one** of the following:
- preventative maintenance log/report
  - company specific reporting procedure
  - inspection schedule
  - specific test report

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the testing activity is to take place, and the responsibility they place on you
2. Your responsibilities under regulations relevant to the communication-electronic testing activities being undertaken
3. The isolation and lock-off procedure or permit-to-work procedure that applies to the testing activities (electrical isolation, locking off switch gear, removal of fuses, placing maintenance warning notices, proving that isolation has been achieved and secured)
4. Isolation procedures unique to communication-electronic systems
5. The specific safety precautions to be taken when carrying out formal inspection, safety checking and testing of communication-electronic equipment
6. The hazards associated with testing communication-electronic systems and with the equipment that is used, and how these can be minimised
7. The importance of wearing protective clothing and other appropriate safety equipment during the testing activities
8. The importance of keeping the work area clean and tidy, and free from waste and surplus materials
9. How the testing activities may effect the work of others, and the procedure for informing them of the work to be carried out
10. The procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
11. How to obtain and interpret information from job instructions and other documents needed to carry out the test (such as drawings, circuit diagram, specifications, manufacturers' manuals, test procedures)
12. How to determine suitable test points within a system, sub-system or assembly
13. How to set up and apply the appropriate test equipment
14. How to determine the calibration state of the equipment, and the actions to be taken if equipment is out of calibration
15. How to check that tools and equipment are free from damage or defect, are in a safe and useable condition, and are configured correctly for their intended purpose
16. The various testing methods and procedures, and how to apply them to different operating conditions
17. The documentation required, and the procedures to be followed at the conclusion of the testing
18. The extent of your authority and whom you should report to if you have problems that you cannot resolve

## Unit 36 Carrying Out Tests on Communication-Electronic Systems

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the maintenance activities (all)</b>				
plan the testing methods and procedures in conjunction with others				
use the correct issue of company and/or manufacturers' testing documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements have been provided for the test area				
carry out the testing activities, using appropriate techniques and procedures				
ensure that all test equipment is within calibration date				
take (ESD) precautions when handling sensitive components				
leave the work area in a safe and tidy condition				
<b>Carry out tests on two of the following types of communication-electronic systems, sub-systems, assemblies or components, to LRU level (at least one of which must be selected from group A)</b>				
<b>Group A – Communication-electronic</b>				
transmitters				
transceivers				
receivers)				
signal processing (analogue)				
signal processing (digital)				
aerial systems				
transmission lines				
display systems				
man-machine interface				
electro-optical systems				
hydraulic-electrical systems				
cryptographic systems				
built-in test equipment				
data network systems				
data network interfaces				
any other identifiable electronic system, sub-system or assemblies to LRU level				
<b>Group B - Associated equipment</b>				
environmental control systems				
electro/mechanical systems				
power generation systems				
power distribution systems				
power supply control systems				
hybrid systems				

<b>Carry out tests using a range of tools and test equipment, to include four of the following (four)</b>				
oscilloscope				
ammeter				
logic analyser				
Q meter				
current tracer				
signal generator				
multimeter				
computer aided diagnostic equipment				
special-purpose testing equipment				
other specific test equipment				
temperature testing devices				
power meters				
valve tester				
spectrum analyser				
time domain reflectometer				
frequency counter				
protocol analyser				
breakout box				
automatic test equipment				
<b>Carry out six of the following testing activities, as applicable to the equipment being tested (six)</b>				
logic states				
DC voltage/current levels				
AC voltage/current levels				
clock/timer switching				
pulse width/rise time				
open/short circuit				
resistance				
heat dissipation				
frequency modulation/demodulation				
performance of system, sub-system or assembly				
conditions of assemblies and components				
signal noise/interference levels				
<b>Carry out all of all the following checks to ensure the accuracy and quality of the tests carried out (all)</b>				
the test equipment is correctly calibrated				
test equipment used is appropriate for the tests being carried out				
test procedures to be used are up to date and follow laid-down procedures				
test equipment is operated within its specification range				
<b>Provide a record/report of the test outcomes, using one of the following (one)</b>				
preventative maintenance log/report				
company specific reporting procedure				
inspection schedule				
specific test report				

Knowledge and understanding reference:



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Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 37 Carrying Out the Configuration of Communication-Electronic Systems

## Unit Summary

This unit identifies the competences you need to carry out configuration tasks on communication-electronic systems, in accordance with approved procedures. You will be required to configure a range of communication-electronic systems, sub-systems or assemblies into a communication-electronic system. You will need to carry out the configuration activities to ensure that the system, sub-system or assembly performs to specified levels.

Your responsibilities will require you to comply with organisational policy and procedures for the configuration activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to the configuration of communication-electronic systems. You will have an understanding of the configuration, and its application, and will know about the configuration requirements and methods, in adequate depth to provide sound basis for carrying out the activities, and for ensuring that the configured system is to the required specification.

You will understand the safety precautions required when carrying out the configuration 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 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** the following during the configuration activities:

- use the correct issue of company publications and/or manufacturers' documentation
- use and adhere to copies of relevant COSHH sheets and risk assessments
- configure communication-electronic systems, using approved methods and techniques
- apply safe working practices and procedures at all times
- leave the work area in a safe and tidy condition

2. Configure systems that contain at least **two** communication-electronic sub-systems or assemblies (at least **one** of which must be selected from group **A**): **Note:** Any of the items below can be identified as a sub-system or assembly in its own right

**Group A – Communication-electronic**

- transmitters (such as HF, VHF, UHF, microwave)
- transceivers (such as HF, VHF, UHF, microwave)
- receivers (such as HF, VHF, UHF, microwave)
- signal processing (analogue) (such as radar anti-clutter, comms audio and AGC stages)
- signal processing (digital) (such as digital MTI, multiplexers, AGC)
- aerial systems (such as phased arrays, long wire and parabolic reflectors)
- transmission lines (such as optical fibres, co-axial, baluns, twin wire, waveguide)
- display systems (such as CRT, plasma, TFT, TV tab)
- man-machine interface (such as IS/ICT equipment or peripherals: keypads, keyboards, microphones)
- electro-optical systems (such as cameras, thermal imaging, targeting systems)
- hydraulic-electrical systems (such as hydraulic motors, HSUs and actuators)
- cryptographic systems (such as data encryption and de-encryption)
- built-in test equipment
- data network systems (such as LANs, WANs)
- data network interfaces (such as switch, router, bridging networks)
- system software
- any other identifiable electronic sub-system or assemblies to LRU level

**Group B - Associated equipment**

- environmental control systems (such as temperature, humidity, vibration, shock, alarm and protection)
- electromechanical systems (such as servos, motors, relays, complex switches)
- power generation systems (such as fixed/transportable AC/DC generators, batteries)
- power distribution systems (such as single phase/3-phase distribution panels)
- power supply control systems (such as voltage/current series/shunt regulator/stabiliser)
- hybrid systems (such as ADC, DAC)

3. Configure systems using a range of tools and equipment, to include **four** of the following:
  - oscilloscope
  - ammeter
  - logic analyser
  - Q meter
  - current tracer
  - signal generator
  - multimeter
  - computer aided diagnostic equipment
  - special-purpose testing equipment
  - other specific equipment
  - temperature testing devices
  - power meters
  - valve tester
  - spectrum analyser
  - time domain reflectometer
  - frequency counter
  - protocol analyser
  - breakout box
  - automatic test equipment
  - software
  
4. Adjust the systems using **six** of the following, as applicable to the equipment being configured:
  - logic states
  - DC voltage/current levels
  - AC voltage/current levels
  - clock/timer switching
  - pulse width/rise time
  - open/short circuit
  - resistance
  - heat dissipation
  - frequency modulation/demodulation
  - performance of system, sub-system or assembly
  - conditions of assemblies and components
  - signal noise/interference levels
  
5. Carry out **all** of the following checks during the configuration process:
  - system location and security are correct
  - system earth bonding is correct
  - all connections are correctly made (mechanical and electrical)
  - the system powers up correctly
  - the system powers down correctly
  
6. Ensure that the configured system meets **all** of the following quality and accuracy standards:
  - the system operates to specifications
  - any potential defects are identified and reported to the appropriate authority for further action
  - all relevant documentation is completed accurately and legibly
  - the system is formally accepted by the end user
  
7. Provide a record/report of the configuration outcome(s), using **one** of the following:
  - job card
  - company-specific reporting procedure
  - specific configuration report



## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The specific safety practices and procedures that you need to observe when configuring communication-electronic systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
2. How to recognise and deal with victims of electric shock (to include methods of safely removing victims from the power source and methods of first aid resuscitation)
3. The health and safety requirements of the work area where you are carrying out the activities, and the responsibility these requirements place on you
4. The hazards associated with configuring communication-electronic systems, and how they can be minimised
5. The personal protective equipment that you need to use during the configuration activities
6. How to obtain and interpret information from job instructions and other documentation used for the configuration activity (such as drawings, standards, operating specifications)
7. The components to be configured, and their basic function within the particular communications-electronic systems
8. The quality control procedures to be followed during the configuration process
9. The techniques used to check the position, alignment and security of the components in a communication-electronic system
10. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
11. How to conduct any necessary basic checks and adjustments to the equipment, to ensure the system integrity, functionality, accuracy and quality
12. The various system operating procedures and their specific configuration requirements
13. The tools and equipment used in the configuration process, and their calibration/care and control procedures
14. Why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the configuration process
15. The recording documentation to be completed for the configuration activities undertaken
16. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 37 Carrying Out the Configuration of Communication-Electronic Systems

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all the following during the configuration activities (all)</b>				
use the correct issue of company publications and/or manufacturers' documentation				
use and adhere to relevant risk assessments				
configure communication-electronic systems, using approved methods and techniques				
apply safe working practices				
leave the work area in a safe and tidy condition				
<b>Configure systems that contain at least two communication-electronic sub-systems or assemblies (at least one of which must be selected from group A)</b>				
<b>Group A – Communication-electronic</b>				
transmitters				
transceivers				
receivers				
signal processing (analogue)				
signal processing (digital)				
aerial systems				
transmission lines				
display systems				
man-machine interface				
electro-optical systems				
hydraulic-electrical systems				
cryptographic systems				
built-in test equipment				
data network systems				
data network interfaces				
system software				
any other identifiable electronic sub-system or assemblies to LRU level				
<b>Group B - Associated equipment</b>				
environmental control systems				
electromechanical systems				
power generation systems				
power distribution systems				
power supply control systems				
hybrid systems				
<b>Configure systems using a range of tools and equipment, to include four of the following (four)</b>				
oscilloscope				
ammeter				
logic analyser				
Q meter				
current tracer				
signal generator				
multimeter				
computer aided diagnostic				

equipment				
special-purpose testing equipment				
other specific equipment				
temperature testing devices				
power meters				
valve tester				
spectrum analyser				
time domain reflectometer				
frequency counter				
protocol analyser				
breakout box				
automatic test equipment				
software				
<b>Adjust the systems using six of the following, as applicable to the equipment being configured</b>				
logic states				
DC voltage/current levels				
AC voltage/current levels				
clock/timer switching				
pulse width/rise time				
open/short circuit				
resistance				
heat dissipation				
frequency modulation/demodulation				
performance of system, sub-system or assembly				
conditions of assemblies and components				
signal noise/interference levels				
<b>Carry out all of the following checks during the configuration process (all)</b>				
system location and security are correct				
system earth bonding is correct				
all connections are correctly made				
the system powers up correctly				
the system powers down correctly				
<b>Ensure that the configured system meets all of the following quality and accuracy standards (all)</b>				
the system operates to specifications				
any potential defects are identified and reported to the appropriate authority for further action				
all relevant documentation is completed accurately and legibly				
the system is formally accepted by the end user				
<b>Provide a record/report of the configuration outcome(s), using one of the following (one)</b>				
job card				
company-specific reporting procedure				
specific configuration report				

Knowledge and understanding reference:

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Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 38 Assisting in the Installation of Communication-Electronic Systems

## Unit Summary

This unit identifies the competences you need to assist in the installation of communication-electronic systems, in accordance with approved procedures. You will be required to use appropriate installation publications, orders and specifications to install the various systems, sub-systems or assemblies. You will be expected to assist in the positioning, alignment and connection of the electronic-communications systems, sub-systems or assemblies in their correct locations, using the specified or appropriate techniques.

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, components or equipment that you cannot personally resolve, or are outside your permitted authority, to the relevant people. You must check that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all of the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying installation techniques and procedures for communication-electronic equipment. You will have an understanding of the communication-electronic systems being installed, and their application, and will know about the installation techniques, tools and methods, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

### 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 activity:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
2. Assist in the installation of systems that contain **three** communication-electronic sub-systems or assemblies (at least **two** of which must be selected from group **A**):

**Note:** Any of the items below can be identified as a system, sub system or assembly in its own right

#### Group A – Communication-electronic

- transmitters (such as HF, VHF, UHF, microwave)
- transceivers (such as HF, VHF, UHF, microwave)
- receivers (such as HF, VHF, UHF, microwave)
- signal processing (analogue) (such as radar anti-clutter, comms audio and AGC stages)
- signal processing (digital) (such as digital MTI, multiplexers, AGC)
- aerial systems (such as phased arrays, long wire and parabolic reflectors)
- transmission lines (such as optical fibres, co-axial, baluns, twin wire, waveguide)
- display systems (such as CRT, Plasma, TFT, TV Tab)
- man-machine interface (such as IS/ICT equipment or peripherals: keypads, keyboards, microphones)
- electro-optical systems (such as cameras, thermal imaging, targeting systems)
- hydraulic-electrical systems (such as hydraulic motors, HSUs, and actuators)
- cryptographic systems (such as data encryption and de-encryption)
- built-in test equipment
- data network systems (such as LANs, WANs)
- data network interfaces (such as switch, router, bridging networks)
- any other identifiable electronic system, sub-system or assemblies to LRU level

#### Group B - Associated equipment

- environmental control systems (such as temperature, humidity, vibration, shock, alarm and protection)
- electro/mechanical systems (such as servos, motors, relays, complex switches)
- power generation systems (such as fixed/transportable AC/DC generators, batteries)
- power distribution systems (such as single phase/3-phase distribution panels)
- power supply control systems (such as voltage/current, series shunt regulator/stabiliser)
- hybrid systems (such as ADC, DAC)

3. Use **all** of the following installation methods and techniques:
  - levelling and aligning
  - earth bonding
  - taking electrostatic discharge (ESD) precautions
  - securing and locking
4. Make **three** of the following types of mechanical securing connections:
  - nuts and bolts
  - locking devices
  - screws
  - torque load bolts
  - quick-release fasteners

5. Make **three** of the following types of electrical connection:

- co-axial
- D10
- screened
- quad
- data cable
- free plugs and sockets
- earth bonding points
- Fibre-optic

6. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- customer standards and requirements
- company standards and requirements
- BS or ISO standards and procedures
- Ministry of Defence (MoD)
- Manufacturer's standards and requirements

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

- job cards.
- specific deployment/installation report
- build records

#### **Knowledge statements:**

##### ***You must have knowledge and understanding of:***

1. The specific safety practices and procedures that you need to observe when assisting with the installation of communication-electronic systems (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
2. 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
3. The hazards associated with installing communication-electronic systems, and how they can be minimised
4. The personal protective equipment that you need to use during the installation activities
5. How to obtain and interpret information from job instructions and other documentation used in the installation activities (such as drawings, quality control procedures and specifications used for installation)
6. The components, communication-electronic systems, sub-systems and assemblies to be installed
7. The various mechanical fasteners that will be used, and their method of installation
8. The importance of using the specified fasteners for the particular installation, and why you must not substitute others
9. The torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved
10. The quality control procedures to be followed during the installation operations
11. Procedures for ensuring that you have the correct tools, equipment, components and fasteners for the activities
12. The techniques used to position, align, adjust and secure the components of the communications-electronic systems, without damage
13. Methods of lifting, handling and supporting the components/equipment during the installation activities
14. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
15. The procedure for the safe disposal of waste materials
16. How to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
17. The tools and equipment used in the installation activities, and their calibration/care and control procedures
18. Why tool/equipment control is critical, and what to do if a tool or piece of equipment is unaccounted for on completion of the activities
19. The problems that can occur with the installation operations, and how these can be overcome
20. The recording documentation to be completed for the installation activities undertaken
21. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 38 Assisting in the Installation of Communication-Electronic Systems

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation activity (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of systems that contain three communication-electronic sub-systems or assemblies (at least two of which must be selected from group A)</b>				
<b>Group A – Communication-electronic</b>				
transmitters				
transceivers				
receivers				
signal processing (analogue)				
signal processing (digital)				
aerial systems				
transmission lines				
display systems				
man-machine interface				
electro-optical systems				
hydraulic-electrical systems				
cryptographic systems				
built-in test equipment				
data network systems				
data network interfaces				
any other identifiable electronic system, sub-system or assemblies to LRU level				
<b>Group B - Associated equipment</b>				
environmental control systems				
electro/mechanical systems				
power generation systems				
power distribution systems				
power supply control systems				
hybrid systems				
<b>Use all of the following installation methods and techniques (all)</b>				
levelling and aligning				
earth bonding				
taking (ESD) precautions				



securing and locking				
<b>Make three of the following types of mechanical securing connections (three)</b>				
nuts and bolts				
locking devices				
screws				
torque load bolts				
quick-release fasteners				
<b>Make three of the following types of electrical connection (three)</b>				
co-axial				
D10				
screened				
quad				
data cable				
free plugs and sockets				
earth bonding points				
Fibre-optic				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
customer standards and requirements				
company standards and requirements				
BS or ISO standards and procedures				
Ministry of Defence (MoD)				
Manufacturer's standards and requirements				
<b>Complete the relevant paperwork, to include one from the following, and pass it to the appropriate people (one)</b>				
job cards.				
specific deployment/installation report				
build records				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 39 Carrying Out Fault Location on Stairlift Equipment

## Unit Summary

This unit identifies the competences you need to carry out efficient and effective location of faults on stairlift equipment, in accordance with approved procedures. You will be required to investigate faults on a range of AC or DC powered stairlifts, including straight, curved and hinged. You will be expected to use a variety of fault location methods and procedures, such as gathering information from the person who reported the fault, using recognised fault finding techniques and diagnostic aids, measuring, inspecting and operating the equipment.

You will understand the safety precautions required when carrying out the fault location 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.

Your responsibilities will require you to comply with organisational policy and procedures for the fault location activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking full responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying fault location procedures to stairlift equipment. You will have an understanding of the basic fault location methods and techniques used, and their application. You will also know how to interpret the information obtained from fault finding aids and equipment, in adequate depth to provide a sound basis for carrying out the activities.

## 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 locating activity:
  - undertake the fault location methods and procedures to cause minimal disruption to the customer
  - use the correct issue of company and/or manufacturers' drawings and documentation
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as electricity, mechanical)
  - provide safe access and working arrangements for the fault maintenance area
  - carry out the fault location activities, using approved procedures
  - identify the fault, and consider appropriate corrective action
  - take actions to resolve the problem (in conjunction with others, where appropriate)
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out fault location on **all** of the following AC or DC powered stairlifts:
  - straight
  - curved
  - hinged
  
3. Use **four** of the following diagnostic techniques, tools and aids to assist in locating the fault:
  - information gathered from the person who reported the fault, including the customer
  - fault finding techniques (such as six point, half-split, input/output, unit substitution)
  - diagnostic aids (such as manuals, flow charts, troubleshooting guides, maintenance records)
  - inspecting (such as checking for breakages, wear/deterioration, overheating, missing parts, loose fittings)
  - operating (such as manually switching off and on, running the equipment)
  
4. Use **three** of the following types of instruments to aid fault location:
  - mechanical measuring instruments/devices
  - multimeter
  - continuity tester
  - insulation resistance tester
  - self-diagnostic systems
  - other specific test equipment
  
5. Locate faults that have resulted in **two** of the following breakdown categories:
  - intermittent action or circuit failure
  - partial failure/reduced performance
  - complete breakdown
  
6. Provide a record of the outcomes of the fault location using **one** of the following:
  - service record card
  - job card/corrective action report
  - company specific documentation

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on you
2. The isolation procedures to be applied when installing or servicing stairlift equipment
3. 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 and resuscitation)
4. The importance of wearing protective clothing and other appropriate safety equipment during fault location activities
5. The hazards associated with carrying out fault location activities on stairlift equipment (such as live electrical components, stored energy, misuse of tools), and how they can be minimised
6. How to use the various diagnostic aids to help identify the location of the fault
7. The various fault location techniques that can be used, and how they are applied (such as half-split, function testing, unit substitution, and equipment self-diagnostics)
8. How to evaluate sensory information (such as sight, sound, smell, touch)
9. How to assess evidence and evaluate the possible causes of faults/problems
10. How to use a range of fault diagnostic equipment to investigate the problem
11. The care, handling and application of measuring/test equipment (such as mechanical and electrical measuring instruments)
12. How to check that measuring/test equipment is within calibration, and that it is free from damage and defects
13. How to obtain and interpret information from job instructions, drawings, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical symbols, and other documents needed in the fault location process
14. The basic principles of how stairlift equipment functions, its operating sequence, the purpose of individual units/components and how they interact
15. The problems that can occur during the fault location activity, and how they can be minimised
16. The importance of completing the correct documentation following the maintenance activity
17. The extent of your own authority and whom you should report to if you have problems that you cannot resolve

## Unit 39 Carrying Out Fault Location on Stair lift Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the fault locating activity (all)</b>				
undertake the fault location methods and procedures to cause minimal disruption				
use the correct issue of drawings and documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the fault maintenance area				
carry out the fault location activities, using approved procedures				
identify the fault, and consider appropriate corrective action				
take actions to resolve the problem				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out fault location on all of the following AC or DC powered stairlifts (all)</b>				
straight				
curved				
hinged				
<b>Use four of the following diagnostic techniques, tools and aids to assist in locating the fault (four)</b>				
information gathered from the person who reported the fault				
fault finding techniques				
diagnostic				
inspecting				
operating				
<b>Use three of the following types of instruments to aid fault location (three)</b>				
mechanical measuring instruments/devices				
multimeter				
continuity tester				
insulation resistance tester				
self-diagnostic systems				
other specific test equipment				
<b>Locate faults that have resulted in two of the following breakdown categories (two)</b>				
intermittent action or circuit failure				
partial failure/reduced performance				
complete breakdown				
<b>Provide a record of the outcomes of the fault location using one of the following (one)</b>				
service record card				
job card/corrective action				

report				
company specific documentation				

Knowledge and understanding reference:

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Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 40 Carrying Out Servicing Activities on Stairlift Equipment

## Unit Summary

You will understand the safety precautions required when carrying out the servicing 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.

This unit identifies the competences you need to carry out the servicing of stairlifts, in accordance with approved procedures. This will involve inspection and adjustment, dismantling, removing and replacing faulty components, in line with company procedures, on a variety of different types of stairlifts such as straight, curved and hinged, and operated by AC or DC power supplies. You will be expected to apply a range of dismantling and assembling methods and techniques, such as proof marking to aid reassembly, dismantling components requiring pressure or expansion/contraction techniques, setting, aligning and adjusting components, torque loading components and making 'off-load' checks before starting up the stairlifts.

Your responsibilities will require you to comply with organisational policy and procedures for the servicing activities undertaken, and to report any problems with these activities, or with 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 servicing activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying stairlift servicing procedures. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any inspection, repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

## Performance statements:

### **You must:**

- a. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
- b. Follow the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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 servicing activity:
  - undertake the servicing activities to cause minimal disruption to the customer
  - provide the customer with a briefing, prior to carrying out the servicing activity
  - review the customer's comments
  - use the correct issue of drawings, job instructions and procedures
  - ensure the safe isolation of equipment (such as mechanical, electricity)
  - ensure safe access and working arrangements for the servicing area
  - carry out the servicing activities, using appropriate techniques and procedures
  - reinstate and return the stairlifts to service on completion of the servicing activities
  - ensure that any potential defects are identified and reported for further action
  - leave the work area in a safe and tidy condition
  
2. Carry out servicing activities on **all** of the following types AC or DC powered stairlifts:
  - straight
  - curved
  - hinged
  
3. Check **all** of the following for operational safety, security and condition, in line with manufacturers' specifications:
  - mains switch
  - safety gear
  - overspeed governor
  - safety sensitive edges/pads
  - safety interlocks
  - hinged rail
  - swivel seat
  - footrest and springs
  - motor gearbox and brake
  - overload devices/fuses
  - seatbelts
  - charging system
  - circuit protection devices (such as residual current device (RCD), and earth leakage circuit breaker (ELCB))
  - levelling devices (mechanical or electrical)
  - limit switches (slow, stop and final)
  - chair, landing and auxiliary controls
  
4. Check **all** of the following for damage, wear, security and condition, in line with manufacturers' specifications:
  - rail
  - rollers
  - upholstery
  - trailing cable
  - wiring looms
  - batteries
  - rack and pinion
  - chains and sprockets
  - fixing of rail to stairs
  - fixing of chair to carriage
  - warning labels
  - printed circuit boards (PCBs)
  
5. Carry out **all** of the following servicing activities:
  - dismantling equipment to the appropriate level
  - make sensory checks (such as sight, sound, smell, touch)



- checking earth continuity
- setting, aligning and adjusting components
- tightening fastenings to the required torque
- remove excess dirt and grime
- applying lubrication
- functionally testing the completed system

6. Ensure that the serviced stairlift complies with **all** of the following, as appropriate to the equipment being serviced:

- organisational guidelines and codes of practice
- equipment manufacturer's operation range
- customers requirements
- BS and/or ISO standards

7. Complete **one** of the following servicing records, and pass it to the appropriate person:

- service record card
- job card/corrective action report
- company specific documentation

### **Knowledge statements:**

#### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the servicing activity is to take place, and the responsibility these requirements place on you
2. The isolation and/or lock-off or permit-to-work procedures that applies
3. The specific health and safety precautions to be applied during the servicing procedure, and their effects on others
4. The hazards associated with carrying out stairlift servicing activities (such as handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down servicing procedures), and how to minimise them
5. The importance of wearing protective clothing and other appropriate safety equipment during the servicing activity
6. How to obtain and interpret information from job instructions and other documents needed in the servicing process (such as drawings, specifications, manufacturers' manuals)
7. The operational safety checks that are applied, and the importance of following them correctly during servicing activities
8. The methods and techniques used to service stairlift equipment (such as visual examination, dismantling equipment, replacing damaged/defective components, setting, aligning and adjusting and functionally testing)
9. Methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
10. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
11. The uses of mechanical and electrical measuring devices
12. How to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel and running and sliding conditions)
13. The importance of making visual checks before running the equipment under power
14. 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 the intended purpose
15. The importance of servicing documentation and/or reports following the servicing activity, and how to complete them
16. The equipment operating and control procedures to be applied during the servicing activity
17. How to apply manual handling techniques when servicing stairlifts
18. The things that can go wrong when carrying out servicing of stairlifts, and what to do if they occur
19. The organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
20. The extent of your own authority and whom you should report to if you have a problem that you cannot resolve

## Unit 40 Carrying Out Servicing Activities on Stair lift Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the servicing activity (all)</b>				
undertake servicing to cause minimal disruption				
brief customer prior to carrying out the servicing activity				
review the customer's comments				
use correct issue of drawings, job instructions and procedures				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the servicing area				
carry out the servicing activities, using appropriate techniques and procedures				
reinstate and return the stairlifts to service on completion				
ensure that any potential defects are identified and reported for further action				
leave the work area in a safe and tidy condition				
<b>Carry out servicing activities on all of the following types AC or DC powered stair lifts (all)</b>				
straight				
curved				
hinged				
<b>Check all of the following for operational safety, security and condition, in line with manufacturers' specifications (all)</b>				
mains switch				
safety gear				
overspeed governor				
safety sensitive edges/pads				
safety interlocks				
hinged rail				
swivel seat				
footrest and springs				
motor gearbox and brake				
overload devices/fuses				
seatbelts				
charging system				
circuit protection devices				
levelling devices				
limit switches				
chair, landing and auxiliary controls				
<b>Check all of the following for damage, wear, security and condition, in line with manufacturers' specifications (all)</b>				
rail				
rollers				

upholstery				
trailing cable				
wiring looms				
batteries				
rack and pinion				
chains and sprockets				
fixing of rail to stairs				
fixing of chair to carriage				
warning labels				
printed circuit boards				
<b>Carry out all of the following servicing activities (all)</b>				
dismantling equipment to the appropriate level				
make sensory checks				
checking earth continuity				
setting, aligning and adjusting components				
tightening fastenings to the required torque				
remove excess dirt and grime				
applying lubrication				
functionally testing the completed system				
<b>Ensure that the serviced stairlift complies with all of the following, as appropriate to the equipment being serviced (all)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
customers requirements				
BS and/or ISO standards				
<b>Complete one of the following servicing records, and pass it to the appropriate person (one)</b>				
service record card				
job card/corrective action report				
company specific documentation				

Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 41 Restoring Stairlifts to Service by Replacing or Repairing Components

## Unit Summary

This unit identifies the competences you need to restore stairlifts to usable condition by component repair or replacement, in accordance with approved procedures. You will be required to restore a variety of different types of stairlifts, such as straight, curved and hinged, to operational condition, by repairing or replacing assemblies/sub-assemblies and components. You will also be required to select the appropriate equipment to use, based on the nature of the activity and the operations that will need to be carried out.

Your responsibilities will require you to comply with organisational policy and procedures for the repairing or replacement activities undertaken, and to report any problems with these activities, or with the tools, equipment or materials used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying stairlift component repair or replacement procedures safely. You will have an understanding of the function and operating conditions of the components, in sufficient depth to determine if the components require replacing or can be repaired. You will also understand the organisational policy on repairing or replacing components, and its application.

You will understand the safety precautions required when carrying out the repair or component replacement activity, 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 the relevant specifications for the component to be repaired
- c. Prepare the component for repair
- d. Carry out the repairs within agreed timescale using approved materials and components and methods and procedures
- e. Ensure that the repaired component meets the specified operating conditions
- f. Produce accurate and complete records of all repair work carried out

**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 repair/replacement activity:
  - undertake the activities to cause minimal disruption to the customer
  - provide the customer with a briefing, prior to carrying out the repair/replacement activity
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, gas, air or fluids)
  - provide safe access and working arrangements for the maintenance area
  - carry out the repair/replacement activities, using appropriate techniques and procedures
  - reinstate and return the stairlifts to service on completion of the activities
  - ensure that any potential defects are identified and reported for further action
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Replace or repair **all** of the following components:
  - motor/gearbox
  - trailing cable
  - carriage rollersPlus **eight** more from the following:
  - printed circuit boards (PCBs)
  - wiring loom
  - batteries (such as carriage/hinge)
  - safety devices (such as switches, interlocks, fuses)
  - controls (such as landing call button, infra-red, radio)
  - overspeed governors
  - cable reeling drum and brushes
  - ropes/chains
  - linkages
  - charging components/units
  - safety gear
  - circuit protection devices (RCD or ELCB)
  - sprockets and/or gears
  - seatbelts
  - springs (footrest or swivel)
  - gas struts
  - pulleys
  - indicator lights/units
  - upholstery
  
3. Carry out **all** of the following during the replacement or repairing activities:
  - dismantling equipment to the appropriate level
  - removal of excess dirt and grime
  - fitting, aligning and adjusting repaired or replaced units/components
  - tightening fastenings to the required torque
  - ensuring that working clearances are met
  - applying lubrication
  - ensuring that components are clear of obstruction and are guarded, where appropriate
  - making sensory checks (sight, sound, smell, touch)
  - checking that all safety devices are operative
  - functionally testing the completed system
  
4. Repair or replace stairlift components, in accordance with **all** of the following, as appropriate to the equipment being repaired:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operation range
  - BS and/or ISO standards
  - customer requirements

5. Complete **one** of the following servicing records, and pass it to the appropriate person:

- service record card
- job card/corrective action report
- company specific documentation

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the repairing or replacing activity is to take place, and the responsibility these requirements place on you
2. The isolation and/or lock-off or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the repair/replacement procedure, and their effects on others
4. The importance of wearing protective clothing and other appropriate safety equipment during repairing activities
5. The hazards associated with carrying out stairlift repairs (handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down servicing procedures), and how to minimise them
6. Where to obtain, and how to interpret job instructions and other relevant documents used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, maintenance schedules)
7. The methods, techniques and company procedures to be followed for restoring stairlifts to service
8. The inspection and safety checks required, and the importance of following them correctly during replacement/repairing activities
9. The methods and techniques used to dismantle/assemble stairlift equipment (such as visual examination, dismantling equipment, replacing damaged/defective components, setting, aligning and adjusting and functionally testing)
10. Methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
11. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
12. The uses of mechanical and electrical measuring devices
13. How to make adjustments to components/assemblies to ensure that they function correctly (such as working clearance, setting travel, running and sliding conditions)
14. The importance of making visual checks before running the equipment under power
15. 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 the intended purpose
16. The importance of completing replacement/repair documentation correctly
17. The equipment operating and control procedures to be applied during the repair/replacement activity
18. How to apply manual handling techniques when restoring stairlifts to service
19. The things that can go wrong when repairing or replacing stairlift components, and what to do if they occur
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 41 Restoring Stair lifts to Service by Replacing or Repairing Components

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the repair/replacement activity (all)</b>				
undertake activities to cause minimal disruption to customer				
brief customer prior to the repair/replacement activity				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
carry out the repair/replacement activities, using appropriate techniques and procedures				
reinstate and return the stairlifts to service on completion of the activities				
ensure that any potential defects are identified and reported for further action				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Replace or repair all of the following components (all)</b>				
motor/gearbox				
trailing cable				
carriage rollers				
<b>Plus eight more from the following (eight)</b>				
printed circuit boards (PCBs)				
wiring loom				
batteries				
safety devices				
controls				
overspeed governors				
cable reeling drum and brushes				
ropes/chains				
linkages				
charging components/units				
safety gear				
circuit protection devices (RCD or ELCB)				
sprockets and/or gears				
seatbelts				
springs (footrest or swivel)				
gas struts				
pulleys				
indicator lights/units				
upholstery				
<b>Carry out all of the following during the replacement or repairing activities (all)</b>				

dismantling equipment to the appropriate level				
removal of excess dirt and grime				
fitting, aligning and adjusting repaired or replaced units/components				
tightening fastenings to the required torque				
ensuring that working clearances are met				
applying lubrication				
ensuring that components are clear of obstruction and are guarded, where appropriate				
making sensory checks				
checking that all safety devices are operative				
functionally testing the completed system				
<b>Repair or replace stair lift components, in accordance with all of the following, as appropriate to the equipment being repaired (all)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and/or ISO standards				
customer requirements				
<b>Complete one of the following servicing records, and pass it to the appropriate person (one)</b>				
service record card				
job card/corrective action report				
company specific documentation				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....



## Unit 42 Carrying Out Fault Location on Service Lifts

### Unit Summary

This unit identifies the competences you need to carry out efficient and effective location of faults on service lifts, in accordance with approved procedures. You will be expected to locate faults on service lifts such as traction, hydraulic, and direct drive. You will be expected to use a variety of fault location methods and procedures, such as gathering information from the person who reported the fault, using recognised fault finding techniques and diagnostic aids, measuring, inspecting and operating the equipment.

Your responsibilities will require you to comply with organisational policy and procedures for the fault location activities undertaken, and to report any problems with these activities, or with 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 to instructions, alone or in conjunction with others, taking full responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying fault location procedures to service lifts. You will have an understanding of the basic fault location methods and techniques used, and their application. You will also know how to interpret the information obtained from fault finding aids and equipment, in adequate depth to provide a sound basis for carrying out the activities.

You will understand the safety precautions required when carrying out the fault location 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. 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 finding activity:
  - undertake the fault location process to cause minimal disruption to the customer
  - use the correct issue of company and/or manufacturers' drawings and documentation
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as electricity, mechanical)
  - provide safe access and working arrangements for the fault finding area
  - carry out the fault location activities, using approved procedures
  - identify the fault, and consider appropriate corrective action
  - take actions to resolve the problem (in conjunction with others, where appropriate)
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition
  
2. Carry out fault location on **one** of the following types of service lift:
  - hydraulic
  - direct drive
  - traction
  
3. Use **four** of the following diagnostic techniques, tools and aids to assist in locating the fault:
  - information gathered from the person who reported the fault, including the customer
  - fault finding techniques (such as six point, half-split, input/output, unit substitution, )
  - diagnostic aids (such as manuals, flow charts, troubleshooting guides, maintenance records)
  - inspecting (such as checking for breakages, wear/deterioration, overheating, missing parts, loose fittings)
  - operating (such as manually switching off and on, running the equipment)
  
4. Use **three** of the following types of test equipment to aid fault location:
  - measuring instruments/devices
  - multimeter
  - continuity tester
  - insulation resistance tester
  - self-diagnostic systems
  - other specific test equipment
  
5. Locate faults that have resulted in **two** of the following breakdown categories:
  - intermittent problem
  - partial failure or reduced performance
  - complete breakdown
  
6. Provide a record of the outcomes of the fault location, using **one** of the following:
  - step-by-step outcome analytical report
  - service record card
  - company-specific documentation
  - corrective action report

## **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 finding investigation, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. 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 and resuscitation)
4. The safe working practices for lifts (as described in BS7255)
5. The importance of wearing protective clothing and other appropriate safety equipment during fault location activities
6. The hazards associated with carrying out fault location activities on service lift equipment (live electrical components, stored energy, misuse of tools), and how they can be minimised
7. How to use the various diagnostic aids to help identify the location of the fault
8. The various fault location techniques that can be used, and how they are applied (such as half-split, function testing, unit substitution, and equipment self-diagnostics)
9. How to evaluate sensory information (sight, sound, smell, touch)
10. How to assess evidence and evaluate the possible causes of faults/problems
11. How to use a range of fault diagnostic equipment to investigate the problem
12. The care, handling and application of measuring/test equipment (such as mechanical and electrical measuring instruments)
13. How to check that measuring/test equipment is within calibration, and that it is free from damage and defects
14. How to obtain and interpret information from job instructions and other documents needed in the fault location process (such as drawings, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical symbols)
15. The basic principles of how service lift equipment functions, its operating sequence, the purpose of individual units/components and how they interact
16. The problems that can occur during the fault location activity, and how they can be minimised
17. The importance of completing the correct documentation following the maintenance activity
18. The extent of your own authority and whom you should report to if you have any problems that you cannot resolve

## Unit 42 Carrying Out Fault Location on Service Lifts

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the fault finding activity (all)</b>				
undertake fault location process to cause minimal disruption				
use the correct issue of company and/or manufacturers' drawings and documentation				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the fault finding area				
carry out the fault location activities, using approved procedures				
identify the fault, and consider appropriate corrective action				
take actions to resolve the problem				
dispose of waste items				
leave the work area in a safe and tidy condition				
<b>Carry out fault location on one of the following types of service lift (one)</b>				
hydraulic				
direct drive				
traction				
<b>Use four of the following diagnostic techniques, tools and aids to assist in locating the fault (four)</b>				
information gathered from the person who reported the fault,				
fault finding techniques				
diagnostic aids				
inspecting				
operating				
<b>Use three of the following types of test equipment to aid fault location (three)</b>				
measuring instruments/devices				
multimeter				
continuity tester				
insulation resistance tester				
self-diagnostic systems				
other specific test equipment				
Locate faults that have resulted in <b>two</b> of the following breakdown categories:				
• intermittent problem				
• partial failure or reduced performance				
complete breakdown				
<b>Provide a record of the outcomes of the fault location, using one of the following (one)</b>				
step-by-step outcome analytical report				
service record card				

company-specific documentation				
corrective action report				

Knowledge and understanding reference:

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Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 43 Carrying Out Servicing of Service Lift Equipment

## Unit Summary

This unit identifies the competences you need to carry out servicing activities of service lifts, in accordance with approved procedures. This will involve inspection and adjustment, dismantling, removing and replacing faulty components, in line with company procedures, on a range of service lifts such as traction, hydraulic, and direct drive.

You will be expected to apply a range of dismantling and assembling methods and techniques, such as proof marking to aid re-assembly, setting, aligning and adjusting components, and to carry out the relevant checks before starting up the service lift.

Your responsibilities will require you to comply with organisational policy and procedures for the servicing 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 servicing activities are removed from the work area on completion of the activities, and that all necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying servicing procedures to service lifts. You will have an understanding of dismantling and reassembly methods and procedures, and their application. You will know how the equipment functions and the purpose of individual components, in adequate depth to provide a sound basis for carrying out any inspection, repair or adjustment. In addition, you will have sufficient knowledge of these components to ensure that they are fit for purpose and meet the specifications, thus providing a sound basis for carrying out reassembly.

You will understand the safety precautions required when carrying out the servicing 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 the relevant maintenance schedules to carry out the required work
- c. Carry out the maintenance activities within the limits of your personal authority
- d. Carry out the maintenance activities in the specified sequence and in an agreed time scale
- e. Report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
- f. Complete relevant maintenance records accurately and pass them on to the appropriate person
- g. Dispose of waste materials in accordance with safe working practices and approved 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** the following during the servicing activity:
  - undertake the servicing activities to cause minimal disruption to the customer
  - use the correct issue of drawings, job instructions and procedures
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity)
  - ensure safe access and working arrangements for the servicing area
  - follow the approved service lift servicing schedule
  - reinstate and return the service lift to service on completion of activities
  - ensure that any potential defects are identified and reported for further action
  - leave the work area in a safe and tidy condition
  
2. Carry out servicing activities on **one** of the following types of service lift:
  - hydraulic
  - direct drive
  - traction
  
3. Check **twelve** of the following for operational safety, security and condition, in line with manufacturers' specifications:
  - overspeed governor
  - motor/gearbox
  - slack chain devices
  - brake system
  - anti-creep system
  - safety gear
  - floor selection system
  - door locking mechanism
  - door gear
  - hydraulic rams
  - safety locks/interlocks
  - switches (such as pressure and limit)
  - shutter suspension system
  - valve block
  - lift run-bys/overtravels
  - residual current devices (RCD)
  
4. Check **ten** the following for damage, wear, security and condition, in line with manufacturers' specifications:
  - diverters
  - traction sheave
  - controllers
  - retiring ramps
  - car doors
  - push buttons/indicators
  - lift structure
  - cabling (such as shaft and trailing)
  - balance weight and rope attachments
  - guide shoes/rollers
  - lifting ropes
  - equalising devices
  - chains and sprockets
  - warning notices
  - hydraulic hoses
  - car interior
  - guides/racks and fixings
  - rack and pinion drive

5. Carry out **all** of the following servicing techniques:
  - visual examination of the complete system
  - dismantling equipment to the appropriate level
  - proof marking/labelling of components
  - checking components for serviceability
  - setting, aligning and adjusting components
  - electrical continuity
  - make sensory checks (sight, sound, smell, touch)
  - tightening fastenings to the required torque
  - making 'off-load' checks before starting up
  - removing excess dirt and grime
  - replenishing oils and/or greases
  - functionally testing the completed system
  
6. Carry out the servicing operations, in accordance with **all** of the following standards, as appropriate to the equipment being serviced:
  - organisational guidelines and codes of practice
  - equipment manufacturer's operating range
  - BS and/or ISO standards
  - customer requirements
  
7. Complete **one** of the following servicing records, and pass it to the appropriate person:
  - Job cards
  - company report
  - service log or report



## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the servicing activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the servicing procedure, and their effects on others
4. The hazards associated with carrying out the servicing of service lifts (handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down servicing procedures), and how to minimise them
5. The importance of wearing protective clothing and other appropriate safety equipment during the servicing process
6. How to obtain and interpret information from job instructions and other documents needed in the servicing process (such as drawings, specifications, manufacturers' manuals, servicing schedules)
7. The inspection and safety checks that are applied, and the importance of following them exactly during servicing operations
8. Methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
9. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
10. The different drive systems, their operation, and associated components
11. The uses of mechanical and electrical measuring devices
12. How to make adjustments to components/assemblies to ensure that they function correctly (setting working clearance, setting travel, running and sliding conditions)
13. The importance of making checks before running the equipment under power
14. 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 the intended purpose
15. The importance of servicing documentation and/or reports following the servicing activity, and how to generate them
16. The equipment operating and control procedures to be applied during the servicing activity
17. The things that can go wrong when carrying out servicing of service lifts, and what to do if they occur
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 43 Carrying Out Servicing of Service Lift Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all the following during the servicing activity (all)</b>				
undertake servicing to cause minimal disruption				
use the correct issue of drawings, job instructions and procedures				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
ensure safe access and working arrangements for the servicing area				
follow the approved service lift servicing schedule				
reinstate and return the service lift to service on completion of activities				
ensure that any potential defects are identified and reported for further action				
leave the work area in a safe and tidy condition				
<b>Carry out servicing activities on one of the following types of service lift (one)</b>				
hydraulic				
direct drive				
traction				
<b>Check twelve of the following for operational safety, security and condition, in line with manufacturers' specifications (twelve)</b>				
overspeed governor				
motor/gearbox				
slack chain devices				
brake system				
anti-creep system				
safety gear				
floor selection system				
door locking mechanism				
door gear				
hydraulic rams				
safety locks/interlocks				
switches				
shutter suspension system				
valve block				
lift run-bys/overtravels				
residual current devices (RCD)				
<b>Check ten the following for damage, wear, security and condition, in line with manufacturers' specifications (ten)</b>				
diverters				
traction sheave				

controllers				
retiring ramps				
car doors				
push buttons/indicators				
lift structure				
cabling				
balance weight/rope attachment				
guide shoes/rollers				
lifting ropes				
equalising devices				
chains and sprockets				
warning notices				
hydraulic hoses				
car interior				
guides/racks and fixings				
rack and pinion drive				
<b>Carry out all of the following servicing techniques (all)</b>				
visual examination				
dismantling equipment				
proof mar/label components				
check component serviceability				
set, align and adjust components				
electrical continuity				
make sensory checks				
tightening fastenings				
making 'off-load' checks before starting up				
removing excess dirt and grime				
replenishing oils and/or greases				
functionally testing the completed system				
<b>Carry out the servicing operations, in accordance with all of the following standards, as appropriate to the equipment being serviced (all)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operating range				
BS and/or ISO standards				
customer requirements				
<b>Complete one of the following servicing records, and pass it to the appropriate person (one)</b>				
Job cards				
company report				
service log or report				

Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 44 Restoring Service Lifts to Service by Replacing or Repairing Components

## Unit Summary

This unit identifies the competences you need to restore service lifts to usable condition by repairing or replacing components, in accordance with approved procedures. You will be required to restore a range of service lifts, such as traction, hydraulic, and direct drive to operational condition, by repairing or replacing assemblies/sub-assemblies and components. You will also be required to select the appropriate equipment to use, based on the nature of the repair, and the operations to be carried out.

Your responsibilities will require you to comply with organisational policy and procedures for the repair/replacement activities undertaken, and to report any problems with these activities, or with the tools, equipment or materials used, that you cannot personally resolve or are outside your permitted authority, to the relevant people. You will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for your own actions and for the quality and accuracy of the work that you carry out.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will provide an informed approach to applying component repair/replacement procedures to service lifts. You will have an understanding of the function and operating conditions of the various components, in sufficient depth to determine if a suitable repair can be made, and to ensure that any repairs or replacements carried out are safe and practical in operation.

You will understand the safety precautions required when carrying out the repair/replacement activity, 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 the relevant specifications for the component to be repaired
- c. Prepare the component for repair
- d. Carry out the repairs within agreed timescale using approved materials and components and methods and procedures
- e. Ensure that the repaired component meets the specified operating conditions
- f. Produce accurate and complete records of all repair work carried out

**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** the following activities during the repair/replacement activity:
  - undertake the activities to cause minimal disruption to the customer
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of equipment (such as mechanical, electricity, air or fluids)
  - provide safe access and working arrangements for the maintenance area
  - carry out the repair/replacement activities, using appropriate techniques and procedures
  - reinstate and return the service lift to service on completion of the repair/replacement activities
  - ensure that any potential defects are identified and reported for further action
  - record the repair/replacement, using appropriate methods or documentation
  - dispose of waste items in a safe and environmentally acceptable manner
  - leave the work area in a safe and tidy condition

2. Replace or repair **four** of the following components:

- motor
- gearbox
- lift controller equipment
- hydraulic pump unit
- lifting ropes/chains
- hydraulic valves, hoses and connectors

Plus **six** from the following:

- electrical wiring and cables
- solenoids
- safety devices (switches, interlocks, fuses)
- landing/car shutter suspension cords
- traction sheave/sprocket
- brakes
- ram seals
- safety gear
- guides and fixings
- guide shoes/rollers
- overspeed governors
- residual current devices (RCD)
- floor selection systems
- printed circuit boards (PCBs)
- controls (landing call stations)

3. Carry out **all** of the following replacement or repair activities:

- dismantling equipment to the appropriate level
- removing excess dirt and grime
- fitting, aligning and adjusting repaired or replaced units/components
- tightening fastenings to the required torque
- ensuring that working clearances are met
- applying lubrication
- ensuring that components are clear of obstruction, and are guarded, where appropriate
- making sensory checks (sight, sound, smell, touch)
- checking that all safety devices are operative
- functionally testing the completed system

5. Carry out repair or replacement of service lift components, in accordance with **all** of the following standards, as appropriate to the equipment being repaired:

- organisational guidelines and codes of practice
- equipment manufacturer's operation range
- BS and/or ISO standards
- customer requirements

6. Complete **one** of the following servicing records, and pass it to the appropriate person
  - job cards
  - company report
  - service log or report

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the repair or replacement activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the repair/replacement procedure, and their effects on others
4. The importance of wearing protective clothing and other appropriate safety equipment during repair/replacement activities
5. The hazards associated with carrying out service lift repairs (handling oils, greases, stored pressure/force, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down servicing procedures), and how to minimise them
6. Where to obtain, and how to interpret job instructions and other relevant documents used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, maintenance schedules)
7. The methods, techniques and company procedures to be followed for repairing/replacing components for service lifts
8. The inspection and safety checks that are applied, and the importance of following them exactly during replacement/repair operation
9. The methods and techniques used to dismantle/assemble service lift equipment (such as release of pressures/force, proof marking, extraction, pressing, alignment)
10. Methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lived' items such as seals and gaskets
11. The basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
12. The uses of mechanical and electrical measuring devices
13. How to make adjustments to components/assemblies to ensure that they function correctly (setting working clearance, setting travel, running and sliding conditions)
14. The importance of making checks before running the equipment under power
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 preparing documentation and/or reports following the replacement/repairing activity, and how to generate them
17. The equipment operating and control procedures to be applied during the repair/replacement activity
18. How to use lifting and handling equipment in the repair/replacement process
19. The things that can go wrong when carrying out repairs to service lifts, and what to do if they occur
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 44**

**Restoring Service Lifts to Service by Replacing or Repairing Components**

	<b>performance evidence 1</b>	<b>performance evidence 2</b>	<b>performance evidence 3</b>	<b>additional performance evidence (if required)</b>
evidence type				
date				
<b>Carry out all the following activities during the repair/replacement activity (all)</b>				
undertake the activities to cause minimal disruption				
adhere to relevant safety standards				
ensure the safe isolation of equipment				
provide safe access and working arrangements for the maintenance area				
carry out the repair/replacement activities				
reinstate and return the service lift to service on				
ensure that any potential defects are identified and reported for further action				
record the repair/replacement,				
<b>Replace or repair four of the following components (four)</b>				
motor				
gearbox				
lift controller equipment				
hydraulic pump unit				
lifting ropes/chains				
hydraulic valves, hoses and connectors				
<b>Plus six from the following:</b>				
electrical wiring and cables				
solenoids				
safety devices (switches, interlocks, fuses)				
landing/car shutter suspension cords				
traction sheave/sprocket				
brakes				
ram seals				
safety gear				
guides and fixings				
guide shoes/rollers				
overspeed governors				
residual current devices (RCD)				
floor selection systems				
printed circuit boards (PCBs)				
<b>Carry out all of the following replacement or repair activities (all)</b>				
dismantling equipment				
removing excess dirt and grime				
fitting, aligning and adjusting repaired or replaced units/components				
tightening fastenings				
ensuring that working				

clearances are met				
applying lubrication				
ensure that components are clear of obstruction, and are guarded, where appropriate				
making sensory checks				
checking that all safety devices are operative				
functionally testing the completed system				
<b>Carry out repair or replacement of service lift components, in accordance with all of the following standards, as appropriate to the equipment being repaired (all)</b>				
organisational guidelines and codes of practice				
equipment manufacturer's operation range				
BS and/or ISO standards				
customer requirements				
<b>Complete one of the following servicing records, and pass it to the appropriate person (one)</b>				
job cards				
company report				
service log or report				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....



# Unit 45     Installing Stairlifts

## Unit Summary

This unit identifies the competences you need to install stairlifts, 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 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 variety of stairlifts, including straight, curved and hinged, operated by AC or DC power supplies.

This unit does not involve assembly type activities, such as fitting bearings and/or gears into a gearbox, or the installation of items of equipment that are simple, self-contained items requiring minimal installation. It does, however, include the connection of sub-assemblies (where these have been broken down for transportation purposes). Connection to a power supply is also a necessary part of the installation process.

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 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 electrical power supply. 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 to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying procedures for stairlift installation. You will have an understanding of the equipment being installed, its installation requirements, the correct function of the equipment and 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 applications, in sufficient depth to be able to carry out the installation 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 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 before installing the stairlift equipment:
  - check that the site is accessible and is free from obstructions or hazards
  - check that installation documentation is complete and current (such as, drawings, instructions, manufacturer's data, settings and other documentation)
  - confirm that the appropriate electrical supply is available
  - check that the required installation consumables are available
  - check that safety and environmental conditions have been met
  - confirm that the site has been suitably prepared for the installation to take place
  - check that consignment contents are correct to the customer specification/order, and are free from damage
  - outline the installation process with the customer
  - undertake the installation to cause minimal disruption to the customer
  
2. Carry out **all** of the following activities during the installation:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of services during installation (such as mechanical, electricity)
  - provide safe access and working arrangements for the installation area
  - 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
  - prepare components and assemblies for installation
  
3. Install **all** of the following AC or DC powered stairlifts:
  - straight
  - curved
  - hinged
  
4. Apply installation methods and techniques, to include **five** of the following:
  - marking out of locating and securing positions
  - positioning equipment
  - aligning equipment
  - levelling equipment
  - shimming and packing
  - fixing by using adhesives and sealants
  - securing by using mechanical fixings
  - securing by using masonry fixings
  - applying screw fastener locking devices
  
5. Install **all** of the following stairlift components/sub-assemblies
  - rails (such as fixings for wood, metal or concrete staircase)
  - carriage assembly
  - chair assembly
  - rail furniture (such as charging ramps, stopping/slowing ramps)
  - stairlift controls (such as hard wired, radio controlled, infrared)
  - electrical wiring, cables and enclosures
  
6. Use **two** of the following during the installation activities:
  - straight edges
  - mechanical measuring instruments/devices
  - electrical measuring devices
  - plumb lines and taut wires
  - levels
  - tapes/rules
  
7. Make **both** of the following connections to the installed equipment:
  - mechanical connections

- electrical connections
8. Carry out checks and adjustments, to include:
- testing to ensure that the equipment operates to the installation specification

Plus **six** more from the following:

- checking level and alignment
- electrical continuity
- electrical insulation resistance
- mains voltage and polarity
- battery voltage and condition
- earth continuity
- stall current and running current overloads
- making visual checks for completeness and freedom from damage
- making sensory checks (sight, sound, smell, touch)
- ensuring that moving parts are clear of obstruction, and are guarded
- ensuring that locking devices are fitted to fasteners (as 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. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- equipment manufacturer's installation specification
- BS and/or ISO standards
- customer requirements
- company standards and procedures

11. Complete **two** of the following installation records, and pass it to the appropriate person:

- user guide
- installation work sheet
- 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 stairlifts (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 complying with any 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 stairlifts, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment that you need to use for the installation activities, and where it can be obtained
6. How to obtain and interpret information from job instructions and other documentation used in the installation activities (such as installation drawings, standards, quality control procedures and specifications)
7. The stairlift equipment to be installed, its function and operating procedures
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 (including, threaded fasteners, special securing devices, special fixing devices)
10. The different stairlift power supplies and associated control systems
11. Procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
12. The types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, levelling and measuring devices)
13. The techniques used to position, align, level, adjust and secure the stairlift equipment
14. Methods of lifting, handling and supporting the stairlift equipment during the installation activities
15. Methods of connecting mechanical devices (such as carriage, chair, rail and rail furniture)
16. Methods and techniques used to connect stairlift equipment to power supplies
17. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
18. The procedure for the safe disposal of waste materials
19. The measuring equipment used to check and adjust the installed equipment
20. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of covers to all moving parts and electrical connections)
21. The tools and equipment used in the installation activities, and their calibration/care and control procedures
22. The problems that can occur with the installation operations, and how these can be overcome
23. The documentation to be completed for the installation activities, and who to pass them to
24. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 45 Installing Stairlifts

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following before installing the stair lift equipment (all)</b>				
check site access is free from obstructions or hazards				
check installation documentation is complete				
confirm that the appropriate electrical supply is available				
check the required installation consumables are available				
check that safety and environmental conditions have been met				
confirm that the site has been suitably prepared for the installation to take place				
check that consignment contents are correct to the customer specification/order				
outline the installation process with the customer				
undertake the installation to cause minimal disruption to the customer				
<b>Carry out all of the following activities during the installation (all)</b>				
adhere to relevant safety standards				
ensure the safe isolation of services during installation				
provide safe access and working arrangements for the installation area				
dispose of waste items				
leave the work area in a safe condition and free from foreign object debris				
prepare components and assemblies for installation				
<b>Install all of the following AC or DC powered stair lifts (all)</b>				
straight				
curved				
hinged				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
positioning equipment				
aligning equipment				
levelling equipment				
shimming and packing				
fixing by using adhesives and sealants				
securing by using mechanical fixings				

securing by using masonry fixings				
applying screw fastener locking devices				
<b>Install all of the following stair lift components/sub-assemblies (all)</b>				
rails				
carriage assembly				
chair assembly				
rail furniture				
stairlift controls				
electrical wiring, cables and enclosures				
<b>Use two of the following during the installation activities (two)</b>				
straight edges				
mechanical measuring instruments/devices				
electrical measuring devices				
plumb lines and taut wires				
levels				
tapes/rules				
<b>Make both of the following connections to the installed equipment (both)</b>				
mechanical connections				
electrical connections				
<b>Carry out checks and adjustments, to include</b>				
testing to ensure that the equipment operates to the installation specification				
<b>Plus six more from the following:</b>				
checking level and alignment				
electrical continuity				
electrical insulation resistance				
mains voltage and polarity				
battery voltage and condition				
earth continuity				
stall current and running current overloads				
making visual checks for completeness and freedom from damage				
making sensory checks				
ensuring that moving parts are clear of obstruction, and are guarded				
ensuring that locking devices are fitted to fasteners				
<b>Deal with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's installation specification				
BS and/or ISO standards				
customer requirements				
company standards and procedures				
<b>Complete two of the following installation records, and pass it to the appropriate person (two)</b>				

user guide				
installation work sheet				
company specific documentation				

Knowledge and understanding reference:

Candidate: .....  
 Assessor: .....

Date: .....  
 Date: .....

# Unit 46 Installing Service Lifts

## Unit Summary

This unit identifies the competences you need to install service lifts, 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 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 service lifts such as traction, hydraulic or direct drive.

This unit does not involve assembly-type activities, such as fitting bearings and/or gears into a gearbox, or the installation of items of equipment that are simple, self-contained items requiring minimal installation. 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 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 electrical power supply. 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 to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying installation procedures for service lifts. You will have an understanding of the equipment being installed, its installation requirements, the correct function of the equipment and 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 applications, in sufficient depth to be able to carry out the installation 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 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 before installing service lift equipment:
  - check that the site is accessible and is free from obstructions or hazards
  - check that the installation documentation is complete and current (such as, drawings, instructions, manufacturer's data, settings and other documentation)
  - confirm that the appropriate electrical supply is available
  - check that the required installation consumables are available
  - check that safety and environmental conditions have been met
  - confirm that the site has been suitably prepared for the installation to take place
  - check that consignment contents are correct to the customer specification/order, and are free from damage
  - outline the installation process with the customer
  - undertake the installation to cause minimal disruption to the customer
  
2. Carry out **all** of the following activities during the installation:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - ensure the safe isolation of services during installation (such as mechanical, electricity)
  - provide safe access and working arrangements for the installation area
  - 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
  - prepare components and assemblies for installation
  
3. Install **one** of the following types of service lift:
  - hydraulic
  - direct drive
  - traction
  
4. Install **all** of the following service lift components/subassemblies:
  - structures/guide brackets
  - machine support steelwork/bedplates
  - drive systems (such as traction, hydraulic or direct drive)
  - electrical wiring (cables, wiring, wiring enclosures)
  - landing and car entrances
  - lifting ropes and/or chains
  - guides and fixings
  - car assembly
  - safety devices
  - lift controller
  - floor selection system
  - ancillary equipment (such as warning signs, company specific options)
  
5. Apply installation methods and techniques, to include **five** of the following:
  - marking out of locating and securing positions
  - positioning equipment
  - aligning equipment
  - levelling equipment
  - shimming and packing
  - securing by using mechanical fixings
  - fixing by using adhesives and sealants
  - securing by using masonry fixings
  - applying screw fastener locking devices
  - routing and securing wires and cables

6. Use **three** of the following tools during the installation activities:

- straight edges
- alignment devices (spirit level, laser equipment)
- measuring instruments (electrical, mechanical)
- plumb lines
- tapes and measures
- self-diagnostic equipment

7. Make **two** of the following connections to the installed equipment:

- mechanical connections
- electrical connections
- fluid power connections

8. Carry out checks and adjustments, to include:

- testing to ensure that the equipment operates to the installation specification

Plus **six** more of the following:

- checking level and alignment
- electrical continuity
- electrical insulation resistance
- mains voltage and polarity
- stall current and running current
- overloads
- earth continuity
- making visual checks for completeness and freedom from damage
- making sensory checks (sight, sound, smell, touch)
- ensuring that moving parts are clear of obstruction, and are guarded
- ensuring that locking devices are fitted to fasteners (as 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. Produce installations which comply with **all** of the following standards, as appropriate to the equipment being installed:

- equipment manufacturer's installation specification
- BS and/or ISO standards
- customer requirements
- company standards and procedures

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

- user guide
- installation work sheet
- 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 service lifts (including any specific legislation, safe working practices for lifts (such as BS7255), 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 complying with any 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 service lifts, and with the tools and equipment used, and how they can be minimised
5. The personal protective equipment that you need to use for the installation activities, and where replacements can be obtained if supplied personal protective equipment becomes worn or damaged
6. How to obtain and interpret information from job instructions and other relevant documentation used in the installation (such as installation drawings, standards, quality control procedures and specifications)
7. The equipment to be installed, its operating procedures and function
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 (including, threaded fasteners, special securing devices, masonry fixing devices)
10. Procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
11. The types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, levelling and alignment devices, measuring devices)
12. The techniques used to position, align, level, connect, adjust and secure the equipment
13. Methods of lifting, handling and supporting the equipment during the installation activities
14. Methods of connecting equipment to power supplies
15. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
16. How to dispose of waste items in an environmentally safe acceptable manner, and leave the work area in a safe condition
17. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation (including the fitting of covers to all moving parts and electrical connections)
18. The tools and equipment used in the installation activities, and their calibration/care and control procedures
19. The problems that can occur with the installation operations, and how these can be overcome
20. The documentation to be completed for the activities, and who to pass them to
21. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 46 Installing Service Lifts

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following before installing service lift equipment (all)</b>				
check the site is accessible and free from obstructions/hazards				
check that the installation documentation is complete and current				
confirm that the appropriate electrical supply is available				
check that the installation consumables are available				
check that safety and environmental conditions have been met				
confirm that the site has been suitably prepared for the installation to take place				
check that consignment contents are correct to the customer specification/order				
outline the installation process with the customer				
undertake the installation to cause minimal disruption				
<b>Carry out all of the following activities during the installation (all)</b>				
adhere to relevant safety standards				
ensure the safe isolation of services during installation				
provide safe access and working arrangements for the installation area				
dispose of waste items				
leave the work area in a safe condition and free from foreign object debris				
prepare components and assemblies for installation				
<b>Install one of the following types of service lift (one)</b>				
hydraulic				
direct drive				
traction				
<b>Install all of the following service lift components/subassemblies (all)</b>				
structures/guide brackets				
machine support steelwork/bedplates				
drive systems				
electrical wiring				
landing and car entrances				
lifting ropes and/or chains				
guides and fixings				
car assembly				
safety devices				

lift controller				
floor selection system				
ancillary equipment				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
positioning equipment				
aligning equipment				
levelling equipment				
shimming and packing				
securing by using mechanical fixings				
fixing by using adhesives and sealants				
securing by using masonry fixings				
applying screw fastener locking devices				
routeing and securing wires and cables				
<b>Use three of the following tools during the installation activities (three)</b>				
straight edges				
alignment devices				
measuring instruments				
plumb lines				
tapes and measures				
self-diagnostic equipment				
<b>Make two of the following connections to the installed equipment (two)</b>				
mechanical connections				
electrical connections				
fluid power connections				
<b>Carry out checks and adjustments, to include:</b>				
testing to ensure that the equipment operates to the installation specification				
<b>Plus six more of the following:</b>				
checking level and alignment				
electrical continuity				
electrical insulation resistance				
mains voltage and polarity				
stall current and running current				
overloads				
earth continuity				
making visual checks for completeness and freedom from damage				
making sensory checks (sight, sound, smell, touch)				
ensuring that moving parts are clear of obstruction, and are guarded				
ensuring that locking devices are fitted to fasteners				
<b>Deal with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				

<b>Produce installations which comply with all of the following standards, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's installation specification				
BS and/or ISO standards				
customer requirements				
company standards and procedures				
<b>Complete the relevant paperwork, to include all of the following, and pass it to the appropriate person (all)</b>				
user guide				
installation work sheet				
company specific documentation				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 47 Assisting in the Installation of Mechanical Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of mechanical equipment, in accordance with approved procedures. You will be required to assist in the installation of a range of mechanical equipment such as machine tools, conveyors, elevators, processing plant, engines, lifting and handling equipment, 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.

You will be required to use the specified tools and equipment throughout the installation, and to apply a range of installation methods and techniques, such as marking out, drilling and hole preparation, positioning equipment, shimming and packing, levelling and aligning equipment, and making the required connections. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that the necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying mechanical installation procedures. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

## 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 of the mechanical equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
  
2. Assist in the installation of **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
  - engines
  - other equipment (specify)
  - process control equipment (such as large valves and actuating mechanisms, pumps)
  
3. Carry out the installation by applying **five** of the following methods and techniques:
  - marking out of locating and securing positions
  - drilling and hole preparation
  - fitting inserts (such as rag bolts or expanding bolts)
  - positioning equipment
  - aligning equipment
  - levelling equipment
  - shimming and packing
  - fitting anti-vibration mountings
  - securing by using mechanical fixings
  - applying screw fastener locking devices
  - make installation connections (such as mechanical, electrical, fluid power, utilities)
  
4. Assist in the movement and positioning of 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
  
5. Use **two** of the following during the installation activities:
  - straight edges and feeler gauges
  - tapes and rules
  - engineers' levels
  - measuring instruments (such as electrical, mechanical, fluid power)
  - plumb lines and taut wires
  - self-diagnostic equipment
  - dial test indicators
  - laser alignment equipment
  
6. Carry out **five** the following checks and adjustments on the installed equipment:
  - fill/replenish fluids, oil, or grease



- make 'off-load' checks
- check level and/or alignment
- make visual checks for completeness and freedom from damage
- ensure that locking devices are fitted to fasteners (as appropriate)
- ensure that moving parts are clear of obstruction and/or guarded

Plus assist in carrying out **two** of the following:

- setting working clearance
- tensioning
- pressurising the system
- testing that the equipment operates to the installation specification
- checking torque settings of fasteners
- making sensory checks (sight, sound, smell, touch)

7. Assist in dealing with **two** of the following conditions during the installation process:

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

8. Assist in using fault location methods and techniques on installed equipment, to include using **one** of the following:

- diagnostic aids (such as manufacturers' manuals, fault analysis charts, troubleshooting guides)
- fault finding techniques (such as six point, half-split, unit substitution)
- functional testing the installation/running equipment self-diagnostics

9. Produce installations which comply with **all** of the following standards, as appropriate to the equipment being installed:

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

10. Assist in the completion of the relevant paperwork, to include **one** of the following:

- installation records
- company specific documentation
- job card

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing mechanical equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documentation used in the installation activities (such as installation drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principle of operation of the equipment being installed
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 (such as threaded fasteners, special securing devices, masonry fixing devices)
10. Procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
11. The types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, crowbars, torque wrenches, engineers levels, alignment telescopes and laser devices)
12. The techniques used to position, align, level and adjust the equipment
13. Methods of lifting, handling and supporting the equipment during the installation activities
14. Methods of connecting to mechanical power transmission devices (such as belt and chain drives, couplings, clutches and brakes)
15. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
16. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
17. The procedure for the safe disposal of waste materials
18. How to identify installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
19. 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
20. The problems that can occur with the installation operations, and how these can be overcome
21. The fault-finding techniques to be used if the equipment fails to operate correctly
22. The recording documentation to be completed for the activities undertaken
23. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 47 Assisting in the Installation of Mechanical Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the mechanical equipment:</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of one of the following types of mechanical equipment (one)</b>				
machine tools				
industrial compressors				
conveyors				
turbines				
elevators				
processing plant				
hoppers or large storage vessels				
lifting and handling equipment				
engines				
other equipment (specify)				
process control equipment				
<b>Carry out the installation by applying five of the following methods and techniques (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				
fitting inserts				
positioning equipment				
aligning equipment				
levelling equipment				
shimming and packing				
fitting anti-vibration mountings				
securing by using mechanical fixings				
applying screw fastener locking devices				
make installation connections				
<b>Assist in the movement and positioning of equipment, using two of the following (two)</b>				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				

rollers/skates				
hoists				
jacks				
manual handling and moving loads				
<b>Use two of the following during the installation activities (two)</b>				
straight edges and feeler gauges				
tapes and rules				
engineers' levels				
measuring instruments (such as electrical, mechanical, fluid power)				
plumb lines and taut wires				
self-diagnostic equipment				
dial test indicators				
laser alignment equipment				
<b>Carry out five the following checks and adjustments on the installed equipment (five)</b>				
fill/replenish fluids, oil, or grease				
make 'off-load' checks				
check level and/or alignment				
make visual checks for completeness and freedom from damage				
ensure that locking devices are fitted to fasteners				
ensure that moving parts are clear of obstruction and/or guarded				
<b>Plus assist in carrying out two of the following (two)</b>				
setting working clearance				
tensioning				
pressurising the system				
testing that the equipment operates to the installation specification				
checking torque settings of fasteners				
making sensory checks				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on installed equipment, to include using one of the following (one)</b>				
diagnostic				
fault finding techniques				
functional testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following standards, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operating range				
BS and/or ISO standards				
customer (contractual) standards and requirements				
company standards and procedures				

<b>Assist in the completion of the relevant paperwork, to include one of the following (one)</b>				
installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 48 Assisting in the Installation of Electrical/Electronic Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of electrical/electronic equipment, in accordance with approved procedures. You will be required to assist in the installation of 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 and distribution panels, motors and starters, control systems, safety devices, luminaires, and wiring enclosures.

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 of equipment requiring minimal installation.

You will be required to use the appropriate tools and equipment throughout the installation, and to apply a range of installation methods and techniques to install various electrical components, wires, cables, enclosures and connectors that make up the electrical system/circuit. In addition, you will be expected to make electrical connections to sensors/activators and other devices, as appropriate to the equipment being installed, which could include mechanical, fluid power, water or fuel supplies. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that the necessary job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying electrical/electronic installation procedures. You will have an understanding of the equipment being installed and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report any that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner

- h. Assist in the completion of installation documentation

**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 of the electrical/electronic equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
  
2. Assist in the installation of **six** of the following electrical modules/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
  - traywork
  - other electrical equipment (specify)
  
3. Carry out **four** of the following installation methods and techniques:
  - marking out the location of components/modules
  - positioning and securing equipment and components
  - securing by using mechanical fixings
  - drilling and hole preparation
  - levelling and/or alignment
  - securing by using masonry fixings
  - making installation connections (such as mechanical, electrical, fluid power, utilities)
  
4. Carry out **four** of the following cable termination activities:
  - stripping cable insulation/protection
  - routeing and securing wires and cables
  - terminating cables and wires
  - making mechanical/screwed/clamped connections
  - soldering and de-soldering
  - attaching suitable cable identification
  - heat shrinking (devices and boots)
  - crimping (such as tags and pins)
  - sealing and protecting cable connections
  - adding cable end fittings

5. Assist in the connection of equipment to **two** of the following types of electrical supplies:
  - single phase
  - direct current
  - three phase
  - low voltage (up to 115V)
  
6. Use **two** of the following instruments during the installation activities:
  - multimeter
  - insulation resistance tester
  - earth-loop impedance tester
  - other specific test equipment
  
7. Carrying out **three** the following checks on the installed equipment:
  - making visual checks for completeness and freedom from damage
  - polarity
  - insulation resistance values
  - earth-loop impedance
  - continuity
  
8. Assist in dealing with **two** of the following conditions during the installation process:
  - installations with no faults
  - partial equipment malfunction
  - complete malfunction of equipment
  
9. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:
  - diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
  - fault finding techniques (such as six point, half-split, unit substitution)
  - functional testing the installation/running equipment self-diagnostics
  
10. Produce installations which comply with **all** of the following standards, as appropriate to the equipment being installed:
  - equipment manufacturer's operation range
  - IEE wiring regulations
  - BS and/or ISO standards
  - customer (contractual) standards and requirements
  - company standards and procedures
  
11. Assist in the completion of the relevant paperwork, to include **one** of the following:
  - installation records
  - company specific documentation
  - job card



## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing electrical/electronic equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documentation used in the installation activities (such as installation drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principle of operation of the equipment/circuits being installed
8. The different types of cabling used in the maintenance activities, and their methods of termination
9. The care, handling and application of electrical measuring instruments (such as multimeter, resistance tester, earth-loop impedance tester)
10. Methods of lifting, handling and supporting the equipment during the installation activities
11. How to check that components meet the required specification/operating conditions (such as values, tolerance, current carrying capacity, voltage rating, power rating, working temperature range)
12. The techniques used to terminate electrical equipment (such as plugs, soldering, screwed, clamped and crimped connections)
13. Methods of attaching markers/labels to components or cables, to assist with identification
14. The tools and equipment used in the installation activities (such as cable stripping tools, crimping tools, soldering irons and torches, gland connecting tools)
15. How to make adjustments to components/assemblies to ensure that they function correctly
16. How to check tools and equipment are free from damage or defects, are in a safe and usable condition
17. The importance of making 'off-load' checks before proving the equipment with the electrical supply on
18. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
19. The calibration/care and control procedures for tools and equipment
20. The problems that can occur with the installation operations, and how these can be overcome
21. The fault-finding techniques to be used if the equipment fails to operate correctly
22. The recording documentation to be completed for the activities undertaken
23. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 48 Assisting in the Installation of Electrical/Electronic Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the electrical/electronic equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of six of the following electrical modules/components (six)</b>				
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				
traywork				
other electrical equipment				
<b>Carry out four of the following installation methods and techniques (four)</b>				
marking out the location of components/modules				
positioning and securing equipment and components				
securing by using mechanical fixings				
drilling and hole preparation				
levelling and/or alignment				
securing by using masonry fixings				

making installation connections				
<b>Carry out four of the following cable termination activities (four)</b>				
stripping cable insulation/protection				
routeing and securing wires and cables				
terminating cables and wires				
making mechanical/screwed/clamped connections				
soldering and de-soldering				
attaching suitable cable identification				
heat shrinking				
crimping				
sealing and protecting cable connections				
adding cable end fittings				
<b>Assist in the connection of equipment to two of the following types of electrical supplies (two)</b>				
single phase				
direct current				
three phase				
low voltage (up to 115V)				
<b>Use two of the following instruments during the installation activities (two)</b>				
multimeter				
insulation resistance tester				
earth-loop impedance tester				
other specific test equipment				
<b>Carrying out three the following checks on the installed equipment (three)</b>				
making visual checks for completeness and freedom from damage				
polarity				
insulation resistance values				
earth-loop impedance				
continuity				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic				
fault finding techniques				
functional testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following standards, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
customer (contractual) standards and requirements				
company standards and procedures				
<b>Assist in the completion of the relevant paperwork, to include one of the following ( one)</b>				

installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

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Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 49 Assisting in the Installation of Equipment to Produce an Engineered System

## Unit Summary

This unit identifies the competences you need to assist in the installation of equipment to produce an engineered system, in accordance with approved procedures. You will be required to assist in the installation of 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 items of equipment that are simple, self-contained items requiring minimal installation. It does, however, include the connection of sub-assemblies where these have been broken down for transportation purposes.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to sensors and actuators which could be electrical, fluid power, water or fuel supply, as appropriate to the equipment installed. Where appropriate, you may also assist in work with PC/PLCs, making connections, installing hardware and loading and editing software. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that the relevant job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying procedures for the installation of an engineered system. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques

- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

**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 of the engineered system:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
  
2. Assist in the installation of an engineered system, which includes installing equipment for **two** of the following interactive technologies:

**(a) Installing mechanical equipment/components:**

Assist in carrying out **all** of the following:

- installing mechanical equipment (such as machine tools, processing plant, turbines engines transfer equipment)
- levelling equipment
- aligning and securing sub-assemblies and units
- connecting units (such as shafts, couplings, belt and chain drives)

Plus **one** of the following:

- 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:**

Assist in carrying out **all** of the following:

- installing electrical equipment (such as switch gear and distribution panels, motors and starters, luminaires)
- attaching suitable cable identification (such as colour coding or numbering systems)
- 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)

Plus **one** of the following:

- terminating cables to electrical components
- terminating cables to main distribution centre

**(c) Installing fluid power components:**

Assist in carrying out **all** of the following:

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

**(d) Installing process controller components:**

Assist in carrying out 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:**

Assist in carrying out all of the following:

installing instrumentation and control equipment (such as pressure, flow, level, temperature, speed, weight, vibration)  
installing and connecting peripherals (such as sensors, actuators, relays, switches)  
installing and connecting process pipework

Plus **one** of the following:

connecting electrical/pneumatic supply to instruments/sensors  
connecting signal transmission supply to instruments/sensors  
checking and confirming that signal measurement and transmission are satisfactory

3. Apply installation methods and techniques, to include **four** of the following:

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

4. Use **two** of the following groups of 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 tester, insulation resistance, earth loop impedance tester)
- fluid/power testing equipment (such as pressure or flow testing devices, speed or temperature measurement)

5. Carry out **all** of the following checks and adjustments as appropriate to the equipment being installed:

- 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 that locking devices are fitted to fasteners
- ensuring that all pipe connections are correctly made, secure and leak free
- ensuring that all moving parts are clear of obstructions and are guarded
- making sensory checks of the system (sight, sound, smell, touch)

Plus assist in carrying out **two** of the following:

- testing that the system operates to the installation specification
- confirm that the correct software has been installed
- ensuring that all electrical connections are correctly made, earth bonding is secure and connections covered

6. Assist in dealing with **two** of the following conditions during the installation process:

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

7. Assist in using fault location methods and techniques on the installation, to include **one** of the following:

- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
  - fault finding techniques (such as six point, half-split, unit substitution)
  - functional testing the installation/running equipment self-diagnostics
8. Produce installations which comply with **all** of the following standards, as appropriate to the equipment being installed:
- equipment manufacturer's operation range
  - BS and/or ISO standards
  - IEE wiring regulations
  - customer (contractual) 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 health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing equipment to form an engineered system, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documentation used in the installation activities (such as installation drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principles of how the system functions, and its operating sequence
8. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. Methods of drilling holes in masonry for rag bolts and expanding bolts (including use of grouting and adhesives)
10. The various mechanical fasteners that will be used, and their method of installation
11. Methods of lifting, handling and supporting the equipment during the installation activities
12. Methods of levelling and aligning the equipment, and the types of tools, instruments and techniques used
13. Methods of connecting to mechanical power transmission devices (such as shafts, couplings belt and chain drives)
14. The different types of cabling used in the installation activities, and their methods of termination
15. The different types of wiring enclosures that are used (to include conduit, trunking and traywork systems)
16. The installation and termination of a range of electrical components (such as plugs, switches, sockets, lighting and fittings)
17. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
18. The care, handling and application of ohmmeters, multimeters and other electrical measuring instruments
19. Methods of assembling and installing pipework, hoses and fittings
20. How to recognise a range of fluid power components
21. Recognition of contaminants and the problems they can create, and the effects and likely symptoms of contamination in the system
22. The recognition of process instrumentation and associated peripherals (such as pressure, flow, temperature)
23. The recognition of PLC systems and associated peripheral devices (such as input/output (I/O) devices)
24. 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)
25. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage)
26. The problems that can occur with the installation operations, and how these can be overcome
27. The fault-finding techniques to be used if 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

**Unit 49**

**Assisting in the Installation of Equipment to Produce an Engineered System**

	<b>performance evidence 1</b>	<b>performance evidence 2</b>	<b>performance evidence 3</b>	<b>additional performance evidence (if required)</b>
evidence type				
date				
<b>Carry out all of the following during the installation of the engineered system (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of an engineered system, which includes installing equipment for two of the following interactive technologies:</b>				
<b>(a) Installing mechanical equipment/components</b>				
<b>Assist in carrying out all of the following (all)</b>				
installing mechanical equipment				
levelling equipment				
aligning and securing sub-assemblies and units				
connecting units				
<b>Plus one of the following:</b>				
setting and adjusting drive mechanisms				
setting and adjusting operating mechanisms				
setting and adjusting control mechanisms				
<b>(b) Installing electrical and electronic equipment/components:</b>				
<b>Assist in carrying out all of the following:</b>				
installing electrical equipment				
attaching suitable cable identification				
installing wiring enclosures/cable protection systems				
installing, routing and securing wires and cables				
<b>Plus one of the following:</b>				
terminating cables to electrical components				
terminating cables to main distribution centre				

<b>(c) Installing fluid power components:</b>				
<b>Assist in carrying out all of the following:</b>				
installing fluid power equipment				
installing fluid power components				
installing rigid and flexible pipework and hoses				
connecting components to pipework, using appropriate fittings				
dressing and securing piping and hoses				
<b>(d) Installing process controller components:</b>				
<b>Assist in carrying out all of the following:</b>				
installing process controllers or sequential controllers				
installing and connecting wires and cables to components				
installing input/output interfacing				
installing program logic peripherals				
checking and confirming that signal measurement and transmission are satisfactory				
<b>(e) Installing instrumentation and control components:</b>				
<b>Assist in carrying out all of the following:</b>				
installing instrumentation and control equipment				
installing and connecting peripherals				
installing and connecting process pipework				
<b>Plus one of the following:</b>				
connecting electrical/pneumatic supply to instruments/sensors				
connecting signal transmission supply to instruments/sensors				
checking and confirming that signal measurement and transmission are satisfactory				
<b>Apply installation methods and techniques, to include four of the following (four)</b>				
marking out positions of all equipment				
drilling and preparing holes				
aligning and levelling equipment				
shimming and packing				
securing by using mechanical fixings (nuts and bolts)				
securing by using adhesives				
applying screw fastener locking devices				
fitting anti-vibration mountings				
moving and positioning equipment, using appropriate lifting and handling equipment				
securing by using masonry fixings				
<b>Use two of the following groups of instruments during the installation activities (two)</b>				

alignment devices)				
linear measuring devices				
electrical measuring equipment				
fluid/power testing equipment				
<b>Carry out all of the following checks and adjustments as appropriate to the equipment being installed (all)</b>				
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 that locking devices are fitted to fasteners				
ensuring that all pipe connections are correctly made, secure and leak free				
ensuring that all moving parts are clear of obstructions and are guarded				
making sensory checks of the system				
<b>Plus assist in carrying out two of the following (two)</b>				
testing that the system operates to the installation specification				
confirm that the correct software has been installed				
ensuring that all electrical connections are correctly made, earth bonding is secure and connections covered				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installation, to include one of the following (one)</b>				
diagnostic aids				
fault finding techniques				
functional testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following standards, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
IEE wiring regulations				
customer (contractual) standards and requirements				
company standards and procedures				
<b>Complete the relevant paperwork, to include one of the following, and pass it to the appropriate people (one)</b>				
installation records				
company specific				

documentation				
job card				

Knowledge and understanding reference:

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Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 50 Assisting in the Installation of Instrumentation and Control Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of instrumentation and control equipment, in accordance with approved procedures. You will be required to assist in the installation of a range of instrumentation and control equipment such as pressure, flow, level, and temperature monitoring and control equipment, fiscal monitoring equipment, 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.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that the relevant job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying installation procedures to instrumentation and control equipment. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 you 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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner

- h. Assist in the completion of installation documentation

**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 of the instrumentation and control equipment:

- adhere to risk assessment, COSHH and other relevant safety standards
- confirm that authorisation to carry out the installation activities has been given
- check that safe access and working arrangements for the installation area have been provided
- confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
- check that all required installation consumables are available
- leave the work area in a safe condition and free from foreign object debris

2. Assist in the installation of **one** of the following types of instrumentation and control equipment:

- pressure monitoring/control
- flow monitoring/control
- level 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 (such as indexing, positioning, sequencing)

3. Carry out **all** of the following installation methods and techniques:

- positioning and securing equipment/components
- making mechanical connections
- proof marking/labelling of wires or components
- installing and connecting process pipework
- tightening fastenings to the required torque
- making installation connections (such as mechanical, electrical, fluid power, utilities)
- taking electrostatic discharge (ESD) precautions when handling components/circuit boards (as appropriate)

**Plus** assist in carrying out **two** of the following:

- installing electrical/electronic components
- setting, calibrating and adjusting instruments
- installing and connecting peripherals (such as sensors, actuators, relays, switches, back-up batteries)
- connecting the electrical/pneumatic supply to instruments/sensors
- connecting the signal transmission supply to instruments/sensors

4. Assist in using **two** of the following types of instrumentation test and calibration equipment:

- 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

5. Carry out **all of** the following checks and adjustments, as appropriate to the equipment being installed:

- making visual checks for completeness and freedom from damage
- making sensory checks (sight, sound, smell, touch)
- checking the system for leaks
- checking security of connections/terminations

**Plus** assist in carrying out **two** more from the following:

- checking signal transmission (electrical, electronic, pneumatic, mechanical)
- confirming that signal measurement and transmission are satisfactory
- final start-up of the system and removal of any trip defeats
- testing that the equipment operates to the installation specification

6. Assist in dealing with **two** of the following conditions during the installation process:

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

7. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:

diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)

- fault finding techniques (such as six point, half-split, unit substitution)
- function testing the installation/running equipment self-diagnostics

8. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- equipment manufacturer's operation range
- IEE wiring regulations
- BS and/or ISO standards
- customer (contractual) 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 health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during installation process
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principles of how the equipment functions, and its operating sequence
8. The reasons for making sure that control systems are isolated or put into manual control, and that appropriate trip locks or keys are inserted, before removing any sensors or instruments from the system
9. The identification of instrument sensors (including how to identify their markings, calibration information, component values, operating parameters and working range)
10. The correct way of fitting instruments to avoid faulty readings (caused by head correction, poor flow past the sensor, blockages, incorrect wiring, poor insulation, or incorrect materials)
11. How to carry out visual checks of the instruments (checking for leaks, security of joints and physical damage)
12. Methods of attaching identification marks/labels to components or cables
13. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
14. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
15. The procedure for the safe disposal of waste materials
16. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
17. 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
18. The problems that can occur with the installation operations, and how these can be overcome
19. The fault finding techniques to be used if the equipment fails to operate correctly
20. The recording documentation to be completed for the activities undertaken
21. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

**Unit 50**

**Assisting in the Installation of Instrumentation and Control Equipment**

	<b>performance evidence 1</b>	<b>performance evidence 2</b>	<b>performance evidence 3</b>	<b>additional performance evidence (if required)</b>
evidence type				
date				
<b>Carry out all of the following during the installation of the instrumentation and control equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of one of the following types of instrumentation and control equipment (one)</b>				
pressure monitoring/control				
flow monitoring/control				
level 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				
<b>Carry out all of the following installation methods and techniques (all)</b>				
positioning and securing equipment/components				
making mechanical connections				
proof marking/labelling of wires or components				
installing and connecting process pipework				
tightening fastenings to the required torque				
making installation connections				
taking electrostatic discharge (ESD) precautions when handling components/circuit boards				
<b>Plus assist in carrying out two of the following (two)</b>				
installing electrical/electronic				

components				
setting, calibrating and adjusting instruments				
installing and connecting peripherals				
connecting the electrical/pneumatic supply to instruments/sensors				
connecting the signal transmission supply to instruments/sensors				
<b>Assist in using two of the following types of instrumentation test and calibration equipment (two)</b>				
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				
<b>Carry out all of the following checks and adjustments, as appropriate to the equipment being installed (all)</b>				
making visual checks for completeness and freedom from damage				
making sensory checks				
checking the system for leaks				
checking security of connections/terminations				
<b>Plus assist in carrying out two more from the following:</b>				
checking signal transmission				
confirming that signal measurement and transmission are satisfactory				
final start-up of the system and removal of any trip defeats				
testing that the equipment operates to the installation specification				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic aids				
fault finding techniques				
function testing the				

installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
customer (contractual) standards and requirements				
company standards and procedures				
<b>Complete the relevant paperwork, to include one of the following, and pass it to the appropriate people (one)</b>				
installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 51 Assisting in the Installation of Fluid Power Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of fluid power equipment, in accordance with approved procedures. You will be required to assist in the installation of a range of fluid power equipment, such as hydraulic, pneumatic or 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.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, align and connect various fluid power components, and to make all necessary connections to the required service. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that the relevant job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying fluid power installation procedures. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

## 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 of the fluid power equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
  
2. Assist in the installation of **one** of the following types of fluid power systems:
  - pneumatic
  - hydraulic
  - vacuum
  
3. Assist in the installation of **eight** the following fluid power components:
  - rigid pipework
  - filters pumps
  - reservoirs/storage
  - compressors
  - accumulators
  - lubricators
  - gaskets and seals
  - regulators pressure intensifiers
  - receivers
  - switches
  - hoses
  - cylinders
  - valves
  - actuators
  - sensors
  - other (specify)
  
4. Carry out the installation by applying **five** of the following methods and techniques:
  - marking out of locating and securing positions
  - drilling and hole preparation
  - positioning equipment/components
  - aligning pipework and connections
  - dressing and securing piping and hoses
  - connect wires and cables
  - securing by using mechanical fixings
  - securing by using masonry fixings
  - applying screw fastener locking devices
  - applying hose/cable clips and fasteners
  - making installation connections (such as mechanical, electrical, fluid power, utilities)
  
5. 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

6. Carry out **all** of the following checks and adjustments, as appropriate to the equipment being installed:

- leak checks
- making 'off-load' checks
- checking level and alignment
- making visual checks for completeness and freedom from damage
- making sensory checks (sight, sound, smell, touch)
- ensuring that moving parts are clear of obstruction and/or are guarded

**Plus** assist in carrying out **two** of the following

- setting system pressure/flow
- pressurising the system
- line pressure checks
- flow checks
- check the sequencing of the system
- ensuring that locking devices are fitted to fasteners (where appropriate)
- testing to ensure that the equipment operates to the installation specifications

7. Assist in dealing with **two** of the following conditions during the installation process:

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

8. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:

- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
- fault finding technique (such as six point, half-split, unit substitution)
- function testing the installation/running equipment self-diagnostics

9. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- equipment manufacturer's operation range
- BS and/or ISO standards
- customer (contractual) standards and requirements
- company standards and procedures

10. Assist in the completion of relevant paperwork, to include **one** of the following:

- installation records
- company specific documentation
- job card

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing fluid power equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, symbols and terminology)
7. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
8. Methods of drilling holes for rag bolts and expanding bolts (including the use of grouting and adhesives)
9. The various mechanical fasteners that will be used, and their method of installation (including threaded fasteners, dowels, special securing devices, masonry fixing devices)
10. The basic principles of how the equipment functions, and its operating sequence
11. How to identify the various components that are to be installed (such as valves, cylinders, actuators, sensors, pumps)
12. How to determine the direction of flow of the components, and their position within the system
13. The application and fitting of static and dynamic seals
14. Recognition of contaminants and the problems they can create, and the effects and likely symptoms of contamination in the system
15. The techniques used during installation of fluid power equipment (release of pressures/force, cylinder/valve movement, sequencing)
16. Procedures for ensuring that you have the correct tools, equipment and consumables for the installation activities
17. 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)
18. Methods of lifting, handling and supporting the equipment during the installation activities
19. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and any fuel supplies)
20. The procedure for the safe disposal of waste materials
21. 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
22. Completion of documentation for the activities undertaken
23. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve



## Unit 51 Assisting in the Installation of Fluid Power Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the fluid power equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of one of the following types of fluid power systems (one)</b>				
pneumatic				
hydraulic				
vacuum				
<b>Assist in the installation of eight the following fluid power components (eight)</b>				
rigid pipework				
filters pumps				
reservoirs/storage				
compressors				
accumulators				
lubricators				
gaskets and seals				
regulators pressure intensifiers				
receivers				
switches				
hoses				
cylinders				
valves				
actuators				
sensors				
other (specify)				
<b>Carry out the installation by applying five of the following methods and techniques (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				
positioning equipment/components				
aligning pipework and connections				
dressing and securing piping and hoses				
connect wires and cables				
securing by using mechanical				

fixings				
securing by using masonry fixings				
applying screw fastener locking devices				
applying hose/cable clips and fasteners				
making installation connections				
<b>Use three of the following instruments during the installation activities (three)</b>				
pressure testing devices				
flow testing devices				
mechanical measuring devices				
bleeding devices				
alignment devices				
electrical measuring devices				
<b>Carry out all of the following checks and adjustments, as appropriate to the equipment being installed (all)</b>				
leak checks				
making 'off-load' checks				
checking level and alignment				
making visual checks for completeness and freedom from damage				
making sensory checks				
ensuring that moving parts are clear of obstruction and/or are guarded				
<b>Plus assist in carrying out two of the following (two)</b>				
setting system pressure/flow				
pressurising the system				
line pressure checks				
flow checks				
check the sequencing of the system				
ensuring that locking devices are fitted to fasteners				
testing to ensure that the equipment operates to the installation specifications				
<b>Assist in dealing with two of the following conditions during the installation process</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic				
fault finding technique				
function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
customer (contractual) standards and requirements				
company standards and procedures				

<b>Assist in the completion of relevant paperwork, to include one of the following (one)</b>				
installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 52 Assisting in the Installation of Process Control Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of process control equipment, in accordance with approved procedures. You will be required to assist in the installation of a range of process control equipment, which typically includes process controllers or sequential controllers (such as programmable logic controllers (PLCs), or equipment controlled by personal computers (PCs)), and which are working in an integrated system involving two or more of the following interactive technologies: mechanical, electrical or fluid power. You will also install peripheral components and communication links, and assist with the loading/downloading of 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.

You will be required to use the appropriate tools and equipment throughout the installation, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to 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 checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that the relevant job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying installation procedures for process controllers. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved

- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

**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 of the process controller equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
2. Assist in the installation of **one** of the following types of process control systems:
  - monitoring system
  - safety system
  - diagnostic system
  - combination system
  - process/product control system
  - business management system
3. Assist in the installation of **one** of the following process controllers:
  - fixed I/O units
  - rack mount controller units
  - modular controller units
4. Assist in the installation of **one** of the following:
  - electrical wires and cables
  - trunking and traywork
  - conduit

**Plus** assist in the installation/connection of **three** of the following:

- sensors
  - actuators
  - switches
  - motor starters
  - modems
  - printers
  - PC peripheral devices
  - panels and sub-assemblies
  - signal transmission components/cables
  - overload protection devices
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 bolts or expanding bolts)
    - positioning equipment
    - connecting wires and cables
    - securing by using mechanical fixings
    - securing by using masonry fixings
    - levelling and alignment equipment
    - making installation connections (such as mechanical, electrical, fluid power, utilities)
  6. Carry out **four** 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  
routing and securing 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 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** the following checks and adjustments, as appropriate to the equipment being installed:

- making sensory checks (sight, sound, smell)
- making 'off-load' checks
- making visual checks for completeness and freedom from damage
- ensuring that moving parts are clear of obstruction and/or are guarded

**Plus** assist in carrying out **two** of the following:

- checking signal transmission
- checking the security of connections/terminations
- confirming that the correct software has been installed
- testing to ensure that the equipment operates to the installation specification
- final start-up of the system and removal of any trip defeats

9. Assist in dealing with **two** of the following conditions during the installation process:

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

10. Assist in using fault location methods and techniques on the installed equipment to include **one** of the following:

- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
- fault finding techniques (such as six point, half-split, unit substitution)
- function testing the installation/running equipment self-diagnostics

11. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- equipment manufacturer's operation range
- IEE wiring regulations
- BS and/or ISO standards
- company standards and procedures
- customer (contractual) standards and requirements

12. Assist in the completion of the relevant paperwork, to include **one** of the following:

- installation records
- company specific documentation
- job card

**Knowledge statements:**

**You must have knowledge and understanding of:**

1. The health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing process control equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. Methods of drilling holes for rag bolts and expanding bolts (including the use of grouting and adhesives)
8. The various mechanical fasteners that will be used, and their method of installation
9. Procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
10. The types of tools, instruments and techniques used to position align, level, secure and adjust the equipment
11. Methods of lifting, handling and supporting the equipment during the installation activities
12. The basic principles of how the system functions, and its operating sequence
13. The techniques used to connect PLC equipment (plugs, soldering, screwed, clamped and crimped connections)
14. The use of IEE wiring, and other, regulations when selecting wires and cables, and when carrying out tests on systems
15. The devices and systems for storing programs
16. The different types of interface cards
17. The numbering system and codes used for identification of inputs and outputs
18. How to interpret a program within the process controller for specific elements
19. How to make adjustments to components to ensure that they function correctly
20. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
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 dry connections, communication difficulties, 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 are correctly covered/protected
24. The problems that can occur with the installation operations, and how these can be overcome
25. The fault-finding techniques to be used if the equipment fails to operate correctly
26. The recording documentation to be completed for the activities undertaken
27. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 52 Assisting in the Installation of Process Controller Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the process controller equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of one of the following types of process control systems (one)</b>				
monitoring system				
safety system				
diagnostic system				
combination system				
process/product control system				
business management system				
<b>Assist in the installation of one of the following process controllers (one)</b>				
fixed I/O units				
rack mount controller units				
modular controller units				
<b>Assist in the installation of one of the following (one)</b>				
electrical wires and cables				
trunking and traywork				
conduit				
<b>Plus assist in the installation/connection of three of the following (three)</b>				
sensors				
actuators				
switches				
motor starters				
modems				
printers				
PC peripheral devices				
panels and sub-assemblies				
signal transmission components/cables				
overload protection devices				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				



fitting inserts				
positioning equipment				
connecting wires and cables				
securing by using mechanical fixings				
securing by using masonry fixings				
levelling and alignment equipment				
making installation connections				
<b>Carry out four of the following cable termination activities (four)</b>				
terminating armoured cables				
terminating mineral cables				
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				
crimping				
stripping cable insulation/protection				
adding cable end fittings				
<b>Carry out all the following checks and adjustments, as appropriate to the equipment being installed (all)</b>				
making sensory checks				
making 'off-load' checks				
making visual checks for completeness and freedom from damage				
ensuring that moving parts are clear of obstruction and/or are guarded				
<b>Plus assist in carrying out two of the following (two)</b>				
checking signal transmission				
checking the security of connections/terminations				
confirming that the correct software has been installed				
testing to ensure that the equipment operates to the installation specification				
final start-up of the system and removal of any trip defeats				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment to include one of the following (one)</b>				
diagnostic aids				
fault finding techniques				

function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
IEE wiring regulations				
BS and/or ISO standards				
company standards and procedures				
customer (contractual) standards and requirements				
<b>Assist in the completion of the relevant paperwork, to include one of the following (one)</b>				
installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

## Unit 53 Assisting in the Installation of Emergency Electrical Power Generation Equipment

### Unit Summary

This unit identifies the competences you need to assist in the installation of emergency electrical power generation equipment, in accordance with approved procedures. You will be required to assist in the installation of 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 removal and replacement of existing equipment.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 the relevant job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying installation procedures to emergency power generation equipment. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

#### **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 of the emergency electrical power generation equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided

- confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
2. Assist in the installation of **one** of the following types of emergency power generation equipment:
- turbine alternator sets
  - piston engine alternator sets
  - generators
3. Apply **five** of the following installation methods and techniques:
- marking out of locating and securing positions
  - drilling and hole preparation
  - fitting inserts (such as rag or expanding bolts)
  - positioning equipment
  - making installation connections (such as mechanical, electrical, fluid power, utilities)
  - aligning equipment
  - levelling equipment
  - shimming and packing
  - fitting anti-vibration mountings
  - securing by using mechanical fixings
  - applying screw fastener locking devices
4. Assist in the movement and positioning of 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
5. Use **two** of the following instruments during the installation activities:
- straight edges and feeler gauges
  - engineers' levels
  - dial test indicators
  - electrical meters
  - plumb lines and taut wires
  - alignment telescopes
  - laser equipment
  - mechanical measuring devices

6. Carry out **all** of the following checks and adjustments, as appropriate to the equipment being installed:
- checking level and alignment
  - making 'off-load' checks
  - checking consumables (oil, water, fuel)
  - making visual checks for completeness and freedom from damage
  - checking the security of connections (mechanical, electrical, service supplies)
  - making sensory checks (sight, sound, smell, touch)
  - ensuring that moving parts are clear of obstruction, and are guarded
  - ensuring that locking devices are fitted to fasteners (where appropriate)

**Plus** assist in carrying out **three** more from the following:

testing to ensure that the equipment operates to the installation specification  
checking for the correct operation of all safety devices

- adjusting settings and working clearances
- testing the system for leaks
- checking electrical integrity
- checking torque settings of fasteners
- checking automatic/power failure switching system

7. Assist in dealing with **two** of the following conditions during the installation process:

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

8. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:

diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)

- fault finding techniques (such as six point, half-split, unit substitution)
- function testing the installation/running equipment self-diagnostics

9. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- equipment manufacturer's operation range
- BS and/or ISO standards
- customer (contractual) standards and requirements
- company standards and procedures

10. Assist in the completion of the relevant paperwork, to include **one** of the following:

- installation records
- company specific documentation
- job card

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing emergency electrical power generation equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
8. Methods of drilling holes for rag bolts and expanding bolts (including the use of grouting and adhesives)
9. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, dowels, special securing devices, masonry fixing devices)
10. The torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved
11. Procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
12. The techniques and types of tools and instruments used to position, align, level, adjust and secure the equipment (such as spanners, wrenches, crowbars, torque wrenches, engineers' levels, alignment telescopes and laser devices)
13. Methods of lifting, handling and supporting the equipment during the installation activities
14. Methods of connecting to mechanical power transmission devices
15. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
16. The basic principles of how the equipment functions, and its operating sequence
17. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
18. The procedure for the safe disposal of waste materials
19. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
20. 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
21. The problems that can occur with the installation operations, and how these can be overcome
22. The fault finding techniques to be used if the equipment fails to operate correctly
23. The recording documentation to be completed for the activities undertaken
24. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

**Unit 53      Assisting in the Installation of Emergency Electrical Power Generation Equipment**

	<b>performance evidence 1</b>	<b>performance evidence 2</b>	<b>performance evidence 3</b>	<b>additional performance evidence (if required)</b>
evidence type				
date				
<b>Carry out all of the following during the installation of the emergency electrical power generation equipment:</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
check that safe access and working arrangements for the installation area have been provided				
confirm that services have been safely isolated, ready for the installation				
check that all installation consumables are available				
<b>Assist in the installation of one of the following types of emergency power generation equipment (one)</b>				
turbine alternator sets				
piston engine alternator sets				
generators				
<b>Apply five of the following installation methods and techniques (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				
fitting inserts				
positioning equipment				
making installation connections				
aligning equipment				
levelling equipment				
shimming and packing				
fitting anti-vibration mountings				
securing by using mechanical fixings				
applying screw fastener locking devices				
<b>Assist in the movement and positioning of equipment, using two of the following (two)</b>				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers/skates				
hoists				
jacks				
manual handling and moving loads				
<b>Use two of the following instruments during the installation activities (two)</b>				
straight edges and feeler gauges				
engineers' levels				

dial test indicators				
electrical meters				
plumb lines and taut wires				
alignment telescopes				
laser equipment				
mechanical measuring devices				
<b>Carry out all of the following checks and adjustments, as appropriate to the equipment being installed (all)</b>				
checking level and alignment				
making 'off-load' checks				
checking consumables				
making visual checks for completeness and freedom from damage				
checking the security of connections				
making sensory checks (				
ensure moving parts are clear of obstruction, and are guarded				
ensuring that locking devices are fitted to fasteners				
<b>Plus assist in carrying out three more from the following (three)</b>				
testing to ensure that the equipment operates to the installation specification				
checking for the correct operation of all safety devices				
adjusting settings and working clearances				
testing the system for leaks				
checking electrical integrity				
checking torque settings of fasteners				
checking automatic/power failure switching system				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic aids				
fault finding techniques				
function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
customer (contractual) standards and requirements				
company standards and procedures				
<b>Assist in the completion of the relevant paperwork, to include one of the following (one)</b>				
installation records				
company specific documentation				



job card				
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Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

# Unit 54 Assisting in the Installation of Environmental Pollution Control Equipment

## Unit Summary

This unit identifies the competencies you need to assist in the installation of environmental pollution control equipment, in accordance with approved procedures. You will be required to assist in the installation of equipment for an environmental pollution control system, which could be air pollution control equipment (such as decarbonisation (CO<sub>2</sub> reduction), denitrification, 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).

This unit does not involve maintenance/repair type activities, such as removal and replacement of existing equipment.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment and to make connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check 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 to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying mechanical installation procedures. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification

- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

**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 of the environmental pollution control equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
  
2. Assist in the installation of **one** of the following types of environmental pollution control equipment:
  - air pollution control equipment (such as decarbonisation (CO<sub>2</sub> reduction), denitrification, 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)
  
3. Assist in the installation of **eight** of the following components:
  - annunciator
  - distribution board
  - switch gear
  - instrumentation
  - pipework and hoses
  - safety device
  - monitoring device
  - couplings or linkages
  - relays or solenoids
  - actuators
  - mechanical drives
  - burners
  - containment booms
  - floor baseplates
  - gear boxes
  - motors
  - sensors
  - cables and wires
  - wiring enclosures
  - switches
  - ducting
  - pumps
  - safety devices
  - motor and starter
  - control panel
  - building management device
  
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 the equipment
- making installation connections (such as mechanical, electrical, fluid power, utilities)
- aligning equipment
- levelling equipment
- shimming and packing
- fitting anti-vibration mountings
- securing by using mechanical fixings
- applying screw fastener locking devices

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

- straight edges and feeler gauges
- engineers' 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)
- plumb lines/taut wires
- alignment telescopes
- laser equipment
- self-diagnostic equipment
- theodolite
- vibration transducer

6. Assist in the movement and positioning equipment using **two** of the following

- slings
- cranes
- fork lift
- portable lifting devices
- block and tackle
- rollers/skates
- hoists
- jacks
- manual handling

7. Carry out **all** of the following checks, and make corrections/adjustments as appropriate:

- making 'on-load' checks
- checking level and alignment
- lubrication effects
- checking for leaks
- making sensory checks (sight, sound, smell, touch)
- ensuring that dangerous areas are properly guarded
- checking torque settings of fasteners

**Plus** assist in carrying out **two** of the following checks:

- assembly fits
- mechanical integrity
- electrical integrity
- temperature levels
- system pressures and flows
- speeds and feeds
- vibration levels
- testing to ensure that the equipment meets the requirements of the installation

8. Assist in dealing with **two** of the following conditions during the installation process:

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

9. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:

- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
- fault finding technique (such as six point, half-split, unit substitution)
- function testing the installation/running equipment self-diagnostics

10. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- equipment manufacturer's operation range
- BS and/or ISO standards
- customer standards and requirements
- company standards and procedures
- IEE wiring regulations

11. Assist in the completion of the relevant paperwork, to include **one** from one of the following:

- 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 environmental pollution control equipment (including the related legislation, regulations and recommendations such as the Water Regulations Advisory Scheme (WRAS), The Prevention and Control of Legionellosis, and Safe Working in Confined Spaces, CE supply of machinery regulations)
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and to the particular plant and site installation details
4. The hazards associated with installing environmental pollution control equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principles of how the equipment functions, and its operating sequence
8. Methods and techniques used to position, assemble, align and secure the plant and equipment
9. Methods of making holes for floor fixing bolts (including the use of various fittings, grouting and adhesives)
10. The various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
11. Procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
12. Methods of lifting, handling and supporting the equipment
13. Checks, tests, corrections and adjustments to ensure proper equipment safety, integrity, operation and accuracy
14. Connecting equipment to external supplies (such as electric, air, water and gas)
15. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
16. The procedure for the safe disposal of waste materials
17. Recognising defects (such as leaks, misalignment, component looseness, damage, or contamination)
18. The importance of ensuring that the completed installation is left in a safe, clean and damage-free state
19. The dangers of leaving any exposed potential energy sources (these must be made safe)
20. Typical problems that can occur during the installation, and how these can be overcome
21. The fault finding techniques to be used if the equipment fails to operate correctly
22. The recording documentation to be completed for the activities undertaken
23. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 54      Assisting in the Installation of Environmental Pollution Control Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the environmental pollution control equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of one of the following types of environmental pollution control equipment (one)</b>				
air pollution control equipment				
effluent treatment equipment				
noise and vibration equipment				
waste and used product handling, storing and recycling equipment				
<b>Assist in the installation of eight of the following components (eight)</b>				
annunciator				
distribution board				
switch gear				
instrumentation				
pipework and hoses				
safety device				
monitoring device				
couplings or linkages				
relays or solenoids				
actuators				
mechanical drives				
burners				
containment booms				
floor baseplates				
gear boxes				
motors				
sensors				
cables and wires				
wiring enclosures				
switches				
ducting				
pumps				
safety devices				

motor and starter				
control panel				
building management device				
<b>Apply installation methods and techniques to include five of the following (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				
fitting inserts				
positioning the equipment				
making installation connections				
aligning equipment				
levelling equipment				
shimming and packing				
fitting anti-vibration mountings				
securing by using mechanical fixings				
applying screw fastener locking devices				
<b>Use three of the following instruments during the installation activities (three)</b>				
straight edges and feeler gauges				
engineers' levels				
dial test indicators				
mechanical measuring instruments				
electrical measuring instruments				
fluid power measuring equipment				
plumb lines/taut wires				
alignment telescopes				
laser equipment				
self-diagnostic equipment				
theodolite				
vibration transducer				
<b>Assist in the movement and positioning equipment using two of the following (two)</b>				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers/skates				
hoists				
jacks				
manual handling				
<b>Carry out all of the following checks, and make corrections/adjustments as appropriate (all)</b>				
making 'on-load' checks				
checking level and alignment				
lubrication effects				
checking for leaks				
making sensory checks				
ensuring that dangerous areas are properly guarded				
checking torque settings of fasteners				
Plus assist in carrying out two of the following checks (two)				
assembly fits				
mechanical integrity				
electrical integrity				



temperature levels				
system pressures and flows				
speeds and feeds				
vibration levels				
testing to ensure that the equipment meets the requirements of the installation				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic aids				
fault finding technique				
function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
customer standards and requirements				
company standards and procedures				
IEE wiring regulations				
<b>Assist in the completion of the relevant paperwork, to include one from one of the following (one)</b>				
installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 55 Assisting in the Installation of Workplace Environmental Control Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of workplace environmental control equipment, in accordance with approved procedures. You will be required to assist in the installation of 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. 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, control panels, printed circuit boards, controller units, computer systems, peripheral devices and environmental monitoring and targeting software.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check 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 to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying installation procedures to workplace environmental control equipment. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

**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 of the workplace environmental control equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
  
2. Assist in the installation of equipment for workplace environmental control systems that control/monitor **two** of the following:
  - heating and ventilation
  - air conditioning and ventilation
  - boilers
  - lighting
  - CCTV
  - chillers
  - lift control
  - fire systems
  - intruder/alarm systems
  - building/room access
  - other specific system
  
3. Assist in the installation of **one** of the following:
  - trunking and traywork
  - electrical cables
  - network cables

**Plus** assist with the installation of **five** of the following:

- motor starters
  - vents/diffusers
  - switches
  - sensors
  - thermostats
  - electronic meters
  - heating elements
  - actuators
  - electronic control panels
  - circuit protection devices
  - safety systems
  - overload protection devices
  - annunciation panel
  - printed circuit boards
  - monitoring equipment
  - modems
  - building management system (BMS) remote PC
  - BMS controller units
  - BMS terminal (PC, server)
  - PC peripheral devices
  - monitoring/targeting software
  - inverters
  - uninterruptible power supplies
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 bolts or expanding bolts)
- positioning the equipment
- levelling the equipment
- connecting wires and cables
- securing by using mechanical fixings
- securing by using masonry fixings
- applying cable clips and ties
- making installation connections (such as mechanical, electrical, fluid power, utilities)

5. Carry out **five** of the following installation activities:

terminating mineral and armoured cables  
 bending and forming conduit  
 bending and forming trunking and trays  
 sealing and protecting cable connections  
 making mechanical/screwed/clamped connections  
 attaching suitable cable identification  
 attach equipment identification labels/markers

- heat shrinking (devices and boots)
- crimping (tags and pins)
- stripping cable insulation/protection
- removing cable end fittings
- extracting/inserting components
- routing and securing wires and cables
- soldering and de-soldering

6. Use **three** of the following instruments 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 equipment

7. Carry out **all** of the following checks and adjustments, as appropriate to the equipment being installed:

- making visual checks for completeness and freedom from damage
- making sensory checks (sight, sound, smell, touch)
- checking the security of connections/terminations
- checking the system for leaks

**Plus** assist with **three** more from the following:

- checking signal transmission (electrical, electronic, pneumatic, mechanical)
- confirming that signal measurement and transmission are satisfactory
- checking and modifying software programs
- final start-up of the system and removal of any trip defeats
- testing that the equipment operates to the installation specification

8. Assist in dealing with **two** of the following conditions during the installation process:

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

9. Assist in using fault location methods and techniques on the installed equipment to include **one** of the following:
- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
  - fault finding techniques (such as six point, half-split, unit substitution)
  - function testing the installation/running equipment self-diagnostics
10. Produce installations which comply with **two** or more of the following standards:
- equipment manufacturer's operation range
  - BS and/or ISO standards
  - company standards and procedures
  - customer standards and requirements
11. Assist in the completion of relevant paperwork, to include **one** from the following:
- installation records
  - company specific documentation
  - job card

**Knowledge statements:**

***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
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 importance of wearing protective clothing and other appropriate safety equipment during the installation process
6. How to obtain and interpret information from drawings and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. Procedures for ensuring that you have the correct tools, equipment and fasteners for the installation activities
8. The types of tools and instruments used to position, secure and align the equipment
9. The techniques used to position, align, level, adjust and secure the equipment
10. Methods of lifting, handling and supporting the equipment during the installation activities
11. The basic principles of how the equipment functions, and its operating sequence
12. The techniques used to assemble electrical equipment (plugs, soldering, screwed, clamped and crimped connections)
13. The use of IEE wiring, and other, regulations when selecting wires and cables, and when carrying out tests on systems
14. How to make adjustments to components to ensure that they function correctly
15. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, gas and water supplies)
16. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
17. The devices and systems for storing programs
18. How to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation
19. How to recognise installation defects (such as leaks, poor seals, misalignment, foreign object damage or contamination)
20. The problems that can occur with the installation operations, and how these can be overcome
21. The fault finding techniques to be used if the equipment fails to operate correctly
22. The recording documentation to be completed for the activities undertaken
23. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

**Unit 55      Assisting in the Installation of Workplace Environmental Control Equipment**

	<b>performance evidence 1</b>	<b>performance evidence 2</b>	<b>performance evidence 3</b>	<b>additional performance evidence (if required)</b>
evidence type				
date				
<b>Carry out all of the following during the installation of the workplace environmental control equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of equipment for workplace environmental control systems that control/monitor two of the following (two)</b>				
heating and ventilation				
air conditioning and ventilation				
boilers				
lighting				
CCTV				
chillers				
lift control				
fire systems				
intruder/alarm systems				
building/room access				
other specific system				
<b>Assist in the installation of one of the following (one)</b>				
trunking and traywork				
electrical cables				
network cables				
<b>Plus assist with the installation of five of the following (five)</b>				
motor starters				
vents/diffusers				
switches				
sensors				
thermostats				
electronic meters				
heating elements				
actuators				
electronic control panels				
circuit protection devices				
safety systems				
overload protection devices				
annunciation panel				

printed circuit boards				
monitoring equipment				
modems				
building management system (BMS) remote PC				
BMS controller units				
BMS terminal (PC, server)				
PC peripheral devices				
monitoring/targeting software				
inverters				
uninterruptible power supplies				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				
fitting inserts				
positioning the equipment				
levelling the equipment				
connecting wires and cables				
securing by using mechanical fixings				
securing by using masonry fixings				
applying cable clips and ties				
making installation connections				
<b>Carry out five of the following installation activities (five)</b>				
terminating mineral and armoured cables				
bending and forming conduit				
bending and forming trunking and trays				
sealing and protecting cable connections				
making mechanical/screwed/clamped connections				
attaching suitable cable identification				
attach equipment identification labels/markers				
heat shrinking				
crimping				
stripping cable insulation/protection				
removing cable end fittings				
extracting/inserting components				
routeing and securing wires and cables				
soldering and de-soldering				
<b>Use three of the following instruments during the installation activities (three)</b>				
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 equipment				
<b>Carry out all of the following checks and adjustments, as appropriate to the equipment being installed(all)</b>				
making visual checks for completeness and freedom from damage				
making sensory checks				
checking the security of connections/terminations				
checking the system for leaks				
<b>Plus assist with three more from the following(three)</b>				
checking signal transmission				
confirming that signal measurement and transmission are satisfactory				
checking and modifying software programs				
final start-up of the system and removal of any trip defeats				
testing that the equipment operates to the installation specification				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment to include one of the following (one)</b>				
diagnostic aids				
fault finding techniques				
function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with two or more of the following standards (two)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
company standards and procedures				
customer standards and requirements				
<b>Assist in the completion of relevant paperwork, to include one from the following (one)</b>				
installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

## Unit 56 Assisting in the Installation of Heating and Ventilation Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of heating and ventilation equipment, in accordance with approved procedures. You will be required to assist in the installation of a range of heating and ventilation equipment, which will include one of the following primary heating sources such as gaseous, liquid, solid fuel, electricity and renewable energy. This will also include the installation of 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 removal and replacement of existing equipment.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check that all tools, equipment and materials used in the installation activities are removed from the work area on completion of the work, and that the relevant job/task documentation is completed accurately and legibly. You will be expected to work to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying heating and ventilation installation procedures. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Assist in the completion of installation documentation

### 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 of the heating and ventilation equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given

- check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
2. Assist in the installation of equipment for **one** of the following types of heating and ventilation systems:
- liquid
  - gaseous
  - solid fuel
  - renewable energy
  - electrical
3. Assist in the installation of **eight** of the following components:
- pipework
  - boiler
  - motors
  - fans
  - blowers
  - pumps
  - calorifiers
  - gauges/indicators
  - regulators
  - sensors and actuators
  - condenser
  - valves
  - control devices
  - radiators
  - safety devices
  - ducting/trunking
  - electrical wiring and connectors
  - electrical components
  - other components (specify)
4. Apply installation methods and techniques, to include **five** of the following:
- marking out of locating and securing positions
  - drilling and hole preparation
  - positioning equipment/components
  - aligning pipes, connections, ducting and equipment
  - dressing and securing piping and hoses
  - making installation connections (such as mechanical, electrical, fluid power, utilities)
  - fitting anti-vibration mountings
  - securing by using mechanical fixings
  - securing by using masonry fixings
  - applying screw fastener locking devices
  - applying hose/cable clips and fasteners
  - levelling the equipment
5. Assist in the movement and positioning of 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 **five** of the following instruments 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

7. Carry out **all of** the following checks and adjustments, as appropriate to the equipment being installed:

- setting working clearance
- leak testing
- making 'off-load' checks
- checking level and alignment
- making visual checks for completeness and freedom from damage
- making sensory checks (sight, sound, smell, touch)
- ensuring that moving parts are clear of obstruction and are guarded

**Plus** assist with **four** more from the following:

- flow checks
- pressurising system
- line pressure tests
- checking torque settings of fasteners
- ensuring that locking devices are fitted to fasteners (*where appropriate*)
- testing that the equipment operates to the installation specification

8. Assist in dealing with **two** of the following conditions during the installation process:

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

9. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:

- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
- fault finding techniques (such as six point, half-split, unit substitution)
- function testing the installation/running equipment self-diagnostics

10. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- equipment manufacturer's operation range
- BS and/or ISO standards
- IEE wiring regulations
- customer (contractual) standards and requirements
- company standards and procedures

11. Assist in the completion of the relevant paperwork, to include **one** of the following:

- installation records
- company specific documentation
- job card

### **Knowledge statements:**

**You must have knowledge and understanding of:**

1. The health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies

3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing heating and ventilation equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principles of how the equipment functions, and its operating sequence
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 bolts 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, special securing devices, masonry fixing devices)
11. Procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
12. The techniques used to position, align, level, adjust and secure the equipment
13. Methods of lifting, handling and supporting the equipment during the installation activities
14. Methods of connecting equipment to service supplies (such as electrical, compressed air, oil and fuel supplies)
15. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
16. The procedure for the safe disposal of waste materials
17. 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)
18. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
19. 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
20. The problems that can occur with the installation operations, and how these can be overcome
21. The fault finding techniques to be used if the equipment fails to operate correctly
22. The recording documentation to be completed for the activities undertaken
23. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 56 Assisting in the Installation of Heating and Ventilation Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the heating and ventilation equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
check that safe access and working arrangements for the installation area have been provided				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of equipment for one of the following types of heating and ventilation systems (one)</b>				
liquid				
gaseous				
solid fuel				
renewable energy				
electrical				
<b>Assist in the installation of equipment for one of the following types of heating and ventilation systems (one)</b>				
liquid				
gaseous				
solid fuel				
renewable energy				
electrical				
<b>Assist in the installation of eight of the following components (eight)</b>				
pipework				
boiler				
motors				
fans				
blowers				
pumps				
calorifiers				
gauges/indicators				
regulators				
sensors and actuators				
condenser				
valves				
control devices				
radiators				
safety devices				
ducting/trunking				
electrical wiring and connectors				

electrical components				
other components (specify				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				
positioning equipment/components				
aligning pipes, connections, ducting and equipment				
dressing and securing piping and hoses				
making installation connections)				
fitting anti-vibration mountings				
securing by using mechanical fixings				
securing by using masonry fixings				
applying screw fastener locking devices				
applying hose/cable clips and fasteners				
levelling the equipment				
<b>Assist in the movement and positioning of equipment, using two of the following (two)</b>				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers/skates				
hoists				
jacks				
manual handling and moving loads				
<b>Use five of the following instruments during the installation activities (five)</b>				
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				
<b>Carry out all of the following checks and adjustments, as appropriate to the equipment being installed (all)</b>				
setting working clearance				
leak testing				
making 'off-load' checks				
checking level and alignment				
making visual checks for completeness and freedom from damage				
making sensory checks (sight, sound, smell, touch)				

ensuring that moving parts are clear of obstruction and are guarded				
<b>Plus assist with four more from the following (four)</b>				
flow checks				
pressurising system				
line pressure tests				
checking torque settings of fasteners				
ensuring that locking devices are fitted to fasteners				
testing that the equipment operates to the installation specification				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
IEE wiring regulations				
customer (contractual) standards and requirements				
company standards and procedures				
<b>Assist in the completion of the relevant paperwork, to include one of the following (one)</b>				
installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

## Unit 57 Assisting in the Installation of Air Conditioning and Ventilation Equipment



## Unit Summary

This unit identifies the competences you need to assist in the installation of air conditioning and ventilation systems equipment, in accordance with approved procedures. You will be required to assist in the installation of a range of air conditioning and ventilation equipment, which will include air generation, distribution and control systems. This will also include the installation of 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 removal and replacement of existing equipment.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check 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 to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying heating and ventilation installation procedures. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

### 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 of the air conditioning and ventilation equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given

- check that safe access and working arrangements for the installation area have been provided
- confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
- check that all required installation consumables are available
- leave the work area in a safe condition and free from foreign object debris

2. Assist in the installation of equipment for **two** of the following types of air conditioning and ventilating systems:

- remote air conditioning generation
- local air conditioning distribution
- air conditioning control

3. Assist in the installation of **eight** of the following air conditioning equipment components:

- pipework
- motors
- chillers
- pumps
- humidifiers
- condensers
- fans
- evaporators
- sensors and actuators
- control devices
- regulators
- heaters
- ducting/trunking
- electrical wiring/connectors
- electrical components
- valves
- safety devices
- filters
- gauges/indicators
- other (specify)

4. 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 piping and hoses
- making installation connections (such as mechanical, electrical, fluid power, utilities)
- levelling the equipment
- fitting anti-vibration mountings
- securing by using mechanical fixings
- securing by using masonry fixings
- applying screw fastener locking devices
- applying hose/cable clips and fasteners

5. Assist in the movement and positioning of equipment, using **two** of the following:

- slings
- cranes
- fork lift
- portable lifting devices
- block and tackle
- rollers
- hoists
- jacks
- manual handling and moving loads

6. Use **three** of the following instruments 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

7. Carry out **all of** the following checks and adjustments, as appropriate to the equipment being installed:

- setting working clearance
- leak testing
- making 'off-load' checks
- checking level and alignment
- making visual checks for completeness and freedom from damage
- making sensory checks (sight, sound, smell, touch)
- ensuring that moving parts are clear of obstruction and are guarded

**Plus** assist with **four** of the following:

- pressurising the system
- line pressure tests
- flow checks
- checking torque settings of fasteners
- ensuring that locking devices are fitted to fasteners (as appropriate)
- testing that the equipment operates to the installation specification

8. Assist in dealing with **two** of the following conditions during the installation process:

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

9. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:

- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
- fault finding techniques (such as six point, half-split, unit substitution)
- function testing the installation/running equipment self-diagnostics

10. Produce installations which comply with **all** of the following, as is appropriate to the equipment being installed:

- equipment manufacturer's operation range
- BS and/or ISO standards
- IEE wiring regulations
- customer (contractual) standards and requirements
- company standards and procedures

11. Assist in the completion of the relevant paperwork, to include **one** of the following:

- installation records
- company specific documentation
- job card

### **Knowledge statements:**

**You must have knowledge and understanding of:**

1. The health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies

3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing air conditioning and ventilation equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principles of how the equipment functions, and its operating sequence
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 bolts 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, special securing devices, masonry fixing devices)
11. Procedures for ensuring that you have the correct tools, equipment and fasteners for the installation activities
12. The techniques used to position, align, level, adjust and secure the equipment
13. Methods of lifting, handling and supporting the equipment during the installation activities
14. How to make adjustments to components to ensure that they function correctly
15. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
16. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
17. The procedure for the safe disposal of waste materials
18. 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)
19. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
20. 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
21. The problems that can occur with the installation operations, and how these can be overcome
22. The fault finding techniques to be used if the equipment fails to operate correctly
23. The recording documentation to be completed for the activities undertaken
24. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 57 Assisting in the Installation of Air Conditioning and Ventilation Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the air conditioning and ventilation equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of equipment for two of the following types of air conditioning and ventilating systems (two)</b>				
remote air conditioning generation				
local air conditioning distribution				
air conditioning control				
<b>Assist in the installation of eight of the following air conditioning equipment components (eight)</b>				
pipework				
motors				
chillers				
pumps				
humidifiers				
condensers				
fans				
evaporators				
sensors and actuators				
control devices				
regulators				
heaters				
ducting/trunking				
electrical wiring/connectors				
electrical components				
valves				
safety devices				
filters				
gauges/indicators				
other (specify)				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				
positioning of				

equipment/components				
aligning pipes, connections, ducting and equipment				
dressing and securing piping and hoses				
making installation connections				
levelling the equipment				
fitting anti-vibration mountings				
securing by using mechanical fixings				
securing by using masonry fixings				
applying screw fastener locking devices				
applying hose/cable clips and fasteners				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				
positioning of equipment/components				
aligning pipes, connections, ducting and equipment				
dressing and securing piping and hoses				
making installation connections				
levelling the equipment				
fitting anti-vibration mountings				
securing by using mechanical fixings				
<b>Use three of the following instruments during the installation activities (three)</b>				
alignment devices				
electrical measuring instruments				
mechanical measuring instruments				
emission testing devices				
temperature sensing devices				
flow testing devices				
<b>Carry out all of the following checks and adjustments, as appropriate to the equipment being installed (all)</b>				
setting working clearance				
leak testing				
making 'off-load' checks				
checking level and alignment				
making visual checks for completeness and freedom from damage				
making sensory checks				
ensuring that moving parts are clear of obstruction and are guarded				
<b>Plus assist with four of the following (four)</b>				
pressurising the system				
line pressure tests				
flow checks				
checking torque settings of fasteners				
ensuring that locking devices				

are fitted to fasteners (as appropriate)				
testing that the equipment operates to the installation specification				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic aids				
fault finding				
function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as is appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
IEE wiring regulations				
customer (contractual) standards and requirements				
company standards and procedures				
<b>Assist in the completion of the relevant paperwork, to include one of the following (one)</b>				
installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 58 Assisting in the Installation of Compressed Air Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of compressed air equipment and systems, in accordance with approved procedures. You will be required to assist in the installation of a range of compressed air equipment, which will include compressed air generation, distribution and control systems. This will also include 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 removal and replacement of existing equipment.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check 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 to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying the installation of compressed air equipment procedures. You will have an understanding of the equipment being installed and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Assist in the completion of installation documentation

## 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 of the compressed air equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
  
2. Assist in the installation of equipment for **two** of the following types of compressed air systems:
  - compressed air generation
  - compressed air distribution
  - compressed air control
  
3. Assist in the installation of **eight** of the following compressed air system components:
  - pipework
  - hoses
  - pumps
  - driers
  - motors
  - compressors
  - silencers
  - regulators
  - valves
  - control equipment
  - gauges/indicators
  - manifolds
  - monitoring equipment
  - filters
  - sensors and actuators
  - lubricators
  - safety devices
  - electrical wiring and connectors
  - electrical components
  - gaskets and seals
  - other components (specify)
  
4. Apply installation methods and techniques, to include **five** of the following:
  - marking out of locating and securing positions
  - drilling and hole preparation
  - positioning equipment/components
  - aligning pipes, ducting and equipment
  - making installation connections (such as mechanical, electrical, fluid power, utilities)
  - dressing and securing piping and hoses
  - fitting anti-vibration mountings
  - securing by using mechanical fixings
  - securing by using masonry fixings
  - applying screw fastener locking devices
  
5. Assist in the movement and positioning of equipment, using **two** of the following:
  - slings
  - cranes
  - fork lift
  - portable lifting devices
  - block and tackle
  - rollers

- hoists
- jacks
- manual handling and moving loads

6. Use **three** of the following instruments during the installation activities:

- alignment devices
- measuring devices (mechanical and electrical)
- pressure sensing and monitoring devices
- temperature sensing devices
- flow testing devices

7. Carry out **all** of the following checks and adjustments, as appropriate to the equipment being installed:

- topping up fluid/oil reservoirs
- making 'off-load' checks
- checking level and alignment
- making visual checks for completeness and freedom from damage
- making sensory checks (sight, sound, smell, touch)
- ensuring that moving parts are clear of obstruction, and are guarded

**Plus** assist with **four** more from the following:

- setting working clearances
- tensioning
- pressurising the system
- making line pressure tests
- checking torque settings of fasteners
- ensuring that locking devices are fitted to fasteners (as appropriate)
- functionally testing to ensure that the equipment operates correctly

8. Assist in dealing with **two** of the following conditions during the installation process:

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

9. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:

- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
- fault finding techniques (such as six point, half-split, unit substitution)
- function testing the installation/running equipment self-diagnostics

10. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- equipment manufacturer's operation range
- BS and/or ISO standards
- IEE wiring regulations
- customer (contractual) standards and requirements
- company standards and procedures

11. Assist in the completion of the relevant paperwork, to include **one** of the following:

- installation records
- company specific
- job card

## **Knowledge statements:**

### ***You must have knowledge and understanding of:***

1. The health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on you
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing compressed air equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principles of how the equipment functions, and its operating sequence
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 bolts 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. Procedures for ensuring that you have the correct tools, equipment, and fasteners for the installation activities
12. The types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, crowbars, torque wrenches, engineers' levels, alignment telescopes and laser devices)
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 (to include chain and rope hoists, pull-lifts/tirfors, rollers and skates, high lifts and the use of levers and crowbars)
15. The correct pipes, hoses and other equipment to accommodate the various pressure ranges
16. How to make adjustments to components to ensure that they function correctly
17. Methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
18. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
19. The procedure for the safe disposal of waste materials
20. 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)
21. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
22. 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)
23. The fault finding techniques to be used if the equipment fails to operate correctly
24. The recording documentation to be completed for the activities undertaken
25. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 58 Assisting in the Installation of Compressed Air Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the compressed air equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of equipment for two of the following types of compressed air systems (two)</b>				
compressed air generation				
compressed air distribution				
compressed air control				
<b>Assist in the installation of eight of the following compressed air system components (eight)</b>				
pipework				
hoses				
pumps				
driers				
motors				
compressors				
silencers				
regulators				
valves				
control equipment				
gauges/indicators				
manifolds				
monitoring equipment				
filters				
sensors and actuators				
lubricators				
safety devices				
electrical wiring and connectors				
electrical components				
gaskets and seals				
other components				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				
positioning equipment/components				
aligning pipes, ducting and				

equipment				
making installation connections				
dressing and securing piping and hoses				
fitting anti-vibration mountings				
securing by using mechanical fixings				
securing by using masonry fixings				
applying screw fastener locking devices				
<b>Assist in the movement and positioning of equipment, using two of the following (two)</b>				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers				
hoists				
jacks				
manual handling and moving loads				
<b>Use three of the following instruments during the installation activities (three)</b>				
alignment devices				
measuring devices				
pressure sensing and monitoring devices				
temperature sensing devices				
flow testing devices				
<b>Carry out all of the following checks and adjustments, as appropriate to the equipment being installed (all)</b>				
topping up fluid/oil reservoirs				
making 'off-load' checks				
checking level and alignment				
making visual checks for completeness and freedom from damage				
making sensory checks				
ensure moving parts are clear of obstruction and guarded				
<b>Plus assist with four more from the following (four)</b>				
setting working clearances				
tensioning				
pressurising the system				
making line pressure tests				
checking torque settings of fasteners				
ensuring that locking devices are fitted to fasteners				
functionally testing to ensure equipment operates correctly				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic aids				

fault finding techniques				
function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
IEE wiring regulations				
customer (contractual) standards and requirements				
company standards and procedures				
<b>Assist in the completion of the relevant paperwork, to include one of the following (one)</b>				
installation records				
company specific				
job card				

Knowledge and understanding reference:

Candidate: .....

Assessor: .....

Date: .....

Date: .....

# Unit 59 Assisting in the Installation of Waste/Foul Water Distribution Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of waste/foul water distribution systems and equipment, in accordance with approved procedures. You will be required to assist in the installation of a range of water 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.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make the necessary connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check 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 to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying installation procedures for waste/foul water distribution equipment. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Assist in the completion of installation documentation

## 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 of the waste/foul water distribution equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - confirm that all required installation consumables are available
  - 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. Assist in the installation of equipment for **one** of the following types of waste water distribution systems:
  - waste/effluent
  - foul water
  - storm water
  
3. Install and connect **two** of the following types of pipes:
  - plastic
  - iron
  - copper
  - clay
  
4. Assist in the fitting of **six** of the following components/equipment during installation:
  - couplings/connectors
  - pumps
  - motors
  - sensors and switches
  - traps and filters
  - dosing plant
  - macerators
  - interceptors
  - gates and valves
  - manifolds
  - gauges/indicators
  - faucets and outlets
  - tanks
  - control devices
  - gaskets and seals
  - electrical wiring and connectors
  - ancillary drainage equipment (such as from sinks, toilets, showers)
  
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
  - connecting equipment to pipework
  - aligning and securing piping and flexible hoses
  - levelling and securing equipment
  - securing by using mechanical fixings
  - securing by using masonry fixings
  - securing by using adhesives (glues or cements)
  - using correct lifting and handling equipment
  - making installation connections (such as mechanical, electrical, fluid power, utilities)
  
6. Use **two** of the following instruments during the installation activities:
  - alignment devices
  - levelling devices
  - multimeter



- measuring devices
- pressure testing devices
- flow testing devices

7. Carry out **three** the following checks and adjustments, as appropriate to the equipment being installed:

- making visual checks for completeness and freedom from damage
- making sensory checks (sight, sound, smell, touch)
- ensuring that moving parts are clear of obstruction and are guarded
- checking level and alignment
- checking for leaks

**Plus** assist with **both** of the following:

- flow check
- functionally testing that the equipment operates correctly

8. Assist in dealing with **two** of the following conditions during the installation process:

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

9. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:

- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
- fault finding techniques (such as half-split, input-to-output, unit substitution)
- function testing the installation/running equipment self-diagnostics

10. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- equipment manufacturer's operation range
- BS and/or ISO standards
- company standards and procedures
- customer (contractual) standards and requirements

11. Assist in the completion of the relevant paperwork, to include **one** of the following:

- 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 isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing waste/foul water distribution equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, symbols and terminology)
7. The basic principles of how the equipment functions, and its operating sequence
8. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. Methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives
10. The techniques used to position, align, level, adjust and secure the pipework and equipment
11. The importance of orientation and flow of certain components/equipment
12. Methods of lifting, handling and supporting the equipment during the installation activities
13. The types and applications of the different types of pipework systems (such as copper, plastic, lead, iron, clay)
14. The applications of the different types of couplings, and how to make watertight connections between pipes and other components
15. The types of contaminants in water systems, and the associated problems they can cause
16. The applications of the different pipework and equipment cleaning procedures (rod, water jet, solvents)
17. How to make adjustments to components, to ensure that they function correctly
18. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
19. The procedure for the safe disposal of waste materials
20. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
21. 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
22. The problems that can occur with the installation operations, and how these can be overcome
23. The fault finding techniques to be used if the equipment fails to operate correctly
24. The recording documentation to be completed for the activities undertaken
25. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

**Unit 59**
**Assisting in the Installation of Waste/Foul Water Distribution Equipment**

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the waste/foul water distribution equipment (all)</b>				
adhere relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
confirm that all required installation consumables are available				
dispose of waste items				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of equipment for one of the following types of waste water distribution systems (one)</b>				
waste/effluent				
foul water				
storm water				
<b>Install and connect two of the following types of pipes (two)</b>				
plastic				
iron				
copper				
clay				
<b>Assist in the fitting of six of the following components/equipment during installation (six)</b>				
couplings/connectors				
pumps				
motors				
sensors and switches				
traps and filters				
dosing plant				
macerators				
interceptors				
gates and valves				
manifolds				
gauges/indicators				
faucets and outlets				
tanks				
control devices				
gaskets and seals				
electrical wiring and connectors				
ancillary drainage equipment				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				

positioning of equipment				
connecting equipment to pipework				
aligning and securing piping and flexible hoses				
levelling and securing equipment				
securing by using mechanical fixings				
securing by using masonry fixings				
securing by using adhesives				
using correct lifting and handling equipment				
making installation connections				
<b>Use two of the following instruments during the installation activities (two)</b>				
alignment devices				
levelling devices				
multimeter				
measuring devices				
pressure testing devices				
flow testing devices				
<b>Carry out three the following checks and adjustments, as appropriate to the equipment being installed (three)</b>				
making visual checks for completeness and freedom from damage				
making sensory checks (sight, sound, smell, touch)				
ensuring that moving parts are clear of obstruction and are guarded				
checking level and alignment				
checking for leaks				
<b>Plus assist with both of the following (both)</b>				
flow check				
functionally testing that the equipment operates correctly				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic aids				
fault finding techniques				
function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
company standards and procedures				
customer (contractual) standards and requirements				
<b>Assist in the completion of the relevant paperwork, to include one of the following (one)</b>				

installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....  
 Assessor: .....

Date: .....  
 Date: .....

## Unit 60 Assisting in the Installation of Fresh Water Distribution Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of fresh water distribution systems and equipment, in accordance with approved procedures. You will be required to assist in the installation of 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.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check 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 to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying installation procedures for fresh water distribution equipment. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Dispose of waste items in a safe and environmentally acceptable manner
- h. Assist in the completion of installation documentation

### 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 installation:
  - adhere to risk assessment, COSHH and other relevant safety standards
  - confirm that authorisation to carry out the installation activities has been given

- check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
2. Assist in the Installation of equipment for **one** of the following types of fresh water distribution systems:
- mains cold water
  - cold down service
  - non-mains supplies
  - hot water supplies
3. Assist in the installation and connection of **two** of the following types of pipes:
- plastic
  - clay
  - iron
  - copper
4. Assist in the fitting of **eight** of the following components/equipment during the installation:
- couplings/connectors pumps
  - motors
  - heaters
  - traps and filters
  - wet and dry risers
  - cylinders and tanks
  - dosing plant
  - gates and valves
  - gauges/indicators
  - manifolds
  - sensors and switches
  - faucets and outlets
  - control devices
  - gaskets and seals
  - electrical wiring and connectors
  - ancillary equipment (such as sinks, toilets, showers)
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
  - connecting equipment to pipework
  - aligning and securing piping and flexible hoses
  - levelling and securing equipment
  - securing by using mechanical fixings
  - securing by using masonry fixings
  - securing by using adhesives (glues or cements)
  - using correct lifting and handling equipment
  - making installation connections (such as mechanical, electrical, fluid power, utilities)
6. Use **three** of the following instruments during the installation activities:
- alignment devices
  - measuring devices
  - pressure testing devices
  - flow testing devices
  - bleeding equipment
  - multimeter
7. Carry out **five** of the following, as appropriate to the equipment being installed:
- topping up fluid reservoirs

- checking level and alignment
  - checking for leaks
  - pressurising the system
  - making visual checks for completeness and freedom from damage
  - making sensory checks (sight, sound, smell, touch)
  - ensuring that moving parts are clear of obstruction and are guarded
  - functionally testing that the equipment operates correctly
8. Assist in dealing with **two** of the following conditions during the installation process:
- installations with no faults
  - partial equipment malfunction
  - complete malfunction of equipment
9. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:
- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
  - fault finding techniques (such as half-split, input-to-output, unit substitution)
  - function testing the installation/running equipment self-diagnostics
10. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:
- equipment manufacturer's operation range
  - BS and/or ISO standards
  - company standards and procedures
  - customer (contractual) standards and requirements
11. Assist in the completion of relevant paperwork, to include **one** from one of the following:
- 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 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 isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
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 importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, symbols and terminology)
7. The basic principles of how the equipment functions, and its operating sequence
8. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. Methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives
10. The techniques used to position, align, level, adjust and secure the pipework and equipment
11. The importance of orientation and flow of certain components/equipment
12. Methods of lifting, handling and supporting the equipment during the installation activities
13. The types and applications of the different pipework systems (such as copper, plastic, lead, iron, clay)
14. The applications of the different types of couplings, and how to make watertight connections between pipes and other components
15. The types of contaminants in water systems, and the associated problems they can cause
16. The applications of the different pipework and equipment cleaning procedures (rod, water jet, solvents)
17. How to make adjustments to components, to ensure that they function correctly
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 recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
22. 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
23. The problems that can occur with the installation operations, and how these can be overcome
24. The fault finding techniques to be used if the equipment fails to operate correctly
25. The recording documentation to be completed for the activities undertaken
26. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve

## Unit 60 Assisting in the Installation of Fresh Water Distribution Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following activities during the installation (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation)				
check that required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the Installation of equipment for one of the following types of fresh water distribution systems (one)</b>				
mains cold water				
cold down service				
non-mains supplies				
hot water supplies				
<b>Assist in the installation and connection of two of the following types of pipes (two)</b>				
plastic				
clay				
iron				
copper				
<b>Assist in the fitting of eight of the following components/equipment during the installation (eight)</b>				
couplings/connectors pumps				
motors				
heaters				
traps and filters				
wet and dry risers				
cylinders and tanks				
dosing plant				
gates and valves				
gauges/indicators				
manifolds				
sensors and switches				
faucets and outlets				
control devices				
gaskets and seals				
electrical wiring and connectors				
ancillary equipment (such as sinks, toilets, showers)				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
marking out of locating and securing positions				
drilling and hole preparation				

positioning of equipment				
connecting equipment to pipework				
aligning and securing piping and flexible hoses				
levelling and securing equipment				
securing by using mechanical fixings				
securing by using masonry fixings				
securing by using adhesives				
using correct lifting and handling equipment				
making installation connections				
<b>Use three of the following instruments during the installation activities (three)</b>				
alignment devices				
measuring devices				
pressure testing devices				
flow testing devices				
bleeding equipment				
multimeter				
<b>Carry out five of the following, as appropriate to the equipment being installed (five)</b>				
topping up fluid reservoirs				
checking level and alignment				
checking for leaks				
pressurising the system				
making visual checks for completeness and freedom from damage				
making sensory checks				
ensuring that moving parts are clear of obstruction and are guarded				
functionally testing that the equipment operates correctly				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic aids				
fault finding techniques				
function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
equipment manufacturer's operation range				
BS and/or ISO standards				
company standards and procedures				
customer (contractual) standards and requirements				
<b>Assist in the completion of relevant paperwork, to include one from one of the following (one)</b>				
installation records				

company specific documentation				
job card				

Knowledge and understanding reference:

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Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

Unit 61      Assisting in the Installation of Refrigeration  
Equipment

## Unit Summary

This unit identifies the competences you need to assist in the installation of refrigeration equipment, in accordance with approved procedures. You will be required to assist in the installation of a range of refrigeration equipment, which will include compression types using air cooled, water cooled condensers, and secondary refrigerants, also 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.

You will be required to use the appropriate tools and equipment throughout the installation activities, and to apply a range of installation methods and techniques to position, level and align the equipment, and to make connections to the required services. The installation activities will include making checks and adjustments, in line with your permitted authority, and assisting others to ensure that the installed equipment functions 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 check 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 to instructions, alone or in conjunction with others, 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 demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and you must demonstrate competence in all the areas required by the standard.

Your underpinning knowledge will be sufficient to provide a sound basis for your work, and will enable you to adopt an informed approach to applying installation of refrigeration equipment procedures. You will have an understanding of the equipment being installed, and its installation requirements, in adequate depth to provide a sound basis for carrying out the installation process safely and effectively.

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 instructions/documentation 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. Assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
- e. Carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
- f. Deal promptly and effectively with problems within your control and report those that cannot be solved
- g. Assist in the completion of installation documentation

#### **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 of the refrigeration equipment:
  - adhere to risk assessment, COSHH and other relevant safety standards

- confirm that authorisation to carry out the installation activities has been given
  - check that safe access and working arrangements for the installation area have been provided
  - confirm that services have been safely isolated, ready for the installation (such as mechanical, electricity, gas, air or fluids)
  - check that all required installation consumables are available
  - leave the work area in a safe condition and free from foreign object debris
2. Assist in the installation of 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
3. Assist with the fitting of **eight** of the following components/equipment during the installation:
- pipework
  - motors
  - evaporative condensers
  - evaporators
  - compressors
  - sensors and actuators
  - interlocks
  - vents/diffusers
  - monitoring equipment
  - safety devices
  - uninterruptible power supplies
  - hoses and connectors
  - gaskets and seals
  - PC peripheral devices
  - electrical wiring and connections
  - software
  - gauges and indicators (such as temperature, humidity, pressure)
  - electronic modules/components
4. 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
  - installing wiring conduit and enclosures
  - securing by using mechanical fixings
  - securing by using masonry fixings
  - applying screw fastener locking devices
  - making installation connections (such as mechanical, electrical, fluid power, utilities)
5. Assist with the movement and positioning of equipment, using **two** of the following:
- slings
  - cranes
  - fork lift
  - portable lifting devices
  - block and tackle
  - rollers
  - hoists
  - jacks
  - manual handling and moving loads
6. Use **three** of the following instruments during the installation activities:
- alignment devices
  - pressure testing devices

- temperature measuring devices
- leak testing devices
- multimeter
- filling and bleeding devices

7. Assist in carrying out **eight** the following, as appropriate to the equipment being installed:

- purging the equipment of all air (such as with dry nitrogen)
- making sensory checks (sight, sound, smell, touch)
- making visual checks for completeness and freedom from damage
- adding refrigeration lubricants
- pumping down a system
- liquid charging of a system
- using flushing lines and equipment
- vapour charging of a system
- functionally testing that the equipment operates correctly
- carrying out pressure leak test
- setting pressure cut-outs
- setting expansion valves
- setting thermostats and controls

8. Assist in dealing with **two** of the following conditions during the installation process:

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

9. Assist in using fault location methods and techniques on the installed equipment, to include **one** of the following:

- diagnostic aids (such as company records/history, manufacturers' manuals, fault analysis charts, troubleshooting guides)
- fault finding techniques (such as half-split, input-to-output, unit substitution)
- function testing the installation/running equipment self-diagnostics

10. Produce installations which comply with **all** of the following, as appropriate to the equipment being installed:

- company standards and procedures
- equipment manufacturer's operation range
- customer (contractual) standards and requirements
- IEE wiring regulations
- BS and/or ISO standards

11. 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/codes of practice for the activities, equipment or materials)
2. The isolation and lock-off procedure or permit-to-work procedure that applies
3. The specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. The hazards associated with installing refrigeration equipment, and with the tools and equipment used, and how they can be minimised
5. The importance of wearing protective clothing and other appropriate safety equipment during the installation
6. How to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, IEE regulations, symbols and terminology)
7. The basic principles of how the equipment functions, and its operating sequence
8. Methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. Methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives
10. The techniques, tools and instruments used to position, align, level, adjust and secure the equipment
11. Methods of lifting, handling and supporting the equipment during the installation activities
12. Types of primary and secondary refrigerants, and methods of purging and charging the system
13. Methods of testing equipment and systems for leaks
14. 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
15. How to make adjustments to components to ensure that they function correctly
16. Methods of connecting equipment to service supplies (such as electrical, fluid, compressed air, oil and fuel supplies)
17. Why electrical bonding is critical, and why it must be both mechanically and electrically secure
18. The procedure for the safe disposal of waste materials
19. How to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
20. 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
21. The problems that can occur with the installation operations, and how these can be overcome
22. The fault finding techniques to be used if the equipment fails to operate correctly
23. The recording documentation to be completed for the activities undertaken
24. The extent of your own responsibility and whom you should report to if you have problems that you cannot resolve



## Unit 61 Assisting in the Installation of Refrigeration Equipment

	performance evidence 1	performance evidence 2	performance evidence 3	additional performance evidence (if required)
evidence type				
date				
<b>Carry out all of the following during the installation of the refrigeration equipment (all)</b>				
adhere to relevant safety standards				
confirm that authorisation to carry out the installation activities has been given				
provide safe access and working arrangements for the installation area				
confirm that services have been safely isolated, ready for the installation				
check that all required installation consumables are available				
leave the work area in a safe condition and free from foreign object debris				
<b>Assist in the installation of equipment for one of the following types of refrigeration equipment (one)</b>				
compression types using air cooled condensers				
compression types using water cooled condensers				
compression types using secondary refrigerants				
air conditioning cooling plant				
<b>Assist with the fitting of eight of the following components/equipment during the installation (eight)</b>				
pipework				
motors				
evaporative condensers				
evaporators				
compressors				
sensors and actuators				
interlocks				
vents/diffusers				
monitoring equipment				
safety devices				
uninterruptible power supplies				
hoses and connectors				
gaskets and seals				
PC peripheral devices				
electrical wiring and connections				
software				
gauges and indicators				
electronic modules/components				
<b>Apply installation methods and techniques, to include five of the following (five)</b>				
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				
installing wiring conduit and enclosures				
securing by using mechanical fixings				
securing by using masonry fixings				
applying screw fastener locking devices				
making installation connections				
<b>Assist with the movement and positioning of equipment, using two of the following (two)</b>				
slings				
cranes				
fork lift				
portable lifting devices				
block and tackle				
rollers				
hoists				
jacks				
manual handling and moving loads				
<b>Use three of the following instruments during the installation activities (three)</b>				
alignment devices				
pressure testing devices				
temperature measuring devices				
leak testing devices				
multimeter				
filling and bleeding devices				
<b>Assist in carrying out eight the following, as appropriate to the equipment being installed (eight)</b>				
purging the equipment of all air				
making sensory checks				
making visual checks for completeness and freedom from damage				
adding refrigeration lubricants				
pumping down a system				
liquid charging of a system				
using flushing lines and equipment				
vapour charging of a system				
functionally testing that the equipment operates correctly				
carrying out pressure leak test				
setting pressure cut-outs				
setting expansion valves				
setting thermostats and controls				
<b>Assist in dealing with two of the following conditions during the installation process (two)</b>				
installations with no faults				
partial equipment malfunction				
complete malfunction of equipment				
<b>Assist in using fault location methods and techniques on the installed equipment, to include one of the following (one)</b>				
diagnostic aids				
fault finding techniques				

function testing the installation/running equipment self-diagnostics				
<b>Produce installations which comply with all of the following, as appropriate to the equipment being installed (all)</b>				
company standards and procedures				
equipment manufacturer's operation range				
customer (contractual) standards and requirements				
IEE wiring regulations				
BS and/or ISO standards				
<b>Complete the relevant paperwork, to include one of the following, and pass it to the appropriate people (one)</b>				
installation records				
company specific documentation				
job card				

Knowledge and understanding reference:

Candidate: .....  
Assessor: .....

Date: .....  
Date: .....

## Level 2 NVQ in Engineering Maintenance and Installation

### Opportunities for generation of Key Skills evidence:

The Level 2 NVQ in Engineering Maintenance and Installation 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.

Engineering Maintenance 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 and Interpreting Engineering Data and Documentation	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 Maintenance or Installation Activities	7.01	C2.1A C2.2		
Unit 5: Carrying Out Fault Location on Mechanical Equipment	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 6: Carrying Out Maintenance Activities on Mechanical Equipment	5.01	C2.1A C2.2 C2.3		
Unit 7: Restoring Mechanical Components to Usable Condition by Repair	5.06	C1.3 C2.2		
Unit 8: Carrying Out Scheduled Maintenance Activities on Mechanical Equipment	5.01	C2.1A C2.2 C2.3		
Unit 9: Carrying Out Fault Location on Electrical Equipment and Circuits	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 10: Carrying Out Maintenance Activities on Electrical Equipment	5.01	C2.1A C2.2 C2.3		
Unit 11: Carrying Out Modifications or Rewiring Electrical Circuits	N/A			
Unit 12: Carrying Out Scheduled Maintenance Tasks on Electrical Equipment	5.01	C2.1A C2.2 C2.3		

Engineering maintenance Unit	ECS Unit	Key Skills Reference		
		Communication	Application of Number	Problem Solving
Unit 13: Carrying Out Fault Location on Electronic Equipment and Circuits	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 14: Carrying Out Tests on Electronic Equipment and Circuits	6.02	C2.2		
Unit 15: Carrying Out Repairs to Electronic Equipment	5.01	C2.1A C2.2 C2.3		
Unit 16: Carrying Out Fault Location on Fluid Power Equipment and Circuits	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 17: Carrying Out Maintenance Activities on Fluid Power Equipment	5.01	C2.1A C2.2 C2.3		
Unit 18: Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment	5.01	C2.1A C2.2 C2.3		
Unit 19: Carrying Out Fault Location on Service Systems and Equipment	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 20: Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment	5.01	C2.1A C2.2 C2.3		
Unit 21: Carrying Out Maintenance on Water Distribution Systems and Equipment	5.01	C2.1A C2.2 C2.3		
Unit 22: Carrying Out Maintenance on Emergency Power Generation Equipment	5.01	C2.1A C2.2 C2.3		
Unit 23: Carrying Out Maintenance on Workplace Environmental Control Equipment	5.01	C2.1A C2.2 C2.3		
Unit 24: Carrying Out Maintenance on Heating and Ventilation Equipment	5.01	C2.1A C2.2 C2.3		
Unit 25: Carrying Out Maintenance on Air Conditioning and Ventilation Equipment	5.01	C2.1A C2.2 C2.3		
Unit 26: Carrying Out Maintenance on Gas Distribution Equipment	5.01	C2.1A C2.2 C2.3		
Unit 27: Carrying Out Maintenance on Compressed Air Equipment	5.01	C2.1A C2.2 C2.3		

Engineering maintenance Unit	ECS Unit	Key Skills Reference		
		Communication	Application of Number	Problem Solving
Unit 28: Carrying Out Maintenance on Process Control Equipment	5.01	C2.1A C2.2 C2.3		
Unit 29: Carrying Out Maintenance on Instrumentation & Control Equipment	5.01	C2.1A C2.2 C2.3		
Unit 30: Carrying Out Maintenance on Industrial Refrigeration Equipment	5.01	C2.1A C2.2 C2.3		
Unit 31: Carrying Out Maintenance on Environmental Control Equipment	5.01	C2.1A C2.2 C2.3		
Unit 32: Carrying Out Fault Location on Communication Electronic Systems	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 33: Carrying Out Scheduled Maintenance on Communication Electronic Systems	5.01	C2.1A C2.2 C2.3		
Unit 34: Carrying Out Repairs to Communication Electronic Systems	6.02	C2.2		
Unit 35: Carrying Out Modifications to Communication Electronic Systems	N/A			
Unit 36: Carrying Out Tests on Communication Electronic Systems	6.02	C2.2		
Unit 37: Carrying Out the Configuration of Communication Electronic Systems	4.01	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 38: Assisting in the Installation of Communication Electronic Systems	N/A			
Unit 39: Carrying Out Fault Location on Stairlift Equipment	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 40: Carrying Out Servicing Activities on Stairlift Equipment	5.01	C2.1A C2.2 C2.3		
Unit 41: Restoring Stairlifts to Service by Replacing or Repairing Components	5.06	C1.3 C2.2		
Unit 42: Carrying Out Fault Location on Service Lifts	6.08	C1.1 C1.3 C2.2		PS1.1 PS1.2
Unit 43: Carrying Out Servicing of Service Lift Equipment	5.01	C2.1A C2.2 C2.3		

Engineering maintenance Unit	ECS Unit	Key Skills Reference		
		Communication	Application of Number	Problem Solving
Unit 44: Restoring Service Lifts to Service by Replacing or Repairing Components	5.06	C1.3 C2.2		
Unit 45: Installing Stairlifts	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 46: Installing Service Lifts	4.02	C2.1a C2.2 C2.3		PS2.1 PS2.2 PS2.3
Unit 47: Assisting in the Installation of Mechanical Equipment	N/A			
Unit 48: Assisting in the Installation of Electrical/Electronic Equipment	N/A			
Unit 49: Assisting in the Installation of Equipment to Produce an Engineered System	N/A			
Unit 50: Assisting in the Installation of Instrumentation and Control Equipment	N/A			
Unit 51: Assisting in the Installation of Fluid Power Equipment	N/A			
Unit 52: Assisting in the Installation of Process Controller Equipment	N/A			
Unit 53: Assisting in the Installation of Emergency Electrical Power Generation Equipment	N/A			
Unit 54: Assisting in the Installation of Environmental Pollution Control Equipment	N/A			
Unit 55: Assisting in the Installation of Workplace Environmental Control Equipment	N/A			
Unit 56: Assisting in the Installation of Heating and Ventilation Equipment	N/A			
Unit 57: Assisting in the Installation of Air Conditioning and Ventilation Equipment	N/A			
Unit 58: Assisting in the Installation of Compressed Air Equipment	N/A			
Unit 59: Assisting in the Installation of Waste/Foul Water Distribution Equipment	N/A			
Unit 60: Assisting in the Installation of Fresh Water Distribution Equipment	N/A			
Unit 61: Assisting in the Installation of Refrigeration Equipment	N/A			

## Further information

Further information regarding centre/scheme approval or any aspect of assessment of our qualifications should be referred to the relevant City & Guilds regional/national office:

<b>Region</b>	<b>Telephone</b>	<b>Facsimile</b>
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 Customer Relations Unit	020 7294 2800	020 7294 2400

Website [www.city-and-guilds.co.uk](http://www.city-and-guilds.co.uk)



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