

1788 Level 2 NVQ Diploma in Engineering Maintenance

Qualification handbook for centres
501/0377/5



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1 About this document

This document contains the information that centres need to offer the following qualifications:

Qualification titles and levels	City & Guilds qualification numbers	Ofqual accreditation numbers	Last registration date	Last certification date
Level 2 NVQ Diploma in Engineering Maintenance	1788	501/0377/5	31/03/2015	31/03/2017

This document includes details and guidance on:

- centre requirements
- candidate entry requirements
- course design and delivery
- qualification standards and specifications
- assessment requirements

2 About the qualifications

2.1 Accreditation details

Accreditation details

This qualification is

- accredited by Ofqual

Qualifications and Credit Framework (QCF)

The QCF replaces the National Qualifications Framework (NQF) in England and Northern Ireland, and is intended to replace the regulated pillar within the Qualifications and Credit Framework for Wales (CQFW). It is also intended to align with the Scottish Credit and Qualifications Framework (SCQF). The QCF provides a way of recognising achievement through the award of credit for units and qualifications. Units within the framework are allocated a:

- level to indicate the level of difficulty
- credit value to indicate the size of the unit. 10 hours of **learning time** = 1 credit value.

Learning time is a notional measure of the amount of time a typical candidate might be expected to take to complete all the learning relevant to achievement of the learning outcomes. It differs from Guided Learning Hours (GLH) which represent only those hours a tutor/trainer or facilitator are present and contributing to the learning process because it takes into account all learning relevant to the learning outcomes regardless of where, when and how it has taken place.

The QCF recognises learning by awarding credit each time a candidate successfully completes a unit. Candidates can accumulate and transfer credit achievement over time.

A unit is the smallest part of learning for which credit is awarded. Candidates can also gain credit for full qualifications.

2 About the qualifications

2.2 Aims of the qualifications

The Level 2 NVQ Diploma in Engineering maintenance (QCF) has been designed to cover those learners who require specific knowledge within the maintenance sector of engineering. The aim of the qualification is to recognise the skills and competence required by those who work within engineering undertaking maintenance operations. Success in the qualification will recognise an ability to perform competently practical work and an understanding of the related technology. It will also demonstrate competence in communication, planning and quality control within the workplace.

There is clear progression both to and from this qualification. This qualification forms a component of SEMTA Apprenticeship framework and will allow progression to higher levels. This qualification allows progression onto the Level 3 Engineering Maintenance and other relevant Engineering qualifications.

1788 – Level 3 Engineering maintenance

2850 – Level 3 Diploma in Engineering

2 About the qualifications

2.3 Rules of combination

Rules of combination are used to define the structure of qualifications. The rules of combination specify the credits which must be achieved through a particular combination of units to gain a full qualification.

Candidates must complete all units in Group A, and a number of optional units from Group B (depending on their chosen pathway). The total credit value to achieve this qualification is 63 credits

City & Guilds Level 2 NVQ Diploma in Engineering Maintenance and installation (QCF) Pathways are:

Mechanical Maintenance

Electrical Maintenance

Electronic Maintenance

Fluid Power Maintenance

Services Maintenance

Communication-Electronics Maintenance

Servicing Stairlifts

Servicing Service Lifts

Installing Stairlifts

Installing Service Lifts

Equipment Installation

Installing Lifting Platforms

Servicing Lifting Platforms

Assistive Technology Systems and Equipment Maintenance

2 About the qualification

2.4 Structure

Engineering Maintenance and Installation Suite 2

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

Unit 001: Complying with Statutory Regulations and Organisational Safety Requirements

Unit 002: Using and Interpreting Engineering Data and Documentation

Unit 003: Working efficiently and effectively in engineering

Pathways:

Mechanical Maintenance

Must complete the following units:

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 005: Carrying Out Fault Location on Mechanical Equipment

Unit 006: Carrying Out Maintenance Activities on Mechanical Equipment

Plus one of the following units:

Unit 007: Restoring Mechanical Components to Usable Condition by Repair

Unit 008: Carrying Out Scheduled Maintenance Activities on Mechanical Equipment

Electrical Maintenance

Must complete the following units:

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 009: Carrying Out Fault Location on Electrical Equipment and Circuits

Unit 010: Carrying Out Maintenance Activities on Electrical Equipment

Plus one of the following units:

Unit 011: Carrying Out Modifications or Rewiring Electrical Circuits

Unit 012: Carrying Out Scheduled Maintenance Tasks on Electrical Equipment

Electronic Maintenance

Must complete all of the following units:

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 009: Carrying Out Fault Location on Electronic Equipment and Circuits

Unit 014: Carrying Out Tests on Electronic Equipment and Circuits

Unit 015: Carrying Out Repairs to Electronic Equipment

Fluid power Maintenance

Must complete all the following units:

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 016: Carrying Out Fault Location on Fluid Power Equipment and Circuits

Unit 017: Carrying Out Maintenance Activities on Fluid Power Equipment

Unit 018: Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment

Services Maintenance

Must complete the following units:

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 019: Carrying Out Fault Location on Service Systems and Equipment

Unit 020: Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment

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

Unit 021: Carrying Out Maintenance on Water Distribution Systems and Equipment

Unit 022: Carrying Out Maintenance on Emergency Power Generation Equipment

Unit 023: Carrying Out Maintenance on Workplace Environmental Control Equipment

Unit 024: Carrying Out Maintenance on Heating and Ventilation Equipment

Unit 025: Carrying Out Maintenance on Air Conditioning and Ventilation Equipment

Unit 026: Carrying Out Maintenance on Gas Distribution Equipment

Unit 027: Carrying Out Maintenance on Compressed Air Equipment

Unit 028: Carrying Out Maintenance on Process Control Equipment

Unit 029: Carrying Out Maintenance on Instrumentation and Control Equipment

Unit 030: Carrying Out Maintenance on Industrial Refrigeration Equipment

Unit 231: Carrying Out Maintenance on Environmental Control Equipment

Communication-Electronics Maintenance

Must complete the following units:

Unit 032: Carrying Out Fault Location on Communication-Electronic Systems

Unit 033: Carrying Out Scheduled Maintenance on Communication-Electronic Systems

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

Unit 034: Carrying Out Repairs to Communication-Electronic Systems

Unit 035: Carrying Out Modifications to Communication-Electronic Systems

Unit 036: Carrying Out Tests on Communication-Electronic Systems

Unit 037: Carrying Out the Configuration of Communication-Electronic Systems

Unit 038: Assisting in the Installation of Communication-Electronic Systems

Servicing Stairlifts

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

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 039: Carrying Out Fault Location on Stairlift Equipment

Unit 040: Carrying Out Servicing Activities on Stairlift Equipment

Unit 041: Restoring Stairlifts to Service by Replacing or Repairing Components

Servicing Service Lifts

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

Unit 042: Carrying Out Fault Location on Service Lifts

Unit 043: Carrying Out Servicing of Service Lift Equipment

Unit 044: Restoring Service Lifts to Service by Replacing or Repairing Components

Installing Stairlifts

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

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 039: Carrying Out Fault Location on Stairlift Equipment

Unit 045: Installing Stairlifts

Installing Service Lifts

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

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 042: Carrying Out Fault Location on Service Lifts

Unit 046: Installing Service Lifts

Equipment Installation

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

Unit 047: Assisting in the Installation of Mechanical Equipment

Unit 048: Assisting in the Installation of Electrical/Electronic Equipment

Unit 049: Assisting in the Installation of Equipment to Produce an Engineered System

Unit 050: Assisting in the Installation of Instrumentation and Control Equipment

Unit 051: Assisting in the Installation of Fluid Power Equipment

Unit 052: Assisting in the Installation of Process Controller Equipment

Unit 053: Assisting in the Installation of Emergency Electrical Power Generation Equipment

Unit 054: Assisting in the Installation of Environmental Pollution Control Equipment

Unit 055: Assisting in the Installation of Workplace Environmental Control Equipment

Unit 056: Assisting in the Installation of Heating and Ventilation Equipment

Unit 057: Assisting in the Installation of Air Conditioning and Ventilation Equipment

Unit 058: Assisting in the Installation of Compressed Air Equipment

Unit 059: Assisting in the Installation of Waste/Foul Water Distribution Equipment

Unit 060: Assisting in the Installation of Fresh Water Distribution Equipment

Unit 061: Assisting in the Installation of Refrigeration Equipment

Installing Lifting Platforms

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

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 062: Carrying Out Fault Location on Lifting Platforms

Unit 063: Installing Lifting Platforms

Servicing Lifting Platforms

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

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 062: Carrying Out Fault Location on Lifting Platforms

Unit 064: Carrying Out Servicing of Lifting Platforms

Unit 065: Restoring Lifting Platforms to Service by Replacing or Repairing Components

Assistive Technology Systems and Equipment Maintenance

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

Unit 004: Handing Over and Confirming Completion of Maintenance or Installation Activities

Unit 066: Carrying out Fault Location Activities on Assistive Technology Systems and Equipment

Unit 067: Carrying out Scheduled Servicing Activities on Assistive Technology Systems and Equipment

Unit 068: Carrying out Maintenance and Repair Activities on Assistive Technology Systems and Equipment

2 About the qualifications

2.5 Relevant sources of information

Related publications

City & Guilds also provides the following documents specifically for these qualifications:

Publication	Available from
Centre Guides	Website
Learner Guides	website
FAQ	website
Fast track approval form/generic fast track approval form	website

Other essential City & Guilds documents

There are other City & Guilds documents which contain general information on City & Guilds qualifications:

- **Providing City & Guilds qualifications – a guide to centre and qualification approval** contains detailed information about the processes which must be followed and requirements which must be met for a centre to achieve ‘approved centre’ status, or to offer a particular qualification.
- **Ensuring quality** contains updates on City & Guilds assessment and policy issues.
- **Centre toolkit** contains additional information on *Providing City & Guilds qualifications*, in a CD-ROM, which links to the internet for access to the latest documents, reference materials and templates. The *Centre Toolkit* is sent to centres when they receive approved centre status. It is also available from to order at an additional cost.
- **Online catalogue/shop** contains details of general regulations, registration and certification procedures and fees.

For the latest updates on our publications and details of how to obtain them and other City & Guilds resources, please refer to the City & Guilds website.

City & Guilds websites

Website	Address	Purpose and content
City & Guilds main website	www.cityandguilds.com	This is the main website for finding out about the City & Guilds group, accessing qualification information and publications.
Walled Garden	www.walled-garden.com	The Walled Garden is a qualification administration portal for approved centres, enabling them to register candidates and claim certification online.

Contacting City & Guilds by e-mail

The following e-mail addresses give direct access to our Customer Relations team.

e-mail	Query types
learnersupport@cityandguilds.com	all learner enquiries, including <ul style="list-style-type: none">• requesting a replacement certificate• information about our qualification• finding a centre.
centresupport@cityandguilds.com	all centre enquiries
walledgarden@cityandguilds.com	all enquiries relating to the Walled Garden, including <ul style="list-style-type: none">• setting up an account• resetting passwords.

3 Centre requirements

3.1 Obtaining centre and qualification approval

Only approved organisations can offer City & Guilds qualifications. Organisations approved by City & Guilds are referred to as **centres**.

Centres must meet a set of quality criteria including:

- provision of adequate resources, both physical and human
- clear management information systems
- effective assessment and quality assurance procedures including candidate support and reliable recording systems.

An organisation that has not previously offered City & Guilds qualifications must apply for approval to become a centre. This is known as the **centre approval process (CAP)**. Centres also need approval to offer a specific qualification. This is known as the **qualification approval process (QAP)**. In order to offer these qualifications, organisations which are not already City & Guilds centres must apply for centre and qualification approval at the same time. Existing City & Guilds centres will only need to apply for qualification approval for these particular qualifications.

Full details of the procedures and forms for applying for centre and qualification approval are given

City and Guilds branch offices will support new centres through the approval process. They will appoint an External Verifier. They will also provide details of fees applicable for approvals. The local office will be the point of contact for all enquiries for these qualifications and will be responsible for monitoring the delivery and assessments through reports submitted by External Verifiers. They will be the first point of contact for any enquiries regarding the multiple choice examination.

Assessments must not be undertaken until qualification approval has been obtained and candidates have been registered.

City & Guilds reserves the right to withdraw qualification or centre approval for reasons of debt, malpractice or non-compliance with City & Guilds' policies, regulations, requirements, procedures and guidelines, or for any reason that may be detrimental to the maintenance of authentic, reliable and valid qualifications or that may prejudice the name of City & Guilds.

3 Centre requirements

3.2 Candidate entry requirement

Candidates should not be entered for a qualification of the same type, content and level as that of a qualification they already hold.

There are no formal entry requirements for candidates undertaking this qualification. However, centres must ensure that candidates have the potential and opportunity to gain the qualification successfully.

3 Centre requirements

3.3 Fast Track Approval

This section outlines the approval processes for Centres to offer this qualification and any resources that Centres will need in place to offer the qualifications including qualification-specific requirements for Centre staff.

Centres already offering City & Guilds qualifications in this subject area

Centres approved to offer the qualification Level 2 NVQ in Engineering maintenance (1688) may apply for approval for the new Level 2 NVQ Diploma in Engineering maintenance (1788) using the **fast track approval form**, available from the City & Guilds website.

Centres may apply to offer the new qualification using the fast track form

- providing there have been no changes to the way the qualifications are delivered, and
- if they meet all of the approval criteria specified in the fast track form guidance notes.

Fast track approval is available for 12 months from the launch of the qualification. After this time, the qualification is subject to the **standard** Qualification Approval Process. It is the centre's responsibility to check that fast track approval is still current at the time of application.

3 Centre requirements

3.4 Resource requirements

Physical resources

Centres must have an adequate learning environment. Resources should be accessible and reflect the nature of the qualification. They must also ensure that they have the staff and access to sufficient equipment so that candidates have the opportunity to cover all of the activities of the qualification.

Centre staff

Centre staff must satisfy the requirements for occupational expertise for these qualifications. Staff should be technically competent and experienced in the units for which they are delivering, teaching, training and assessing learning

3 Centre requirements

3.5 Registration and Certification

Candidates must be registered at the beginning of their course. Centres should submit registrations using the Walled Garden, or Form S (Registration), under qualification and complex number 1788. Candidates achieving the required Rules of Combination will be issued with the full Level 3 NVQ Diploma in Engineering maintenance (1788). For information on the registration and certification periods for the qualification, centre should refer to the City & Guilds Directory of qualifications.

Full details of City & Guilds' administrative procedures for this qualification are provided in the *Directory of qualifications*, provided online to City & Guilds registered centres. This information includes details on:

- registration procedures
- enrolment numbers
- fees
- claiming certification.

These details are also available on the **www.cityandguilds.com**

3 Centre requirements

3.6 Quality Assurance

Internal quality assurance

Approved centres must have effective quality assurance systems to ensure optimum delivery and assessment of qualifications.

Quality assurance includes initial centre approval, qualification approval and the centre's own internal procedures for standardising and monitoring quality. Centres are responsible for internal quality assurance, ensuring that there are appropriate opportunities for open communication between the course team, scheme co-ordinator and external verifier. City & Guilds is responsible for external quality assurance.

Full details and guidance on the internal and external quality assurance requirements and procedures, are provided in *Providing City & Guilds Qualifications* and in the centre toolkit. This document also explains the tasks, activities and responsibilities of quality assurance staff.

All candidates' evidence must be available for external verification; Centres are also required to retain copies of candidates' assessment and internal verification records for three years after certification.

National standards and rigorous quality assurance are maintained by use of:

- City & Guilds assignment, marked by the centres according to externally set marking criteria
- Portfolio evidence assessed against set criteria
- Internal (centre) quality assurance
- City & Guilds external verification.

To meet the quality assurance criteria for this qualification, the centre must ensure that the following internal roles are undertaken:

- quality assurance co-ordinator
- primary assessor
- independent assessor
- internal verifier.

External quality assurance

External verifiers are appointed by City & Guilds to approve centres, and to monitor the assessment and internal quality assurance carried out by centres. External verification is carried out to ensure that assessment is valid and reliable, and that there is good assessment practice in centres.

To carry out their quality assurance role, external verifiers must have appropriate occupational and verifying knowledge and expertise. City & Guilds external verifiers attend training and development designed to keep them up-to-date, to facilitate standardisation between verifiers and to share good practice.

Further details of the role of external verifiers are given in *Providing City & Guilds qualifications*.

4 Course design and delivery

Recommended delivery strategies

Centre staff should familiarise themselves with the structure, content and assessment requirements of the qualifications before designing a course programme.

Provided that the requirements for the qualifications are met, centres may design course programmes of study in any way that they feel best meets the needs and capabilities of their candidates.

Centres may wish to include topics as part of the course programme which will not be assessed through the qualifications for example to address local, organisational or government needs. Provided the aims, outcomes and knowledge requirements are met, centres have the flexibility to deliver the qualification in as many hours as they deem appropriate.

Data protection and confidentiality

Centres offering these qualifications may need to provide City & Guilds with personal data for staff and candidates. Centres will need to abide by the legal requirements of the country that they operate in. Centres and staff will be expected to maintain the confidentiality required by the laws and policies of national governments and the centres that offer the qualifications.

Health and safety

The requirement to follow safe working practices is an integral part of all City & Guilds qualifications and assessments, and it is the responsibility of centres to ensure that all relevant health and safety requirements are in place before candidates commence the programme.

Should a candidate fail to follow health and safety practice and procedures during an assessment, the assessment must be stopped. The candidate should be informed that they have not reached the standard required to successfully pass the assessment and told the reason why. Candidates may retake the assessment at a later date, at the discretion of the centre. In case of any doubt, guidance should be sought from the external verifier.

Initial assessment and induction

Centres will need to make an initial assessment of each candidate prior to the start of their programme. Candidates should have a reasonable level of English language and literacy skills.

The initial assessment should identify any specific training needs the candidate has, and the support and guidance they may require when working towards their qualification. The results of initial assessment will assist centres and tutors with the design and delivery of the courses to meet the particular needs of their candidates for both the class based and practical aspects of the course.

Centres should provide an induction programme to ensure the candidate fully understands the requirements of the qualifications they will work towards, their responsibilities as a candidate, and the responsibilities of the centre. It may be helpful to record the information as part of the learning contract/individual learning plan.

Equal opportunities

It is a requirement of centre approval that centres have an equal opportunities policy (see *Providing City & Guilds qualifications*).

The regulatory authorities require City & Guilds to monitor centres to ensure that equal opportunity policies are being followed.

The City & Guilds equal opportunities policy is set out on the City & Guilds website, in *Providing City & Guilds qualifications*, in the *Directory of qualifications*, and is also available from the City & Guilds Customer Relations department.

Access to assessment

City & Guilds' guidance and regulations on access to assessment are designed to facilitate access for assessments and qualifications for candidates who are eligible for adjustments to assessment arrangements. Access arrangements are designed to allow attainment to be demonstrated. For further information, please see *Access to assessment and qualifications*, available on the City & Guilds website.

Results and certification

All candidates for City & Guilds qualifications receive a Notification of Candidates Results giving details of their performance.

Centres will also receive a consolidated results list detailing the performance of all candidates they enter, whether they are successful or not.

Further information about the issue of results and certification for centres is available online at www.cityandguilds.com or by contacting the City & Guilds Operations Support Service enquiries team

Appeals

Centres must have their own, auditable, appeals procedure that must be explained to candidates during their induction. Appeals must be fully documented by the quality assurance co-ordinator and made available to the external verifier or City & Guilds.

Further information on appeals is given in *Providing City & Guilds qualifications*. There is also information on appeals for centres and learners on the City & Guilds website or available from the Customer Relations department.

5 Assessment

Summary of assessment methods

For this qualification, candidates will be required to complete a portfolio of evidence for **each** unit. The minimum level of evidence required is determined by SEMTA.

External quality control

External quality control is provided by the usual City & Guilds external verification process which includes the use of the electronically scannable report form which is designed to provide an objective risk analysis of individual centre assessment and verification practice.

Assessment environment

The evidence put forward for this unit can only be regarded valid, reliable, sufficient and authentic if achieved and obtained in the working environment and be clearly attributable to the learner. However, in certain circumstances, simulation/replication of work activities may be acceptable.

- The use of high quality, realistic simulations/replication, which impose pressures which are consistent with workplace expectations, should only be used in relation to the assessment of the following:-
 - rare or dangerous occurrences, such as those associated with health, safety and the environment issues, emergency scenarios and rare operations at work;
 - the response to faults and problems for which no opportunity has presented for the use of naturally occurring workplace evidence of learners competence;
 - aspects of working relationships and communications for which no opportunity has presented for the use of naturally occurring workplace evidence of learner's competence.
- Simulations/replications will require prior approval from the specific Awarding Organisation and should be designed in relation to the following parameters: -
 - the environment in which simulations take place must be designed to match the characteristics of the working environment ;
 - competencies achieved via simulation/replication must be transferable to the working environment
 - simulations which are designed to assess competence in dealing with emergencies, accidents and incidents must be verified as complying with relevant health, safety and environmental legislation by a competent health and safety/environmental control officer before being used;
 - simulated activities should place learners under the same pressures of time, access to resources and access to information as would be expected if the activity was real;
 - simulated activities should require learners to demonstrate their competence using plant and/or equipment used in the working environment;
 - simulated activities which require interaction with colleagues and contacts should require the learner to use the communication media that would be expected at the workplace;
 - for health and safety reason simulations need not involve the use of genuine substances/materials. Any simulations which require the learner to handle or otherwise

deal with materials substances/should ensure that the substitute take the same form as in the workplace

Carrying Out Assessment

The NVQ units were specifically developed to cover a wide range of activities. The evidence produced for the units will, therefore, depend on the learners choice of “bulleted items” listed in the unit assessment criteria.

Where the assessment criteria gives a choice of bulleted items (for example ‘any three from five’), assessors should note that learners do not need to provide evidence of the other items to complete the unit (in this example, two) items, particularly where these additional items may relate to other activities or methods that are not part of the learners normal workplace activity or area of expertise.

Minimum 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 examples of performance must be provided, and must be sufficient to show that the assessment criteria have been achieved to the prescribed standards. It is possible that some of the bulleted items in the assessment criteria may be covered more than once. The assessor and learner need to devise an assessment plan to ensure that performance evidence is sufficient to cover all the specified assessment criteria and which maximises the opportunities to gather evidence. Where applicable, performance evidence maybe used for more than one unit.

The most effective way of assessing competence, is through direct observation of the learner. Assessors must make sure that the evidence provided reflects the learner’s competence and not just the achievement of a training programme.

Evidence that has been produced from team activities, for example, maintenance or installation activities is only valid when it clearly relates to the learners specific and individual contribution to the activity, and not to the general outcome(s).

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

Performance evidence must be a combination of:

- outputs of the learner’s work, such as items that have been manufactured, installed, maintained, designed, planned or quality assured, and documents produced as part of a work activity

together with:

- evidence of the way the learner carried out the activities such as witness testimonies, assessor observations or authenticated learner reports, records or photographs of the work/activity carried out, etc.

Competent performance is more than just carrying out a series of individual set tasks. Many of the units contain statements that require the learner 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 valid, authentic and reliable evidence, the internal and/or 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 learners 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. SEMTA expects oral questioning and practical demonstrations to be used, as these are considered the most appropriate for these units. Assessors should ask enough questions to make sure that the learner has an appropriate level of knowledge and understanding, as required by the unit.

Evidence of knowledge and understanding will **not** be required for those bulleted items in the assessment criteria that have not been selected by the learner.

The achievement of the specific knowledge and understanding requirements of the units cannot simply be inferred by the results of tests or assignments from other units, qualifications or training programmes. Where evidence is submitted from these sources, the assessor must, as with any assessment, make sure the evidence is valid, reliable, authentic, directly attributable to the learner, and meets the full knowledge and understanding requirements of the unit.

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

Witness testimony

Where 'observation is used to obtain performance evidence, this must be carried out against the unit assessment criteria. 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 assessment criteria by someone else that is in close contact with the learner. This could be a team leader, supervisor, mentor or line manager who may be regarded as a suitable witness to the learner'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 learner. It will be the responsibility of the assessor to make sure that any witness testimonies accepted as evidence of the learner's competency are reliable, auditable and technically valid.

Recording forms

Candidates and centres may decide to use a paper-based or electronic method of recording evidence.

City & Guilds has developed a set of *Recording forms* including examples of completed forms, for new and existing centres to use as appropriate. **N/SVQ Recording forms** are available on the City & Guilds website.

Although it is expected that new centres will use these forms, centres may devise or customise alternative forms, which must be approved for use by the external verifier, before they are used by candidates and assessors at the centre.

City & Guilds endorses several ePortfolio systems. Further details are available at:
www.cityandguilds.com/eportfolios.

6 Units

Structure of units

The units in this [these] qualification[s] are written in a standard format and comprise the following:

- City & Guilds reference number
- unit accreditation number
- title
- level
- credit value
- unit aim
- relationship to NOS, other qualifications and frameworks
- endorsement by a sector or other appropriate body
- information on assessment
- learning outcomes which are comprised of a number of assessment criteria
- notes for guidance.

Summary of units

City & Guilds unit number	Title	QCF unit number	Credit Value	GLH	Level
001	Complying with statutory regulations and organisational safety requirements	A/601/5013	5	35	2
002	Using and interpreting engineering data and documentation	Y/601/5102	5	25	2
003	Working efficiently and effectively in engineering	K/601/5055	5	25	2
004	Handing Over and Confirming Completion of Maintenance or Installation Activities	D/600/5669	18	35	2
005	Carrying Out Fault Location on Mechanical Equipment	K/600/5674	26	49	2
006	Carrying Out Maintenance Activities on Mechanical Equipment	J/600/5679	35	98	2
007	Restoring Mechanical Components to Usable Condition by Repair	F/600/5681	23	77	2
008	Carrying Out Scheduled Maintenance Activities on Mechanical Equipment	D/600/5686	19	56	2
009	Carrying Out Fault Location on Electrical Equipment and Circuits	M/600/5689	26	49	2
010	Carrying Out Maintenance Activities on Electrical Equipment	L/600/5697	35	98	2
011	Carrying Out Modifications or Rewiring Electrical Circuits	R/600/5703	20	49	2

012	Carrying Out Scheduled Maintenance Tasks on Electrical Equipment	D/600/5705	19	56	2
013	Carrying Out Fault Location on Electronic Equipment and Circuits	T/600/5709	26	49	2
014	Carrying Out Tests on Electronic Equipment and Circuits	T/600/5712	20	49	2
015	Carrying Out Repairs to Electronic Equipment	R/600/5717	23	77	2
016	Carrying Out Fault Location on Fluid Power Equipment and Circuits	R/600/5720	26	49	2
017	Carrying Out Maintenance Activities on Fluid Power Equipment	K/600/5724	35	98	2
018	Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment	T/600/5726	19	56	2
019	Carrying Out Fault Location on Service Systems and Equipment	J/600/5729	26	49	2
020	Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment	J/600/5732	19	56	2
021	Carrying Out Maintenance on Water Distribution Systems and Equipment	R/600/5734	35	98	2
022	Carrying Out Maintenance on Emergency Power Generation Equipment	D/600/5736	35	98	2
023	Carrying Out Maintenance on Workplace Environmental Control Equipment	K/600/5741	35	98	2
024	Carrying Out Maintenance on Heating and Ventilation Equipment	F/600/5745	35	98	2
025	Carrying Out Maintenance on Air Conditioning and Ventilation Equipment	F/600/5759	35	98	2
026	Carrying Out Maintenance on Gas Distribution Equipment	H/600/6063	35	98	2
027	Carrying Out Maintenance on Compressed Air Equipment	M/600/6065	35	98	2
028	Carrying Out Maintenance on Process Control Equipment	T/600/6066	35	98	2
029	Carrying Out Maintenance on Instrumentation and Control Equipment	Y/600/5475	35	98	2
030	Carrying Out Maintenance on Industrial Refrigeration Equipment	J/600/5505	35	98	2
031	Carrying Out Maintenance on Environmental Control Equipment	A/600/5517	35	98	2
032	Carrying Out Fault Location on Communication-Electronic Systems	D/600/5526	26	49	2

033	Carrying Out Scheduled Maintenance on Communication-Electronic Systems	M/600/5532	19	56	2
034	Carrying Out Repairs to Communication-Electronic Systems	R/600/5538	23	77	2
035	Carrying Out Modifications to Communication-Electronic Systems	K/600/5545	20	49	2
036	Carrying Out Tests on Communication-Electronic Systems	T/600/5550	20	49	2
037	Carrying Out the Configuration of Communication-Electronic Systems	Y/600/5556	20	49	2
038	Assisting in the Installation of Communication-Electronic Systems	H/600/5589	48	161	2
039	Carrying Out Fault Location on Stairlift Equipment	M/600/5594	26	49	2
040	Carrying Out Servicing Activities on Stairlift Equipment	L/600/5604	19	56	2
041	Restoring Stairlifts to Service by Replacing or Repairing Components	D/600/5607	23	77	2
042	Carrying Out Fault Location on Service Lifts	M/600/5613	26	49	2
043	Carrying Out Servicing of Service Lift Equipment	F/600/5616	19	56	2
044	Restoring Service Lifts to Service by Replacing or Repairing Components	J/600/5620	23	77	2
045	Installing Stairlifts	Y/600/5623	42	161	2
046	Installing Service Lifts	M/600/5627	42	161	2
047	Assisting in the Installation of Mechanical Equipment	M/600/5630	48	161	2
048	Assisting in the Installation of Electrical/Electronic Equipment	F/600/5633	48	161	2
049	Assisting in the Installation of Equipment to Produce an Engineered System	T/600/5399	48	161	2
050	Assisting in the Installation of Instrumentation and Control Equipment	M/600/5403	48	161	2
051	Assisting in the Installation of Fluid Power Equipment	T/600/5404	48	161	2
052	Assisting in the Installation of Process Control Equipment	J/600/5407	48	161	2
053	Assisting in the Installation of Emergency Electrical Power Generation Equipment	J/600/5410	48	161	2
054	Assisting in the Installation of Environmental Pollution Control Equipment	D/600/5414	48	161	2
055	Assisting in the Installation of Workplace Environmental Control Equipment	K/600/5416	48	161	2

056	Assisting in the Installation of Heating and Ventilation Equipment	T/600/5418	48	161	2
057	Assisting in the Installation of Air Conditioning and Ventilation Equipment	T/600/5421	48	161	2
058	Assisting in the Installation of Compressed Air Equipment	J/600/5424	48	161	2
059	Assisting in the Installation of Waste/Foul Water Distribution Equipment	L/600/5425	48	161	2
060	Assisting in the Installation of Fresh Water Distribution Equipment	D/600/5428	48	161	2
061	Assisting in the Installation of Refrigeration Equipment	K/600/5433	48	161	2
062	Carrying Out Fault Location on Lifting Platforms	F/600/5437	26	49	2
063	Installing Lifting Platforms	J/600/5438	42	161	2
064	Carrying Out Servicing of Lifting Platforms	R/600/5443	19	56	2
065	Restoring Lifting Platforms to Service by Replacing or Repairing Components	M/600/5451	23	77	2
066	Carrying Out Fault Location Activities on Assistive Technology Systems and Equipment	F/600/5454	26	49	2
067	Carrying Out Scheduled Servicing Activities on Assistive Technology Systems and Equipment	L/600/5456	19	56	2
068	Carrying Out Maintenance and Repair Activities on Assistive Technology Systems and Equipment	R/600/5460	35	98	2

Unit 001

Complying with statutory regulations and organisational safety requirements

Level: 2

Credit value: 5

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to deal with statutory regulations and organisational safety requirements. It does not deal with specific safety regulations or detailed requirements, it does, however, cover the more general health and safety requirements that apply to working in an industrial environment.

The learner will be expected to comply with all relevant regulations that apply to their area of work, as well as their general responsibilities as defined in the Health and Safety at Work Act. The learner will need to be able to identify the relevant qualified first aiders and know the location of the first aid facilities. The learner will have a knowledge and 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. The learner will also need to be fully conversant with their organisation's procedures for fire alerts and the evacuation of premises.

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

The learner's responsibilities will require them to comply with all relevant statutory and organisational policy and procedures for health and safety in the workplace. The learner must act in a responsible and safe manner at all times, and present themselves in the workplace suitably prepared for the activities to be undertaken. The learner will be expected to report any problems with health and safety issues, to the relevant authority.

The learner's knowledge will provide a good understanding of the relevant statutory regulations and organisational requirements associated with their work, and will provide an informed approach to the procedures used. The learner will need to understand their organisation's health and safety requirements and their application, in adequate depth to provide a sound basis for carrying out their activities in a safe and competent manner.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Comply with statutory regulations and organisational safety requirements
2. Know how to comply with statutory regulations and organisational safety requirements.

Guided learning hours

It is recommended that **35** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from national occupational standard: Complying with statutory regulations and organisational safety requirements (Suite 2)

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's unit assessment strategies which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 001

Complying with statutory regulations and organisational safety requirements

Outcome 1

Comply with statutory regulations and organisational safety requirements

Assessment Criteria

Practical Skills

The learner will be able to:

1. comply with their duties and obligations as defined in the Health and Safety at Work Act
2. demonstrate their understanding of their duties and obligations to health and safety by:
 - applying in principle their duties and responsibilities as an individual under the Health and Safety at Work Act
 - identifying, within their organisation, appropriate sources of information and guidance on health and safety issues, such as:
 - eye protection and personal protective equipment (PPE)
 - 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
3. present themselves in the workplace suitably prepared for the activities to be undertaken
4. follow organisational accident and emergency procedures
5. comply with emergency requirements, to include:
 - identifying the appropriate qualified first aiders and the location of first aid facilities
 - identifying the procedures to be followed in the event of injury to themselves or others
 - following organisational procedures in the event of fire and the evacuation of premises
 - identifying the procedures to be followed in the event of dangerous occurrences or hazardous malfunctions of equipment
6. recognise and control hazards in the workplace
7. identify the hazards and risks that are associated with the following:
 - their working environment
 - the equipment that they use
 - materials and substances (where appropriate) that they use
 - working practices that do not follow laid-down procedures
8. use correct manual lifting and carrying techniques
9. demonstrate one of the following methods of manual lifting and carrying:
 - lifting alone
 - with assistance of others
 - with mechanical assistance
10. apply safe working practices and procedures to include:
 - maintaining a tidy workplace, with exits and gangways free from obstruction

- using equipment safely and only for the purpose intended
- observing organisational safety rules, signs and hazard warnings
- taking measures to protect others from any harm resulting from the work that they are carrying out

Unit 001

Complying with statutory regulations and organisational safety requirements

Outcome 2

Know how to comply with statutory regulations and organisational safety requirements

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the roles and responsibilities of themselves 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. describe the specific regulations and safe working practices and procedures that apply to their work activities
3. describe the warning signs for the seven main groups of hazardous substances defined by Classification, Packaging and Labelling of Dangerous Substances Regulations
4. explain how to locate relevant health and safety information for their tasks, and the sources of expert assistance when help is needed
5. explain what constitutes a hazard in the workplace (such as moving parts of machinery, electricity, slippery and uneven surfaces, poorly placed equipment, dust and fumes, handling and transporting, contaminants and irritants, material ejection, fire, working at height, environment, pressure/stored energy systems, volatile, flammable or toxic materials, unshielded processes, working in confined spaces)
6. describe their responsibilities for identifying and dealing with hazards and reducing risks in the workplace
7. describe the risks associated with their working environment (such as the tools, materials and equipment that they use, spillages of oil, chemicals and other substances, not reporting accidental breakages of tools or equipment and not following laid-down working practices and procedures)
8. describe the processes and procedures that are used to identify and rate the level of risk (such as safety inspections, the use of hazard checklists, carrying out risk assessments, COSHH assessments)
9. describe the first aid facilities that exist within their work area and within the organisation in general; the procedures to be followed in the case of accidents involving injury
10. explain what constitute dangerous occurrences and hazardous malfunctions, and why these must be reported even if no-one is injured

Unit 002

Using and interpreting engineering data and documentation

Level: 2

Credit value: 5

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to make effective use of text, numeric and graphical information, by interpreting and using technical information extracted from documents such as engineering drawings, technical manuals, reference tables, specifications, technical sales/marketing documentation, charts or electronic displays, in accordance with approved procedures. The learner will be required to extract the necessary information from the various documents, in order to establish and carry out the work requirements, and to make valid decisions about the work activities based on the information extracted.

The learner's responsibilities will require them to comply with organisational policy and procedures for obtaining and using the documentation applicable to the activity. They will be expected to report any problems with the use and interpretation of the documents that they cannot personally resolve, or are outside their permitted authority, to the relevant people. They will be expected to work to instructions if necessary, with an appropriate level of supervision or as a member of a team, and take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's underpinning knowledge will provide a good understanding of the types of documentation used, and will provide an informed approach to applying instructions and procedures. They will be able to read and interpret the documentation used 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.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Use and interpret engineering data and documentation
2. Know how to use and interpret engineering data and documentation

Guided learning hours

It is recommended that **25** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from national occupational standard: Using and interpreting engineering data and documentation (Suite 2)

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's unit assessment strategies which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 002

Using and interpreting engineering data and documentation

Outcome 1

Use and interpret engineering data and documentation

Assessment Criteria

The learner will be able to:

1. use the approved source to obtain the required data and documentation
2. use the data and documentation 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 and documentation
 - make valid decisions based on the evaluation of the engineering information extracted from the documents
 - return all documents to the approved location on completion of the work
 - complete all necessary work related documentation such as production documentation, installation documentation, maintenance documentation, planning documentation
3. correctly identify, interpret and extract the required information
4. extract information that includes three of the following:
 - materials or components required
 - dimensions
 - tolerances
 - build quality
 - installation requirements
 - customer requirements
 - time scales
 - financial information
 - operating parameters
 - surface texture requirements
 - location/orientation of parts
 - process or treatments required
 - dismantling/assembly sequence
 - inspection/testing requirements
 - number/volumes required
 - repair/service methods
 - method of manufacture
 - weld type and size
 - operations required
 - connections to be made
 - surface finish required
 - shape or profiles
 - fault finding procedures
 - safety/risk factors

- environmental controls
 - specific data (such as component data, maintenance data, electrical data, fluid data)
 - resources (such as tools, equipment, personnel)
 - utility supply details (such as electricity, water, gas, air)
 - location of services, including standby and emergency backup systems
 - circuit characteristics (such as pressure, flow, current, voltage, speed)
 - protective arrangements and equipment (such as containment, environmental controls, warning and evacuation systems and equipment)
 - other specific related information
5. use the information obtained to ensure that work output meets the specification
 6. use information extracted from documents to include one from the following:
 - drawings (such as component drawings, assembly drawings, modification drawings,
 - repair drawings, welding/fabrication drawings, distribution and installation drawings)
 - diagrams (such as schematic, fluid power diagrams, piping, wiring/circuit diagrams)
 - manufacturers manuals/drawings
 - approved sketches
 - technical illustrations
 - photographic representations
 - visual display screen information
 - technical sales/marketing documentation
 - contractual documentation
 - other specific drawings/documents
 7. use information extracted from related documentation, to include two from the following:
 - instructions (such as job instructions, drawing instructions, manufacturers instructions)
 - specifications (such as material, finish, process, contractual, calibration)
 - reference materials (such as manuals, tables, charts, guides, notes)
 - schedules
 - operation sheets
 - service/test information
 - planning documentation
 - quality control documents
 - company specific technical instructions
 - national, international and organisational standards
 - health and safety standards relating to the activity (such as COSHH)
 - other specific related documentation
 8. deal promptly and effectively with any problems within their control and report those which cannot be solved
 9. report any inaccuracies or discrepancies in documentation and specifications

Unit 002

Using and interpreting engineering data and documentation

Outcome 2

Know how to use and interpret engineering data and documentation

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. explain what information sources are used for the data and documentation that they use in their work activities
2. explain how documents are obtained, and how to check that they are current and valid
3. explain the basic principles of confidentiality (including what information should be available and to whom)
4. describe the different ways/formats that data and documentation can be presented (such as such as drawings, job instructions product data sheets, manufacturers' manuals, financial spreadsheets, production schedules, inspection and calibration requirements, customer information)
5. explain how to use other sources of information to support the data (such as electronic component pin configuration specifications, reference charts, standards, 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, health and safety documentation)
6. describe the importance of differentiating fact from opinion when reviewing data and documentation
7. describe the importance of analysing all available data and documentation before decisions are made
8. describe the different ways of storing and organising data and documentation to ensure easy access
9. describe the procedures for reporting discrepancies in the data or documentation, and for reporting lost or damaged documents
10. describe the importance of keeping all data and documentation up to date during the work activity, and the implications of this not being done
11. explain the care and control procedures for the documents, and how damage or graffiti on documents can lead to scrapped work
12. explain the importance of returning documents to the designated location on completion of the work activities
13. explain what basic drawing conventions are used and why there needs to be different types of drawings (such as isometric and orthographic, first and third angle, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)
14. explain what types of documentation are used and how they interrelate (such as production drawings, assembly drawings, circuit and wiring diagrams, block and schematic diagrams)
15. explain the imperial and metric systems of measurement; tolerancing and fixed reference points
16. describe the meaning of the different symbols and abbreviations found on the documents that they use (such as surface finish, electronic components, weld symbols, linear and geometric tolerances, pressure and flow characteristics)
17. describe the extent of their own responsibility, when to act on their own initiative to find, clarify and evaluate information, and to whom they should report if they have problems that they cannot resolve

Unit 003

Working efficiently and effectively in engineering

Level: 2

Credit value: 5

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to work efficiently and effectively in the work place, in accordance with approved procedures and practices. Prior to undertaking the engineering activity, the learner will be required to carry out all necessary preparations within the scope of their responsibility. This may include preparing the work area and ensuring that it is in a safe condition to carry out the intended activities, ensuring they 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, the learner will be required to return their immediate work area to an acceptable condition before recommencing further work requirements. This may involve placing completed work in the correct location, returning and/or storing any tools and equipment in the correct area, identifying any waste and/or scrapped materials and arranging for their disposal, and reporting any defects or damage to tools and equipment used.

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

The learner's responsibilities will require them to comply with organisational policy and procedures for the engineering activities undertaken, and to report any problems with the activities or the tools and equipment that are used that they cannot personally resolve, or are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, with a minimum of supervision, and to take personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a good understanding of their work, and will provide an informed approach to working efficiently and effectively in an engineering environment. The learner will understand the need to work efficiently and effectively, and will know about the areas they need to consider when preparing and tidying up the work area, how to deal with problems, maintain effective working relationships and agree their development objectives and targets, in adequate depth to provide a sound basis for carrying out the activities safely and correctly.

The learner will understand the safety precautions required when carrying out engineering activities. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Work efficiently and effectively in engineering
2. Know how to work efficiently and effectively in engineering

Guided learning hours

It is recommended that **25** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from national occupational standard: Working efficiently and effectively in engineering (Suite 2)

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's unit assessment strategies which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 003 Working efficiently and effectively in engineering

Outcome 1 Work efficiently and effectively in engineering

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. prepare the work area to carry out the engineering activity
3. 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
 - tools and equipment required are obtained and checked that they are in a safe and useable condition
 - all necessary drawings, specifications and associated documentation is 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
4. check that there are sufficient supplies of materials and/or consumables and that they meet work requirements
5. ensure completed products or resources are stored in the appropriate location on completion of the activities
6. complete work activities, to include all of the following:
 - returning tools and equipment
 - returning drawings and work instructions
 - completing all necessary documentation accurately and legibly
 - identifying, where appropriate, any unusable tools, equipment and components
 - arranging for the safe disposal of waste materials
7. tidy up the work area on completion of the engineering activity
8. deal promptly and effectively with problems within their control and report those that cannot be resolved
9. 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

10. contribute to organisational procedures for identifying opportunities for improvement to one of the following:
 - working practices
 - working methods
 - quality
 - safety
 - tools and equipment
 - supplier relationships
 - internal communication
 - customer service
 - training and development
 - teamwork
 - other

11. maintain effective working relationships with colleagues to include two of the following:
 - colleagues within their own working group
 - people outside their normal working group
 - line management
 - external contacts

12. review personal training and development as appropriate to the job role
13. review personal development objectives and targets to include one of the following:
 - dual or multi-skilling
 - training on new equipment/technology
 - increased responsibility
 - understanding of company working practices, procedures, plans and policies
 - other specific requirements

Unit 003

Working efficiently and effectively in engineering

Outcome 2

Know how to work efficiently and effectively in engineering

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the safe working practices and procedures to be followed whilst preparing and tidying up their work environment
2. describe the correct use of any equipment to protect the health and safety of themselves and their colleagues
3. describe the procedure for ensuring that all documentation relating to the work being carried out is available and current, prior to starting the activity
4. describe the action that should be taken if documentation received is incomplete and/or incorrect
5. describe the procedure for ensuring that all tools and equipment are available prior to undertaking the activity
6. describe the checks to be carried out to ensure that tools and equipment are in full working order, prior to undertaking the activity
7. describe the action that should be taken if tools and equipment are not in full working order
8. describe the checks to be carried out to ensure that all required materials are correct and complete, prior to undertaking the activity
9. describe the action that should be taken if materials do not meet the requirements of the activity
10. explain whom to inform when the work activity has been completed
11. describe the information and/or documentation that others will require to confirm that the activity has been completed
12. explain what materials, equipment and tools can be re-used
13. explain how any waste materials and/or products are transferred, stored and disposed of
14. explain where tools and equipment should be stored and located
15. describe the importance of maintaining effective working relationships within the workplace
16. describe the procedures for dealing with and reporting any problems that can affect working relationships
17. describe the importance of making a contribution to improving working practices
18. describe the procedure and format for making suggestions for improvements
19. describe the benefits for the work area if improvements can be identified
20. describe the difficulties that can occur in working relationships
21. describe the regulations that affect how they should be treated at work (such as equal opportunities act, race and sex discrimination, working time directive)
22. describe the benefits of continuous personal development
23. describe the training opportunities that are available in the workplace
24. describe the importance of reviewing their training and development
25. explain with whom to discuss training and development issues
26. describe the extent of their own authority and to whom they should report if they have any problems that they cannot resolve

Unit 004

Handing Over and Confirming Completion of Maintenance or Installation Activities

Level: 2

Credit value: 18

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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, the learner 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, the learner 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. The learner must also ensure that they receive confirmation that everyone involved in the handover accepts that the maintained and/or installed equipment functions to the agreed specification.

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

The learner's knowledge will be sufficient to provide a sound understanding of their work, and will provide an informed approach to applying maintenance and/or installation handover procedures. The learner 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.

The learner will understand the safety precautions to be observed when handing over the maintained and/or installed equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace/area.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Hand over and confirm completion of maintenance or installation activities
2. Know how to hand over and confirm completion of maintenance or installation activities.

Guided learning hours

It is recommended that **35** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 4: Handing Over and Confirming Completion of Maintenance or Installation Activities (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 004

Handing Over and Confirming Completion of Maintenance or Installation Activities

Outcome 1

Hand over and confirm completion of maintenance or installation activities

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
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
 - medical equipment
 - other specific equipment
3. carry out the handover, either following two of the following maintenance activities:
 - breakdown
 - preventative maintenance activity
 - scheduled servicing
 - modification to equipmentor
 - on completion of the installation activities
4. confirm that the equipment is ready to operate, by carrying out all of the following checks:
5. the maintenance and/or installation activity has been completed, and the equipment functions correctly
 - all safety systems or features are functioning correctly
 - any waste materials, safety barriers and warning signs have been removed (where appropriate)
 - 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 that the equipment is about to be operated/used
6. confirm that everyone involved accepts the product or asset is in a satisfactory condition for handover to take place
7. clearly identify any unusual features of the condition of the product or asset
8. make the handover and obtain agreement between everyone involved on the precise moment of transfer of responsibility

9. carry out all of the following during the handover procedures:
 - operate/use 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

10. carry out handover procedures to one of the following:
 - production/process operator
 - supervisor of production/process
 - maintenance supervisor
 - customer
 - other specific person

11. deal promptly and effectively with problems within their control and report those that they cannot solve

12. make sure that clear, accurate and complete records of the handover are made

13. complete the relevant paperwork, to include one of the following, and pass it to the appropriate people
 - job card
 - maintenance log and action report
 - other handover paperwork
 - company reporting procedures

Unit 004

Handing Over and Confirming Completion of Maintenance or Installation Activities

Outcome 2

Know how to hand over and confirm completion of maintenance or installation activities.

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the handover is to take place, and the responsibility they place on them
2. describe the specific health and safety precautions to be applied during the handover procedure, and their effects on others
3. describe the importance of wearing protective clothing and other appropriate safety equipment whilst operating/using the equipment during the handover operations
4. describe 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. describe the correct procedure to be followed when handing over maintained and/or installed equipment
6. describe the procedure for involving the appropriate people when operating/using the equipment
7. describe the need to highlight, where appropriate, any new, current or changed operating features of the maintained or installed equipment
8. describe the importance of informing the appropriate person of any future maintenance requirements
9. describe the need to confirm that the other person understands how to use/operate the equipment before handing the equipment over to them
10. describe the need to ensure that the person they are handing over the equipment to accepts that it is in a satisfactory condition
11. describe the organisational documentation procedures to be used with regard to the handover
12. explain how to create and maintain effective working relationships with appropriate people (such as encouraging, helping, politeness, open discussions both ways)
13. describe the problems that can occur during handover, and how they can be overcome
14. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 005

Carrying Out Fault Location on Mechanical Equipment

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to locate faults on mechanical equipment, in accordance with approved procedures. The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking full responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying fault location procedures on mechanical equipment. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location on mechanical equipment
2. Know how to carry out fault location on mechanical equipment

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 5: Carrying Out Fault Location on Mechanical Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 005

Carrying Out Fault Location on Mechanical Equipment

Outcome 1

Carry out fault location on mechanical equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the fault locating activity:
 - plan the fault location methods and procedures in conjunction with others
 - obtain and use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
 - adhere to procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. locate faults that have resulted in two of the following breakdown categories:
 - intermittent problem
 - partial failure/out-of-specification output
 - complete breakdowns

5. review and use all relevant information on the symptoms and problems associated with the products or assets
6. investigate and establish the most likely causes of the faults
7. select, use and apply diagnostic techniques, tools and aids to locate faults using four of the following:
 - 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)
8. 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
9. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
10. determine the implications of the fault for other work and for safety considerations
11. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
12. record details on the extent and location of the faults in an appropriate format
13. complete one of the following maintenance records, and pass it to the appropriate person:
 - scheduled maintenance report
 - corrective maintenance report
 - company-specific report

Unit 005

Carrying Out Fault Location on Mechanical Equipment

Outcome 2

Know how to carry out fault location on mechanical equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
4. describe the 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. describe the procedure to be adopted to establish the background of the fault
6. explain how to use the various diagnostic aids to help identify the location of the fault
7. describe 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. explain how to evaluate sensory information (such as sight, sound, smell, touch)
9. explain how to assess evidence and evaluate the possible causes of faults/problems
10. explain how to use a range of fault diagnostic equipment to investigate the problem
11. describe 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. explain how to check that mechanical measuring/test equipment is within calibration, and that it is free from damage and defects
13. explain 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. describe the basic principles of how the mechanical equipment functions, its operating sequence, the purpose of individual units/components and how they interact
15. describe the problems that can occur during the fault location activity, and how they can be minimised
16. explain how to evaluate the likely risk to themselves and others, and the effects the fault could have on the overall process or system
17. describe the importance of completing the correct documentation following the fault locating activity
18. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 006

Carrying Out Maintenance Activities on Mechanical Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner 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 'lified' 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying mechanical maintenance procedures. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance activities on mechanical equipment
2. Know how to carry out maintenance activities on mechanical equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 6: Carrying Out Maintenance Activities on Mechanical Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 006

Carrying Out Maintenance Activities on Mechanical Equipment

Outcome 1

Carry out maintenance activities on mechanical equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. follow the relevant maintenance schedules to carry out the required work
5. maintain mechanical equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
6. carry out the maintenance activities within the limits of their personal authority

7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. 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
9. 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
 - springs
 - sub-assemblies/replacement units
 - structural components (such as guards, fences, supports, housings)
 - locking and retaining devices (such as keys, pins, screw fasteners)
 - other specific components
10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:
 - job cards
 - permit to work/formal risk assessment
 - maintenance log and action report
 - company-specific documentation
12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 006

Carrying Out Maintenance Activities on Mechanical Equipment

Outcome 2

Know how to carry out maintenance activities on mechanical equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during maintenance process
6. explain 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. describe the methods and techniques used to dismantle/assemble mechanical equipment (such as release of pressures/force, proof marking, extraction, pressing, alignment)
8. describe the 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. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
10. describe the uses of measuring equipment (such as micrometers, verniers, run-out devices and other measuring devices)
11. explain 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. describe the importance of making 'off-load' checks before running the equipment under power
13. explain 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. describe the importance of maintenance documentation and/or reports following the maintenance activity, and how to generate them
15. describe the equipment operating and control procedures to be applied during the maintenance activity
16. explain how to use lifting and handling equipment in the maintenance activity

Unit 007

Restoring Mechanical Components to Usable Condition by Repair

Level: 2

Credit value: 23

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to restore mechanical components to usable condition by repair, in accordance with approved procedures. The learner 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. The learner 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, the learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying component repair procedures. The learner 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. The learner will also understand the organisational policy on repairing components, and its application.

The learner will understand the safety precautions required when carrying out the repairing activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Restore mechanical components to usable condition by repair
2. Know how to restore mechanical components to usable condition by repair

Guided learning hours

It is recommended that **77** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 7: Restoring Mechanical Components to Usable Condition by Repair (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 007

Restoring Mechanical Components to Usable Condition by Repair

Outcome 1

Restore mechanical components to usable condition by repair

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following activities during the repairing activity:
 - undertake the repairing activities to cause minimal disruption to normal working
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. follow the relevant specifications for the component to be repaired
5. prepare the component for repair
6. carry out the repairs within agreed timescale using approved materials and components and methods and procedures
7. 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)
8. ensure that the repaired component meets the specified operating conditions
 9. carry out repairs to mechanical equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 10. produce accurate and complete records of all repair work carried out

Unit 007

Restoring Mechanical Components to Usable Condition by Repair

Outcome 2

Know how to restore mechanical components to usable condition by repair

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the repairing activity is to take place, and the responsibility these requirements place on them
2. describe the isolation procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the repairing procedure, and their effects on others
4. describe the importance of wearing protective clothing and other appropriate safety equipment during the repairing activities
5. describe 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. explain 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. describe the methods, techniques and company procedures to be followed for repairing mechanical equipment
8. describe 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. explain how to use a range of hand tools (such as files, scrapers, threading devices)
10. explain how to select saw blades (for different materials and different operations)
11. describe the types and application of portable power tools that can be used for the repairing operations
12. explain how to confirm that portable power tools and extension cables are in a safe and usable condition
13. describe 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. explain how to handle and store tools and equipment, safely and correctly
15. describe the application of cutting fluids
16. describe the company recording procedures to be used following a repair, and how to apply them
17. describe the problems associated with repairing mechanical components, and how to resolve them
18. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 008

Carrying Out Scheduled Maintenance Activities on Mechanical Equipment

Level: 2

Credit value: 19

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out scheduled maintenance activities on mechanical equipment, in accordance with approved procedures. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying scheduled maintenance procedures to mechanical equipment. The learner 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, they will be expected to report where the outcomes identify the need for further investigation or maintenance work.

The learner will understand the safety precautions required when carrying out the maintenance tasks, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out scheduled maintenance activities on mechanical equipment
2. Know how to carry out scheduled maintenance activities on mechanical equipment

Guided learning hours

It is recommended that **56** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 8: Carrying Out Scheduled Maintenance Activities on Mechanical Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 008

Carrying Out Scheduled Maintenance Activities on Mechanical Equipment

Outcome 1

Carry out scheduled maintenance activities on mechanical equipment

Assessment Criteria

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. follow the relevant maintenance schedules to carry out the required work
5. carry out the maintenance activities within the limits of their personal authority
6. carry out the maintenance activities in the specified sequence and in an agreed time scale
7. 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 'lifer' 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)
8. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
9. complete relevant maintenance records accurately. to include one of the following, and pass them on to the appropriate person:
- job cards
 - specific company documentation
 - permit to work/formal risk assessment
10. maintain mechanical equipment in accordance with one of the following:
- organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
11. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 008

Carrying Out Scheduled Maintenance Activities on Mechanical Equipment

Outcome 2

Know how to carry out scheduled maintenance activities on mechanical equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe 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 them
2. describe the isolation procedure or permit-to-work procedure that applies to the equipment being maintained
3. describe the specific health and safety precautions to be applied during the scheduled maintenance activities, and their effects on others
4. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. describe 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. explain 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. describe the various checks to be carried out during the scheduled maintenance procedure
8. describe the procedure for obtaining the consumables to be used during the scheduled maintenance activity
9. describe the methods of checking that components are fit for purpose, and the need to replace 'lived' items
10. explain how to check that any replacement components meet the required specification/operating conditions
11. explain how to make appropriate sensory checks (such as sight, sound, smell and touch)
12. describe the appropriate testing instructions to be adopted during the maintenance activity
13. explain how to make adjustments to components/assemblies to ensure they function to specification
14. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
15. explain how to complete scheduled maintenance records/logs/reports, in accordance with company policy and procedures
16. describe the equipment operating and control procedures, and how to apply them in order to carry out scheduled maintenance
17. describe the problems that can occur whilst carrying out the scheduled maintenance tasks, and how they can be avoided
18. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 009

Carrying Out Fault Location on Electrical Equipment and Circuits

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to locate faults on electrical equipment and circuits, in accordance with approved procedures. The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound understanding of their work, and will provide an informed approach to applying fault location procedures to electrical equipment and circuits. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location on electrical equipment and circuits
2. Know how to carry out fault location on electrical equipment and circuits

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 9: Carrying Out Fault Location on Electrical Equipment and Circuits (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 009

Carrying Out Fault Location on Electrical Equipment and Circuits

Outcome 1

Carry out fault location on electrical equipment and circuits

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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 circuit

plus 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
4. locate faults that have resulted in two of the following breakdown categories:
 - intermittent fault
 - partial failure or reduced performance
 - complete breakdown
 5. review and use all relevant information on the symptoms and problems associated with the products or assets

6. investigate and establish the most likely causes of the faults
7. select, use and apply diagnostic techniques, tools and aids to locate faults using four of the following:
 - 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)
8. 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
9. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
10. determine the implications of the fault for other work and for safety considerations
11. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
12. record details on the extent and location of the faults in an appropriate format
13. complete one of the following maintenance records and pass it to the appropriate person:
 - scheduled maintenance report
 - corrective maintenance report
 - company specific report

Unit 009

Carrying Out Fault Location on Electrical Equipment and Circuits

Outcome 2

Know how to carry out fault location on electrical equipment and circuits

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. explain 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. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
5. describe 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. describe the procedure to be adopted to establish the background of the fault
7. explain how to use the various diagnostic aids to help identify the location of the fault
8. describe 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. explain how to evaluate sensory information (such as by sight, sound, smell, touch)
10. explain how to assess evidence and evaluate the possible causes of faults/problems
11. explain how to use a range of fault diagnostic equipment to investigate the problem
12. describe the care, handling and application of electrical test equipment (such as multimeter, portable appliance tester, earth loop impedance tester, insulation resistance tester)
13. explain how to check that electrical test equipment is within calibration, and that it is free from damage and defects
14. explain how to use and extract information from drawings, circuit and physical layouts, charts, specifications, manufacturers' manuals, history/maintenance reports, graphical electrical symbols, bs 7671/iee wiring regulations, and other documents needed in the fault location process
15. describe the basic principles of how the circuit functions, its operating sequence, the purpose of individual units/components and how they interact
16. explain how to evaluate the likely risk to themselves and others, and the effects the fault could have on the overall process or system
17. describe the problems that can occur during the fault location activity, and how they can be minimised
18. describe the importance of completing the correct documentation following the maintenance activity
19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 010

Carrying Out Maintenance Activities on Electrical Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner 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.

The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying electrical maintenance procedures. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance activities on electrical equipment
2. Know how to carry out maintenance activities on electrical equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 10: Carrying Out Maintenance Activities on Electrical Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 010

Carrying Out Maintenance Activities on Electrical Equipment

Outcome 1

Carry out maintenance activities on electrical equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
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 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
5. follow the relevant maintenance schedules to carry out the required work
6. maintain electrical equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards

7. carry out the maintenance activities within the limits of their personal authority
8. carry out the maintenance activities in the specified sequence and in an agreed time scale
9. 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
10. 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
11. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
12. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:
 - job cards
 - company-specific documentation
 - permit to work/formal risk assessment
 - maintenance logs and action reports
13. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 010

Carrying Out Maintenance Activities on Electrical Equipment

Outcome 2

Know how to carry out maintenance activities on electrical equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them
2. describe 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. explain 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. explain how to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
6. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components
7. describe the different types of cabling used in the maintenance activities, and their method of termination
8. describe the care, handling and application of electrical measuring instruments
9. describe the techniques used to dismantle/assemble electrical equipment (such as unplugging, de-soldering, removal of screwed, clamped and crimped connections)
10. describe the methods of removing and replacing cables and wires in wiring enclosures without causing damage to existing cables
11. describe the use of IEE wiring, and other, regulations when selecting wires and cables and when carrying out tests on systems
12. describe the methods of attaching identification markers/labels to removed components or cables, to assist with re-assembly
13. describe 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. describe the 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. explain how to make adjustments to components/assemblies to ensure that they function correctly
16. explain 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. describe the importance of making 'off-load' checks before proving the equipment with the electrical supply on
18. describe the equipment operating and control procedures to be applied during the maintenance activity
19. explain how to use appropriate lifting and handling equipment in the maintenance activity

20. describe the problems that can occur during the maintenance activity, and how they can be overcome
21. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
22. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 011

Carrying Out Modifications or Rewiring Electrical Circuits

Level: 2

Credit value: 20

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying modification/rewiring procedures to electrical circuits. The learner 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. The learner will also understand the organisational policy on modifying/rewiring electrical circuits, and its application.

The learner will understand the safety precautions required when carrying out modification activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out modifications or rewiring electrical circuits
2. Know how to carry out modifications or rewiring electrical circuits

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 11: Carrying Out Modifications or Rewiring Electrical Circuits (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 011

Carrying Out Modifications or Rewiring Electrical Circuits

Outcome 1

Carry out modifications or rewiring electrical circuits

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. 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
5. obtain and follow the relevant modification specifications and job instructions
6. confirm and agree what modifications are to be carried out to meet the specification
7. prepare the electrical system for the required modification
8. carry out the system modification using approved materials, methods and procedures
9. 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

10. 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

11. complete the modification within the agreed timescale

12. ensure the modified electrical system meets the specified operating conditions

13. carry out modifications or rewiring to electrical circuits, in accordance with one of the following:

- organisational guidelines and codes of practice
- equipment manufacturers' operation range
- BS7671/IEE wiring regulations
- BS, ISO and/or BSEN standards

14. produce accurate and complete records of all modification work carried out

15. 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 and action reports

16. deal promptly and effectively with problems within their control and report those that cannot be solved

Unit 011

Carrying Out Modifications or Rewiring Electrical Circuits

Outcome 2

Know how to carry out modifications or rewiring electrical circuits

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe 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. describe the health and safety requirements of the work area in which they are carrying out the modification activities, and the responsibility these requirements place on them
3. describe the hazards associated with carrying out modifications of electrical circuits, and how they can be minimised
4. explain 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. describe the personal protective equipment and clothing to be worn during the modification activities
6. explain 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, BS7671/IEE regulations, symbols and terminology)
7. describe the basic principles of how the system functions, its operating sequence, the working purpose of individual units/components, and how they interact
8. describe 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. describe the different types of electrical components (such as plugs, switches, lighting and fittings, junction boxes, consumer units)
10. describe the preparations to be undertaken on the equipment, prior to the modification
11. explain 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. describe the methods and techniques used for soldering and de-soldering, and the importance of adhering to these procedures
13. describe the methods and techniques used for crimping and heat shrinking, and the importance of adhering to these procedures
14. describe the importance of ensuring that the completed circuit is free from foreign objects, and that all terminations are electrically sound and mechanically secure
15. explain how to conduct any necessary checks to ensure that the completed modification complies with all appropriate standards
16. explain 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. describe the problems that can occur with the modification operations, and how these can be overcome
18. describe the recording documentation to be completed for the activities undertaken
19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 012

Carrying Out Scheduled Maintenance Tasks on Electrical Equipment

Level: 2

Credit value: 19

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out scheduled maintenance tasks on electrical equipment, in accordance with approved procedures. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying scheduled maintenance procedures to electrical equipment. The learner 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, the learner will be expected to report where the outcomes identify the need for further investigation or maintenance work.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out scheduled maintenance tasks on electrical equipment
2. Know how to carry out scheduled maintenance tasks on electrical equipment

Guided learning hours

It is recommended that **56** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 12: Carrying Out Scheduled Maintenance Tasks on Electrical Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 012

Carrying Out Scheduled Maintenance Tasks on Electrical Equipment

Outcome 1

Carry out scheduled maintenance tasks on electrical equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. follow the relevant maintenance schedules to carry out the required work
5. maintain electrical equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - BS7671/IEE wiring regulations
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. 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)
9. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
10. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:
- job cards
 - specific company documentation
 - permit to work/formal risk assessment
11. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 012

Carrying Out Scheduled Maintenance Tasks on Electrical Equipment

Outcome 2

Know how to carry out scheduled maintenance tasks on electrical equipment

Assessment Criteria

The learner will be able to:

1. describe 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 them
2. describe the isolation procedure or permit-to-work procedure that applies to the equipment being maintained
3. describe the specific health and safety precautions to be applied during the scheduled maintenance tasks, and their effects on others
4. explain 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
6. describe 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. explain how to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
8. describe the various checks to be carried out during the scheduled maintenance procedure
9. describe the procedure for obtaining the consumables to be used during the scheduled maintenance activity
10. describe the methods of checking that components are fit for purpose, and the need to replace 'lifer' items
11. explain how to check that any replacement components meet the required specification/operating conditions
12. explain how to make appropriate sensory checks (such as sight, sound, smell and touch)
13. describe the appropriate testing instructions to be adopted during the maintenance activity
14. explain how to make adjustments to components/assemblies to ensure they function to specification
15. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components, and how they interact
16. explain how to complete scheduled maintenance records/logs/reports, in accordance with company policy and procedures
17. describe the equipment operating and control procedures, and how to apply them in order to carry out scheduled maintenance
18. describe the problems that can occur whilst carrying out the scheduled maintenance tasks, and how they can be avoided
19. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
20. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 013

Carrying Out Fault Location on Electronic Equipment and Circuits

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to locate faults on electronic equipment/circuits, in accordance with approved procedures. The learner 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. The learner 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. The learner will be expected to take care that they 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 their role.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying fault location procedures to electronic equipment and circuits. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location on electronic equipment and circuits
2. Know how to carry out fault location on electronic equipment and circuits

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 13: Carrying Out Fault Location on Electronic Equipment and Circuits (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

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Unit 013

Carrying Out Fault Location on Electronic Equipment and Circuits

Outcome 1

Carry out fault location on electronic equipment and circuits

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the fault location activity:
 - plan the fault location methods and procedures in conjunction with others
 - obtain and use the correct issue of maintenance documentation (such as drawings, manuals, maintenance records)
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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))
4. locate faults that have resulted in two of the following breakdown categories:
 - intermittent action or circuit failure
 - partial failure or reduced performance
 - complete breakdown

5. review and use all relevant information on the symptoms and problems associated with the products or assets
6. investigate and establish the most likely causes of the faults
7. select, use and apply diagnostic techniques, tools and aids to locate faults using four of the following:
 - 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)
8. 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
9. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
10. determine the implications of the fault for other work and for safety considerations
11. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
12. record details on the extent and location of the faults in an appropriate format
13. complete one of the following maintenance records, and pass it to the appropriate person:
 - scheduled maintenance report
 - corrective maintenance report
 - other company-specific report

Unit 013

Carrying Out Fault Location on Electronic Equipment and Circuits

Outcome 2

Know how to carry out fault location on electronic equipment and circuits

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. explain 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. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
5. describe 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. describe the procedure to be adopted to establish the background of the fault
7. explain how to use the various diagnostic aids to help identify the location of the fault
8. describe 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. explain how to evaluate sensory information (such as sight, sound, smell, touch)
10. explain how to assess evidence and evaluate the possible causes of faults/problems
11. explain how to use a range of fault diagnostic equipment to investigate the problem
12. describe the care, handling and application of electrical test equipment (such as multimeter, signal generator, logic probe, signal tracer and oscilloscope)
13. describe 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. explain how to use a range of fault diagnostic equipment to investigate the problem
15. explain how to check that electronic test equipment is within calibration and that it is free from damage and defects
16. explain 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, BS7671/IEE regulations, symbols and terminology)
17. describe the functions of different types of electronic components (analogue or digital), and their operation
18. explain how to evaluate the likely risk to themselves and others, and the effects the fault could have on the overall process or system
19. describe the problems that can occur during the fault location activity, and how they can be minimised
20. describe the importance of completing the correct documentation, following the maintenance activity
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 014

Carrying Out Tests on Electronic Equipment and Circuits

Level: 2

Credit value: 20

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out inspections and tests on electronic equipment and circuits, in accordance with approved procedures. The learner 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.

The learner 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. The learner will be expected to take care that they 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 their role.

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

The learner's knowledge will be sufficient to provide a sound basis for their work of carrying out the defined inspections and tests, and will provide an informed approach to applying the necessary test procedures. The learner 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, the learner 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.

The learner 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 themselves and others against direct and indirect electric shock. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out tests on electronic equipment and circuits
2. Know how to carry out tests on electronic equipment and circuits

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 14: Carrying Out Tests on Electronic Equipment and Circuits (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

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Unit 014 Carrying Out Tests on Electronic Equipment and Circuits

Outcome 1 Carry out tests on electronic equipment and circuits

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. follow the appropriate procedures for use of tools and equipment to carry out the required tests
5. 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
6. set up and carry out the tests using the correct procedures and within agreed timescales
 7. carry out tests on electronic equipment and components, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's specifications
 - customer requirements
 - BS, ISO and/or BSEN standards
 8. 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
 9. record the results of the tests in the appropriate format
 10. complete one of the following records, and pass it to the appropriate person:
 - job cards
 - maintenance logs and action reports
 - company-specific test documentation
 11. review the results and carry out further tests if necessary

Unit 014 Carrying Out Tests on Electronic Equipment and Circuits

Outcome 2 Know how to carry out tests on electronic equipment and circuits

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the testing activity is to take place, and the responsibility these requirements place on them
2. describe their responsibilities under regulations relevant to the electronic testing activities being undertaken
3. describe 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. describe the specific safety precautions to be taken when carrying out formal inspection, safety and circuit testing of electronic equipment
5. describe the hazards associated with testing electronic equipment and circuits, and with the equipment that is used, and how these hazards can be minimised
6. describe the importance of wearing protective clothing, and other appropriate safety equipment, during the testing activities
7. describe the importance of keeping the work area clean, tidy and free from waste and surplus materials
8. explain how the testing activities may affect the work of others, and the procedure for informing them of the work to be carried out
9. describe the procedures and precautions to be adopted to eliminate/protect against electrostatic discharge (ESD)
10. Explain 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. describe the basic principles of how the electronic circuit functions, its operating sequence, the function/purpose of individual units/components, and how they interact
12. explain how to set up and apply the appropriate test equipment
13. explain 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. explain how to ensure the test equipment has been correctly calibrated
15. describe the various testing methods and procedures
16. explain how to assess test results, and make comparison with the specification
17. describe the environmental control requirements and company operating procedures relating to functional testing
18. describe the documentation required, and the procedures to be followed, at the conclusion of the testing
19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 015

Carrying Out Repairs to Electronic Equipment

Level: 2

Credit value: 23

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out repairs on electronic equipment, in accordance with approved procedures. The learner 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.

The learner 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. The learner will be expected to take care that they 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 their role.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying electronic repair procedures. The learner 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.

The learner 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 themselves, and others, against direct and indirect electric shock. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out repairs to electronic equipment
2. Know how to carry out repairs to electronic equipment

Guided learning hours

It is recommended that **77** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 15: Carrying Out Repairs to Electronic Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 015

Carrying Out Repairs to Electronic Equipment

Outcome 1

Carry out repairs to electronic equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. 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

2. 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

3. 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

4. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
5. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:
 - job cards
 - repair log/report
 - company specific documentation
6. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 015

Carrying Out Repairs to Electronic Equipment

Outcome 2

Know how to carry out repairs to electronic equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the repair activity is to take place, and the responsibility these requirements place on them
2. describe their responsibilities under regulations that apply to the electronic repair activities being undertaken
3. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the repair activities
5. describe 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. describe the importance of keeping the work area clean and tidy, and free from waste and surplus materials
7. explain how the repair activities may affect the work of others, and the procedure for informing them of the work to be carried out
8. describe the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD) hazards
9. explain 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. describe the basic principles of how the electronic circuit functions, and its operating sequence
11. explain how to check that the replacement components meet the required specification/operating conditions (such as values, tolerance, current-carrying capacity, ambient temperatures)
12. describe the 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. describe the importance of removing faulty components without causing damage to other components, wiring or the surrounding structure
14. describe the methods of attaching identification marks/labels to removed components or connections, in order to assist with re-assembly
15. describe 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. explain 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. describe 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. describe the importance of making 'off-load' checks before proving the equipment with the electrical supply on
19. explain how to make adjustments to components/assemblies to ensure that they function correctly
20. describe 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. describe the problems that can occur with the repair activity, and how they can be overcome
22. describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials
23. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 016

Carrying Out Fault Location on Fluid Power Equipment and Circuits

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to locate faults on fluid power equipment and circuits, on mobile or static plant, in accordance with approved procedures. The learner will be required to investigate faults on fluid power equipment such as pneumatic, hydraulic and vacuum devices, both at unit and component level. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking full responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying fault location procedures to fluid power equipment. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location on fluid power equipment and circuits
2. Know how to carry out fault location on fluid power equipment and circuits

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 16: Carrying Out Fault Location on Fluid Power Equipment and Circuits (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 016

Carrying Out Fault Location on Fluid Power Equipment and Circuits

Outcome 1

Carry out fault location on fluid power equipment and circuits

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - adhere to company specific contamination and control procedures at all times
 - 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
3. carry out fault location on one of the following types of fluid power system:
 - pneumatic system
 - hydraulic system
 - vacuum system
4. to include six of the following fluid power components:
 - pumps
 - pistons
 - spools
 - valves
 - actuators
 - motors
 - bearings
 - reservoirs/storage devices
 - accumulators
 - pressure intensifiers
 - compressors
 - receivers
 - gaskets and seals
 - pipework and hoses/tubing

- switches
 - sensors
 - lubricators/filters
 - regulators
 - other specific components
5. find faults that have resulted in two of the following breakdown categories:
 - intermittent problem
 - partial failure or reduced performance
 - complete breakdown
 6. review and use all relevant information on the symptoms and problems associated with the products or assets
 7. investigate and establish the most likely causes of the faults
 8. select, use and apply diagnostic techniques, tools and aids to locate faults using four of the following:
 - 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)
 - sequence charts
 - functional diagrams
 9. use two of the following types of instruments to assist in locating faults:
 - measuring devices/meters
 - pressure indicators
 - flow indicators
 - self-diagnostic equipment
 - contamination monitoring and analysing devices
 10. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
 11. determine the implications of the fault for other work and for safety considerations
 12. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
 13. record details on the extent and location of the faults in an appropriate format
 14. complete one of the following maintenance records, and pass it to the appropriate person:
 - scheduled maintenance report
 - other company specific report
 - corrective maintenance report

Unit 016

Carrying Out Fault Location on Fluid Power Equipment and Circuits

Outcome 2

Know how to carry out fault location on fluid power equipment and circuits

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
4. describe the 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. describe the importance of following the correct de-contamination procedure
6. explain 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)
7. describe the procedure to be adopted to establish the background of the fault
8. explain how to use the various diagnostic aids to help identify the location of the fault
9. describe 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, equipment self-diagnostics and fault cause remedy)
10. explain how to evaluate sensory information (sight, sound, smell, touch)
11. explain how to assess evidence and evaluate the possible causes of faults/problems
12. explain how to use a range of fault diagnostic equipment to investigate the problem
13. describe the care, handling and application of mechanical measuring/test equipment (such as measuring instruments, pressure and flow indicators and self-diagnostic equipment)
14. explain how to check that fluid power measuring/test equipment is within current calibration dates, and that it is free from damage and defects
15. describe the basic principles of how the fluid power equipment functions, and the operation and application, of the various units and components
16. describe the problems that can occur during the fault location activity, and how they can be minimised
17. explain how to evaluate the likely risk to themselves and others, and the effects the fault could have on the overall process or system
18. describe the importance of completing the correct documentation following the fault locating activity
19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 017

Carrying Out Maintenance Activities on Fluid Power Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out corrective maintenance activities on fluid power equipment, on mobile or static plant, 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.

The learner 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 'lifted' 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying maintenance procedures to fluid power equipment. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner 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 themselves and others in the workplace. The learner will be required to demonstrate safe working practices throughout.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance activities on fluid power equipment
2. Know how to carry out maintenance activities on fluid power equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 17: Carrying Out Maintenance Activities on Fluid Power Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

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Unit 017

Carrying Out Maintenance Activities on Fluid Power Equipment

Outcome 1

Carry out maintenance activities on fluid power equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - adhere to company specific contamination and control procedures at all times
 - 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
3. carry out maintenance activities on one of the following types of fluid power equipment:
 - pneumatic
 - hydraulic
 - vacuum
4. follow the relevant maintenance schedules to carry out the required work
5. maintain fluid power equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice (such as BFPA guidance documentation)
 - equipment manufacturers' operation range
 - BS, ISO and/or BSEN standards
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. maintain and/or replace six of the following fluid power system components:
 - pumps
 - pistons
 - spools
 - valves
 - actuators
 - motors
 - bearings
 - reservoirs

- accumulators
 - pressure intensifiers
 - compressors
 - receivers
 - gaskets and seals
 - pipework and hoses/tubing
 - switches
 - sensors
 - lubricators/filters
 - regulators
 - valve solenoid
 - other specific components
9. carry out eight of the following maintenance activities, as applicable to the equipment being maintained:
- chocking/supporting rams/components
 - releasing stored pressure
 - draining and removing fluids (as applicable)
 - disconnecting/removing hoses, pipes and hoses/tubing
 - proof marking/labelling of removed components
 - checking components for serviceability
 - replacing all 'lived' items (such as seals, filters, gaskets, hoses)
 - tightening fastenings to the required torque
 - priming and bleeding the system (where applicable)
 - removing and replacing units/components
 - setting, aligning and adjusting replaced components
 - making 'off-load' checks before re-pressurising the system
 - functional/performance testing of the maintained system
10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:
- job cards
 - maintenance log and action report
 - permit to work/formal risk assessment
 - company-specific documentation
12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 017

Carrying Out Maintenance Activities on Fluid Power Equipment

Outcome 2

Know how to carry out maintenance activities on fluid power equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them
2. describe the isolation procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be taken during the maintenance activities, and their effects on others
4. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. describe the importance of following the de-contamination procedure
6. describe the hazards associated with carrying out maintenance activities on fluid power equipment (such as handling fluids, stored pressure/force, misuse of tools), and how these can be minimised
7. describe the regulations and codes of practice that apply to working with fluid power equipment
8. explain how to obtain and interpret information from job instructions, drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process
9. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
10. describe the recognition of contaminants, the problems they can create, and the effects and likely symptoms of contamination in the system
11. describe the techniques used to dismantle/assemble fluid power equipment (such as release of pressures/force, proof marking, extraction)
12. describe the need to establish the cleanliness level of oil in the hydraulic reservoirs
13. describe the procedures to be followed to correctly fill hydraulic reservoirs
14. explain how to make adjustments to components/assemblies to ensure that they function correctly
15. describe the basic principles of how the fluid power equipment functions, and the operation and application, of the various units and components
16. explain 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
17. describe the generation of documentation and/or reports following the maintenance activity
18. describe the equipment operating and control procedures to be applied during the maintenance activity
19. explain how to use lifting and handling equipment, safely and correctly in the maintenance activity
20. describe the problems associated with the maintenance activity, and how they can be overcome
21. describe the procedure to be adopted for the safe disposal of waste of all types of materials
22. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 018

Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment

Level: 2

Credit value: 19

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out scheduled maintenance tasks on fluid power equipment on mobile or static plant, in accordance with approved procedures. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying scheduled maintenance procedures to fluid power equipment. The learner 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, the learner will be expected to report where the outcomes identify the need for further investigation or maintenance work.

The learner 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 themselves and others in the workplace. The learner will be required to demonstrate safe working practices throughout.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out scheduled maintenance tasks on fluid power equipment
2. Know how to carry out scheduled maintenance tasks on fluid power equipment

Guided learning hours

It is recommended that **56** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 18: Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

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Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 018

Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment

Outcome 1

Carry out scheduled maintenance tasks on fluid power equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations
 - adhere to company specific contamination and control procedures at all times
 - 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
3. carry out scheduled maintenance tasks on one of the following types of fluid power equipment:
 - pneumatic equipment
 - hydraulic equipment
 - vacuum equipment
4. carry out scheduled maintenance tasks on four of the following:
 - pumps
 - pipework and hoses/tubing
 - compressors
 - sensors/switches
 - storage devices (such as reservoirs, receivers, accumulators)
 - mechanical control devices (such as valves, actuators, motors)
 - valve solenoid
 - other specific system components
5. follow the relevant maintenance schedules to carry out the required work
6. maintain fluid power equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards

7. carry out the maintenance activities within the limits of their personal authority
8. carry out the maintenance activities in the specified sequence and in an agreed time scale
9. 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)
10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:
 - job cards
 - specific company documentation
 - permit to work/formal risk assessment
12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 018

Carrying Out Scheduled Maintenance Tasks on Fluid Power Equipment

Outcome 2

Know how to carry out scheduled maintenance tasks on fluid power equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe 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 them
2. describe the isolation procedure or permit-to-work procedure that applies to the equipment being maintained
3. describe the specific health and safety precautions to be applied during the scheduled maintenance tasks, and their effects on others
4. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. describe 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. explain how to obtain and extract information from job instructions, drawings, specifications, manufacturers' manuals and other documents needed in the maintenance process
7. describe the various checks to be carried out during the scheduled maintenance procedure
8. describe the importance of following correct decontamination procedures
9. describe the procedure for obtaining the consumables to be used during the scheduled maintenance activity
10. describe the methods of checking that components are fit for purpose, and the need to replace 'lived' items
11. explain how to check that any replacement components meet the required specification/operating conditions
12. explain how to make appropriate sensory checks (such as sight, sound, smell and touch)
13. describe the appropriate testing instructions to be adopted during the maintenance activity
14. explain how to make adjustments to components/assemblies to ensure they function to specification
15. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components, and how they interact
16. explain how to complete scheduled maintenance records/logs/reports, in accordance with company policy and procedures
17. describe the importance of recording an adjustments and modifications to the system and the implications if this is not carried out
18. describe the equipment operating and control procedures, and how to apply them in order to carry out scheduled maintenance
19. describe the problems that can occur whilst carrying out the scheduled maintenance tasks, and how they can be avoided
20. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 019

Carrying Out Fault Location on Service Systems and Equipment

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to locate faults on services, and service equipment and systems, in accordance with approved procedures. The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying fault location procedures to service equipment and systems. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location on service systems and equipment
2. Know how to carry out fault location on service systems and equipment

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 19: Carrying Out Fault Location on Service Systems and Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 019

Carrying Out Fault Location on Service Systems and Equipment

Outcome 1

Carry out fault location on service systems and equipment

Assessment Criteria

Practical Skills

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. locate faults that have resulted in two of the following breakdown categories:
 - intermittent problem
 - partial failure or reduced performance
 - complete breakdowns

5. review and use all relevant information on the symptoms and problems associated with the products or assets
6. investigate and establish the most likely causes of the faults
7. select, use and apply diagnostic techniques, tools and aids to locate faults using four of the following:
 - 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)
8. 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)
9. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
10. determine the implications of the fault for other work and for safety considerations
11. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
12. record details on the extent and location of the faults in an appropriate format
13. complete one of the following maintenance records, and pass it to the appropriate person:
 - scheduled maintenance report
 - corrective action report
 - company-specific documentation

Unit 019

Carrying Out Fault Location on Service Systems and Equipment

Outcome 2

Know how to carry out fault location on service systems and equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
4. describe 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. describe the procedure to be adopted to establish the background of the fault
6. explain how to use the various diagnostic aids to help identify the location of the fault
7. describe 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. explain how to evaluate sensory information (such as sight, sound, smell, touch)
9. explain how to assess evidence and evaluate the possible causes of faults/problems
10. explain how to use a range of fault diagnostic equipment to investigate the problem
11. describe 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. explain how to check that measuring/test equipment is within calibration and that it is free from damage and defects
13. explain 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. describe the basic principles of how the service equipment functions, its operating sequence, the purpose of individual units/components and how they interact
15. describe the problems that can occur during the fault location activity, and how they can be minimised
16. explain how to evaluate the likely risk to themselves and others, and the effects the fault could have on the overall process or system
17. describe the importance of completing the correct documentation, following the maintenance activity
18. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 020

Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment

Level: 2

Credit value: 19

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying scheduled maintenance procedures to services systems and equipment. The learner 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, the learner will be expected to report where the outcomes identify the need for further investigation or maintenance work.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out scheduled maintenance tasks on service systems and equipment
2. Know how to carry out scheduled maintenance tasks on service systems and equipment

Guided learning hours

It is recommended that **56** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 20: Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 020

Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment

Outcome 1

Carry out scheduled maintenance tasks on service systems and equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. follow the relevant maintenance schedules to carry out the required work
5. maintain services or systems equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
6. carry out the maintenance activities within the limits of their personal authority

7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. 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, 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-'lived' components)
9. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
10. complete relevant maintenance records accurately, to include one of the following and pass them on to the appropriate person:
 - job cards
 - specific company documentation
 - permit to work/formal risk assessment
11. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 020

Carrying Out Scheduled Maintenance Tasks on Service Systems and Equipment

Outcome 2

Know how to carry out scheduled maintenance tasks on service systems and equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

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

Unit 021

Carrying Out Maintenance on Water Distribution Systems and Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying procedures for fresh water distribution equipment. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on water distribution systems and equipment
2. Know how to carry out maintenance on water distribution systems and equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 21: Carrying Out Maintenance on Water Distribution Systems and Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 021

Carrying Out Maintenance on Water Distribution Systems and Equipment

Outcome 1

Carry out maintenance on water distribution systems and equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. follow the relevant maintenance schedules to carry out the required work
5. maintain water distribution systems, in accordance with one of the following:
 - organisational guidelines and codes of practise
 - equipment manufacturer's operation range
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. carry out all of the following maintenance activities:
 - dismantling equipment to 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 checks before re-connecting the supply
- functionally testing the maintained equipment

9. 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)

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permits to work/formal risk assessment
- maintenance log and action report
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 021

Carrying Out Maintenance on Water Distribution Systems and Equipment

Outcome 2

Know how to carry out maintenance on water distribution systems and equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe 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. describe the hazards associated with carrying out maintenance activities on water distribution equipment and systems, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. explain 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, BS7671/IEE wiring regulations)
7. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance
8. describe the sequence to be adopted for the dismantling/reassembly of various types of assemblies
9. describe the methods and techniques used to dismantle/assemble water distribution equipment (such as release of water/pressures/force, bonding, extraction, pressing, alignment)
10. describe the methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lified' items (such as seals, gaskets, washers)
11. describe the basic principles of how the system functions, its operating sequence, the working purpose of individual units/components and how they interact
12. describe the applications of different types of pipework systems (such as copper, plastic, lead, iron and clay)
13. describe the different types of couplings and their fittings (such as tees, bends, branches)
14. describe the equipment and tools used to bend, form and thread pipework
15. describe the methods of treating water systems
16. describe the applications of the different pipework and equipment cleaning procedures (such as rod, water jet, solvents)
17. explain how to make adjustments to components/assemblies to ensure that they function correctly
18. explain how to check that tools and equipment are free from damage or defects, and are in a safe and usable condition
19. describe the generation of maintenance documentation and/or reports, following the maintenance activity
20. describe the problems associated with the maintenance activity, and how they can be overcome

21. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
22. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 022

Carrying Out Maintenance on Emergency Power Generation Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying maintenance procedures to emergency power generation systems and equipment. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on emergency power generation equipment
2. Know how to carry out maintenance on emergency power generation equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 22: Carrying Out Maintenance on Emergency Power Generation Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 022

Carrying Out Maintenance on Emergency Power Generation Equipment

Outcome 1

Carry out maintenance on emergency power generation equipment

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. follow the relevant maintenance schedules to carry out the required work
5. maintain emergency power generation equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's guidelines
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. 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

9. 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)
- temperature control components (such as thermostat, thermocouples, thermistors)
- electronic components (such as circuit boards, timers, transducers)
- noise reduction/attenuation

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permit to work/formal risk assessment
- maintenance log and action report
- company specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 022 Carrying Out Maintenance on Emergency Power Generation Equipment

Outcome 2 Know how to carry out maintenance on emergency power generation equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies to the equipment being maintained
3. describe the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. describe 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. describe the importance of wearing the correct personal and environmental protection equipment, and other appropriate safety equipment, during the maintenance process
6. explain 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, BS7671/IEE wiring regulations)
7. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
8. explain why electrical earthing and bonding is critical, and why it must be both mechanically and electrically secure
9. describe the sequence to be adopted for the dismantling/reassembly of various types of assemblies
10. describe 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. describe the 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. explain how to make adjustments to components/assemblies to ensure that they function correctly
13. describe the methods of removing and replacing components and units, without damaging the system and infrastructure
14. describe the use of electrical measuring equipment (such as multimeters and resistance testers)
15. describe the methods of testing the equipment and systems for leaks, and the tools and equipment that can be used

16. describe the types of coolants and antifreeze agents; quantities used; and methods of flushing and filling the system
17. explain how to check that tools and equipment are free from damage or defects, and are in a safe and usable condition
18. describe the importance of maintenance documentation and/or reports following the maintenance activity, and how to generate them
19. describe the equipment operating and control procedures to be applied during the maintenance activity
20. explain how to use lifting and handling equipment correctly and safely in the maintenance activity
21. describe the problems associated with the maintenance activity, and how they can be overcome
22. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
23. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 023

Carrying Out Maintenance on Workplace Environmental Control Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner 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.

The learner's responsibilities will require them to comply with organisational policy and procedures for the maintenance activities undertaken, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying maintenance procedures to workplace environmental control systems and equipment. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on workplace environmental control equipment
2. Know how to carry out maintenance on workplace environmental control equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 23: Carrying Out Maintenance on Workplace Environmental Control Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 023

Carrying Out Maintenance on Workplace Environmental Control Equipment

Outcome 1

Carry out maintenance on workplace environmental control equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. follow the relevant maintenance schedules to carry out the required work
5. maintain environmental control equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. 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

9. 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

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permit to work/formal risk assessment
- maintenance log and action report
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 023

Carrying Out Maintenance on Workplace Environmental Control Equipment

Outcome 2

Know how to carry out maintenance on workplace environmental control equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility these requirements place on them
2. describe 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. explain 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
5. explain 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, BS7671/IEE wiring regulations)
6. describe the sequence to be adopted for the dismantling/reassembly of various types of assemblies
7. describe 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. describe the 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. explain how to make adjustments to components/assemblies to ensure that they function correctly
10. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
11. describe the methods of removing and replacing components and units, without damaging the system and infrastructure
12. explain 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. describe the generation of maintenance documentation and/or reports following the maintenance activity
14. describe the equipment operating and control procedures to be applied during the maintenance activity
15. explain how to use lifting and handling equipment correctly and safely in the maintenance activity
16. describe the problems associated with the maintenance activity, and how they can be overcome
17. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials

18. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 024

Carrying Out Maintenance on Heating and Ventilation Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying heating and ventilation maintenance procedures. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on heating and ventilation equipment
2. Know how to carry out maintenance on heating and ventilation equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 24: Carrying Out Maintenance on Heating and Ventilation Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 024

Carrying Out Maintenance on Heating and Ventilation Equipment

Outcome 1

Carry out maintenance on heating and ventilation equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. carry out maintenance activities on one of the following types of primary energy heat source systems:
 - liquid
 - gaseous
 - solid fuel
 - renewable energy
 - electrical
4. follow the relevant maintenance schedules to carry out the required work
5. maintain heating and ventilation systems, in accordance with one of the following:
 - organisational codes of practise
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - BS7671/IEE wiring regulations
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. 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

9. maintain and/or replace 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)

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permit to work/formal risk assessment
- maintenance log and action report
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 024

Carrying Out Maintenance on Heating and Ventilation Equipment

Outcome 2

Know how to carry out maintenance on heating and ventilation equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. explain 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, BS7671/IEE wiring regulations)
7. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
8. describe the sequence to be adopted for the dismantling/reassembly of various types of assemblies
9. describe the methods and techniques used to dismantle/assemble heating and ventilation equipment (release of pressures/force/fluids, proof marking, extraction, pressing, alignment)
10. describe the 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. explain how to make adjustments to components/assemblies to ensure that they function correctly
12. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
13. describe the typical building design temperatures (such as for offices, factories (light and heavy work) warehouses and canteens)
14. explain 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. describe the generation of maintenance documentation and/or reports following the maintenance activity
16. describe the equipment operating and control procedures to be applied during the maintenance activity
17. explain how to use lifting and handling equipment correctly and safely in the maintenance activity
18. describe the problems associated with the maintenance activity, and how they can be overcome

19. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
20. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 025

Carrying Out Maintenance on Air Conditioning and Ventilation Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying air conditioning and ventilation maintenance procedures. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on air conditioning and ventilation equipment
2. Know how to carry out maintenance on air conditioning and ventilation equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 25: Carrying Out Maintenance on Air Conditioning and Ventilation Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 025

Carrying Out Maintenance on Air Conditioning and Ventilation Equipment

Outcome 1

Carry out maintenance on air conditioning and ventilation equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. carry out maintenance activities on two of the following types of equipment:
 - remote air conditioning generation
 - local air conditioning distribution
 - air conditioning control
4. follow the relevant maintenance schedules to carry out the required work
5. maintain air conditioning and ventilation systems, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - BS7671/IEE wiring regulations
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. 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)

9. 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

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permit to work/formal risk assessment
- maintenance log and action report
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 025

Carrying Out Maintenance on Air Conditioning and Ventilation Equipment

Outcome 2

Know how to carry out maintenance on air conditioning and ventilation equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe 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. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. explain 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, BS7671/IEE wiring regulations)
7. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance
8. describe the sequence to be adopted for the dismantling/reassembly of various types of assemblies
9. describe the methods and techniques used to dismantle/assemble air conditioning equipment (such as release of pressures/force/fluid, proof marking, extraction, pressing, alignment)
10. describe the 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. explain how to make adjustments to components/assemblies to ensure that they function correctly
12. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
13. describe the correct operating ranges (including temperature and pressure of secondary heating sources (air and water))
14. describe the typical building design temperatures (such as for offices, factories (light and heavy work) warehouses and canteens)
15. explain 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. describe the generation of maintenance documentation and/or reports following the maintenance activity
17. describe the equipment operating and control procedures to be applied during the maintenance activity
18. explain how to use lifting and handling equipment correctly and safely in the maintenance activity

19. describe the problems associated with the maintenance activity, and how they can be overcome
20. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 026

Carrying Out Maintenance on Gas Distribution Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying gas distribution maintenance procedures. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on gas distribution equipment
2. Know how to carry out maintenance on gas distribution equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 26: Carrying Out Maintenance on Gas Distribution Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 026

Carrying Out Maintenance on Gas Distribution Equipment

Outcome 1

Carry out maintenance on gas distribution equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. carry out maintenance activities on one of the following types of gas distribution system:
 - mains
 - tanks
 - cylinders
4. follow the relevant maintenance schedules to carry out the required work
5. maintain gas distribution systems, in accordance with one of the following:
 - equipment manufacturer's operation range
 - organisational guidelines and codes of practice
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed timescale
8. 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 '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

9. 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

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permit to work/formal risk assessment
- maintenance log and action report
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 026

Carrying Out Maintenance on Gas Distribution Equipment

Outcome 2

Know how to carry out maintenance on gas distribution equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies to the gas system being maintained
3. describe the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. explain 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, BS7671/IEE wiring regulations)
7. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
8. describe the importance of following the correct procedures for purging and de-commissioning components
9. describe the sequence to be adopted for the dismantling/reassembly of various types of gas assemblies
10. describe the 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. explain how to make adjustments to components/assemblies to ensure that they function correctly
12. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
13. describe the methods used to label and identify different pipework systems (including colour coding and warning signs)
14. describe the different types and applications of measuring and monitoring equipment used
15. explain 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. describe the generation of maintenance documentation and/or reports following the maintenance activity
17. describe the equipment operating and control procedures to be applied during the maintenance activity
18. explain how to use lifting and handling equipment correctly and safely in the maintenance activity

19. describe the problems associated with the maintenance activity, and how they can be overcome
20. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 027

Carrying Out Maintenance on Compressed Air Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying compressed air maintenance procedures. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on compressed air equipment
2. Know how to carry out maintenance on compressed air equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 27: Carrying Out Maintenance on Compressed Air Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 027

Carrying Out Maintenance on Compressed Air Equipment

Outcome 1

Carry out maintenance on compressed air equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations
 - 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
3. carry out maintenance activities on two of the following types of equipment:
 - compressed air generation
 - compressed air distribution
 - compressed air control
4. follow the relevant maintenance schedules to carry out the required work
5. maintain compressed air systems equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed timescale
8. 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

9. 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

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permit to work/formal risk assessment
- maintenance log and action report
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 027 Carrying Out Maintenance on Compressed Air Equipment

Outcome 2 Know how to carry out maintenance on compressed air equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies to the compressed air equipment/system being worked on
3. describe the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. explain 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, BS7671/IEE wiring regulations)
7. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
8. describe the sequence to be adopted for the dismantling/reassembly of various types of assemblies used on compressed air equipment
9. describe the methods and techniques used to dismantle/assemble compressed air equipment (release of pressures/force/fluid, proof marking, extraction, pressing, alignment)
10. describe the 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. explain how to make adjustments to components/assemblies to ensure that they function correctly
12. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
13. explain 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. describe the generation of maintenance documentation and/or reports following the maintenance activity
15. describe the equipment operating and control procedures to be applied during the maintenance activity
16. explain how to use lifting and handling equipment correctly and safely in the maintenance activity
17. describe the problems associated with the maintenance activity, and how they can be overcome
18. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials

19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 028

Carrying Out Maintenance on Process Control Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying maintenance procedures to process control systems. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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. The learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on process control equipment
2. Know how to carry out maintenance on process control equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 28: Carrying Out Maintenance on Process Control Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 028

Carrying Out Maintenance on Process Control Equipment

Outcome 1

Carry out maintenance on process control equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. carry out maintenance activities on one of the following types of process controller equipment:
 - fixed input/output (i/o)
 - modular
 - rack mount
4. follow the relevant maintenance schedules to carry out the required work
5. maintain process control equipment, in accordance with one of the following:
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed timescale
8. 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

9. 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

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- maintenance log and action report
- permit to work/formal risk assessment
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 028

Carrying Out Maintenance on Process Control Equipment

Outcome 2

Know how to carry out maintenance on process control equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility they place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies to the process control system being worked on
3. describe the specific health and safety precautions to be applied during the maintenance activity, and their effects on others
4. explain 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities, and where this can be obtained
6. describe the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
7. describe 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. explain 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, BS7671/IEE wiring regulations)
9. describe the basic principles of how the system functions, and its operating sequence
10. describe the devices and systems for storing programmes
11. explain how to search the user program within the process controller for specific elements
12. describe the techniques involved in editing, and the procedure to be followed for 'on' and 'off-line' programming
13. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance process
14. describe 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. describe the methods of attaching identification marks/labels to removed components or cables, to assist with reassembly
16. describe the methods of checking that components are fit for purpose, and the need to replace batteries, boards and other failed items
17. explain 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. describe the importance of making 'off-load' checks before proving the equipment with the electrical supply on

19. describe the generation of maintenance documentation and/or reports following the maintenance activity
20. describe the equipment operating and control procedures to be applied during the maintenance activity
21. explain how to use lifting and handling equipment correctly and safely in the maintenance activity
22. describe the problems that can occur during the maintenance of the process control system, and how they can be overcome
23. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
24. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 029

Carrying Out Maintenance on Instrumentation and Control Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying maintenance procedures to instrumentation and control equipment and systems. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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. The learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on instrumentation and control equipment
2. Know how to carry out maintenance on instrumentation and control equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 29: Carrying Out Maintenance on Instrumentation and Control Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 029

Carrying Out Maintenance on Instrumentation and Control Equipment

Outcome 1

Carry out maintenance on instrumentation and control equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. carry out maintenance activities on one of the following types of instrumentation and control system:
 - 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
4. follow the relevant maintenance schedules to carry out the required work
5. maintain installation and control systems in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed timescale
8. 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)

9. 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

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permits to work/formal risk assessment
- maintenance log and action report
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 029

Carrying Out Maintenance on Instrumentation and Control Equipment

Outcome 2

Know how to carry out maintenance on instrumentation and control equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place, and the responsibility they place on them
2. describe 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. describe the specific health and safety precautions to be applied during the maintenance process, and their effects on others
4. explain 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities, and where this can be obtained
6. describe the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
7. Describe 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. explain 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, BS7671/IEE wiring regulations)
9. describe the basic principles of operation of the instrumentation being maintained, and its operating sequence
10. describe 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. describe 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. explain how to carry out visual checks of the instruments (such as security of joints and physical damage)
13. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance process
14. describe 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. describe the methods of attaching identification marks/labels to removed components or cables, to assist with reassembly
16. describe the methods of checking that components are fit for purpose, and the need to replace batteries, boards and other failed items

17. explain 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. describe the generation of maintenance documentation and/or reports following the maintenance activity
19. describe the equipment operating and control procedures to be applied during the maintenance activity
20. describe the problems that can occur during the maintenance of the instrumentation and control system, and how they can be overcome
21. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
22. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 030

Carrying Out Maintenance on Industrial Refrigeration Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying maintenance procedures on refrigeration systems and equipment. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating, charging and purging the equipment. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on industrial refrigeration equipment
2. Know how to carry out maintenance on industrial refrigeration equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 30: Carrying Out Maintenance on Industrial Refrigeration Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 030

Carrying Out Maintenance on Industrial Refrigeration Equipment

Outcome 1

Carry out maintenance on industrial refrigeration equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. follow the relevant maintenance schedules to carry out the required work
5. maintain industrial refrigeration equipment, in accordance with one of the following:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - BS7671/IEE wiring regulations
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. 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 'lifer' 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

9. 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

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permit to work/formal risk assessment
- maintenance log and action report
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 030

Carrying Out Maintenance on Industrial Refrigeration Equipment

Outcome 2

Know how to carry out maintenance on industrial refrigeration equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies to the refrigeration equipment being maintained
3. describe the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. describe 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. describe the 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
7. explain 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, BS7671/IEE wiring regulations)
8. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
9. describe the sequence to be adopted for the dismantling/reassembly of various types of assemblies
10. describe the methods and techniques used to dismantle/assemble refrigeration equipment (unplugging, de-soldering, removal of screwed, clamped and crimped connections, removing bolted components and assemblies)
11. describe the 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. explain how to make adjustments to components/assemblies to ensure that they function correctly
13. describe 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. describe the system operating pressures and temperatures, and the relationship between refrigerant gas pressures and temperatures
15. describe the methods of removing and replacing components and units, without damaging the system and infrastructure
16. describe the 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. describe the types and application of primary and secondary refrigerants, and methods of purging and charging the system using liquid and vapour refrigerants
18. describe the use of vacuum pumps, pressure gauges, compound gauges, flow gauges and indicators
19. explain 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. describe the generation of maintenance documentation and/or reports following the maintenance activity
21. describe the equipment operating and control procedures to be applied during the maintenance activity
22. explain how to use lifting and handling equipment correctly and safely in the maintenance activity
23. describe the problems associated with the maintenance activity, and how they can be overcome
24. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
25. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 031

Carrying Out Maintenance on Environmental Control Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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.

The learner will be expected to cover a range of maintenance activities, such as labelling/markings 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying maintenance procedures to environmental control equipment. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance on environmental control equipment
2. Know how to carry out maintenance on environmental control equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 31: Carrying Out Maintenance on Environmental Control Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 031 Carrying Out Maintenance on Environmental Control Equipment

Outcome 1 Carry out maintenance on environmental control equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations
 - 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
3. carry out maintenance activities on one of the following types of environmental control equipment:
 - air pollution control equipment (such as decarbonisation (CO₂ reduction), de-nitrification, deodorising, desulphurisation, dust collectors, smoke filters, scrubbers, and removal of refrigerant gases)
 - effluent treatment equipment (such as aerobic and anaerobic biochemical treatment, filter screens and presses, liquid separators, waste oil treatment, sewage treatment, industrial waste water treatment)
 - noise and vibration equipment (such as vibration prevention and isolation, noise attenuation and acoustic enclosures)
 - waste and used product handling, storing and recycling equipment (such as appliance recycling, battery recycling, incinerators, ash handling, heat recovery, shredders and crushers, conveyors and sorters, compaction)
4. follow the relevant maintenance schedules to carry out the required work
5. maintain environmental control equipment, in accordance with one of the following (as appropriate to the equipment being maintained):
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - BS7671/IEE wiring regulations
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed time scale
8. carry out all of the following maintenance activities:

- dismantling equipment to the required level
- marking/labelling of components
- checking components for serviceability
- replacing 'lifer' 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

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9. 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

10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule

11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:

- job cards
- permit to work/formal risk assessment
- maintenance log and action report
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 031

Carrying Out Maintenance on Environmental Control Equipment

Outcome 2

Know how to carry out maintenance on environmental control equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the maintenance activity is to take place
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies to the environmental control equipment being maintained
3. describe the specific health and safety precautions to be applied during the maintenance procedure, and their effects on others
4. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
6. describe the associated hazardous substances, their monitoring and exposure limits
7. explain how to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
8. describe the procedure for obtaining replacement parts, materials and other consumables necessary for the maintenance activities
9. describe the sequence to be adopted for the dismantling/reassembly of various types of assemblies
10. describe 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. describe the 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. explain how to make adjustments to components/assemblies to ensure that they function correctly
13. describe the basic principles of how environmental control systems function, their operating sequence, the working purpose of individual units/components and how they interact
14. describe the methods of removing and replacing components and units, without damaging the system and infrastructure
15. explain 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. describe the generation of maintenance documentation and/or reports following the maintenance activity
17. describe the equipment operating and control procedures to be applied during the maintenance activity
18. explain how to use lifting and handling equipment correctly and safely in the maintenance activity

19. describe the problems associated with the maintenance activity, and how they can be overcome
20. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 032

Carrying Out Fault Location on Communication-Electronic Systems

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to locate faults on communication-electronic systems, in accordance with approved procedures. The learner will be required to locate faults on a range of communication-electronic systems, sub-systems, assemblies or components at line replacement unit (LRU) level. The learner 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. The learner will be expected to take care that they 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 their role.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking full responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying fault location procedures on communication-electronic systems. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location on communication-electronic systems
2. Know how to carry out fault location on communication-electronic systems

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 32: Carrying Out Fault Location on Communication-Electronic Systems (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 032

Carrying Out Fault Location on Communication-Electronic Systems

Outcome 1

Carry out fault location on communication-electronic systems

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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)

- 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
- review and use all relevant information on the symptoms and problems associated with the products or assets
- investigate and establish the most likely causes of the faults
- select, use and apply diagnostic techniques, tools and aids to locate faults using four of the following methods:
 - 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
- 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
- complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
- determine the implications of the fault for other work and for safety considerations
- use the evidence gained to draw valid conclusions about the nature and probable cause of the fault

12. record details on the extent and location of the faults in an appropriate format
13. complete one of the following maintenance records, and pass it to the appropriate person:
 - scheduled maintenance report
 - corrective maintenance report
 - other company-specific report

Unit 032

Carrying Out Fault Location on Communication-Electronic Systems

Outcome 2

Know how to carry out fault location on communication-electronic systems

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies in the work area
3. explain 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. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
5. describe 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. describe the procedure to be adopted to establish the background of the fault
7. explain how to use the various diagnostic aids to help identify the location of the fault
8. describe 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. explain how to evaluate sensory information (sight, sound, smell, touch)
10. explain how to assess evidence and evaluate the possible causes of faults/problems
11. describe the care, handling and application of electrical test equipment
12. describe 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. explain how to use a range of fault diagnostic equipment to investigate the problem
14. explain how to check that the electronic test equipment is within calibration, and that it is free from damage and defects
15. explain 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, BS7671/IEE wiring regulations)
16. describe the functions of different types of electronic components (analogue or digital), and their operation
17. describe the problems that can occur during the fault location activity, and how they can be minimised
18. describe the importance of completing the correct documentation, following the maintenance activity
19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 033

Carrying Out Scheduled Maintenance on Communication-Electronic Systems

Level: 2

Credit value: 19

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out scheduled maintenance on communication-electronic systems, in accordance with approved procedures. The learner will be required to carry out scheduled maintenance tasks on a range of communication-electronic systems, sub-systems or assemblies. The learner 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.

The learner's responsibilities will require them to comply with organisational policy and procedures for the scheduled maintenance tasks undertaken, and to report any problems with these activities that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying scheduled maintenance procedures to communication-electronic systems. The learner 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, the learner will be expected to report where the outcomes identify the need for further investigation or maintenance work.

The learner 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 themselves against direct or indirect electric shock. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out scheduled maintenance on communication-electronic systems
2. Know how to carry out scheduled maintenance on communication-electronic systems

Guided learning hours

It is recommended that **56** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 33: Carrying Out Scheduled Maintenance on Communication-Electronic Systems (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 033

Carrying Out Scheduled Maintenance on Communication-Electronic Systems

Outcome 1

Carry out scheduled maintenance on communication-electronic systems

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. follow the relevant maintenance schedules to carry out the required work
 5. ensure that the maintained system meets one of the following quality and accuracy standards:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - Ministry of Defence (MOD) standards
 6. carry out the maintenance activities within the limits of their personal authority
 7. carry out the maintenance activities in the specified sequence and in an agreed time scale
 8. 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 'lived' 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- 'lived' components)
 9. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
 10. complete relevant maintenance records accurately, to include all of the following, and pass them on to the appropriate person:
 - job cards
 - maintenance log and action report
 - permit to work/formal risk assessment

- company-specific documentation

11. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 033

Carrying Out Scheduled Maintenance on Communication-Electronic Systems

Outcome 2

Know how to carry out scheduled maintenance on communication-electronic systems

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the scheduled maintenance activity is to take place, and the responsibility they place on them
2. describe 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. describe the isolation procedures unique to communication-electronic systems, sub-systems or assemblies
4. describe the specific health and safety precautions needed to be applied during the scheduled maintenance procedure and their effects on others
5. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance activities
7. explain how the maintenance activities may effect the work of others, and the procedure for informing them of the work to be carried out
8. describe the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
9. explain how to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
10. describe the maintenance schedules and methods to be followed in order to comply with company procedures for scheduled maintenance
11. describe the various checks to be carried out during the scheduled maintenance procedure
12. explain how to make sensory checks (by sight, sound, smell or touch)
13. describe the company policy on repair/replacement of systems, sub-systems and assemblies during the scheduled maintenance process
14. describe the methods of checking that systems, sub-systems and assemblies are fit for purpose, and the need to replace 'lifer' items (such as batteries)
15. explain how to make adjustments to systems, sub-systems and assemblies to ensure they function correctly
16. describe the generation of maintenance documentation and/or reports following the maintenance activity
17. describe the simple problems that can occur during the scheduled maintenance activity, and how they can be overcome
18. describe the organisational procedure to be adopted for the safe disposal of waste of all types of materials
19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 034

Carrying Out Repairs to Communication-Electronic Systems

Level: 2

Credit value: 23

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out repairs on communication-electronic systems, in accordance with approved procedures. The learner 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.

The learner 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. The learner will be expected to take care that they 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 their role.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying electronic repair procedures. The learner 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.

The learner 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 themselves and others against direct or indirect electric shock. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out repairs to communication-electronic systems
2. Know how to carry out repairs to communication-electronic systems

Guided learning hours

It is recommended that **77** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 34: Carrying Out Repairs to Communication-Electronic Systems (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 034

Carrying Out Repairs to Communication-Electronic Systems

Outcome 1

Carry out repairs to communication-electronic systems

Assessment Criteria

Practical skills

The learner will be able to:

1. Work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. follow the relevant maintenance schedules to carry out the required work
 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, ISO and/or BSEN standards
 - Ministry of Defence (MoD)
 6. carry out the maintenance activities within the limits of their personal authority
 7. carry out the maintenance activities in the specified sequence and in an agreed timescale
 8. 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
 9. 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)
 10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
 11. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:
 - job cards
 - permit to work/formal risk assessment
 - maintenance logs and action reports
 - company-specific documentation
 12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 034

Carrying Out Repairs to Communication-Electronic Systems

Outcome 2

Know how to carry out repairs to communication-electronic systems

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the repair activity is to take place, and the responsibility these requirements place on them
2. describe their responsibilities under regulations that apply to the electronic repair activities being undertaken
3. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the repair activities
5. describe 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. describe the importance of keeping the work area clean and tidy, and free from waste and surplus materials
7. explain how the repair activities may affect the work of others, and the procedure for informing them of the work to be carried out
8. describe the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD) hazards
9. explain 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. describe the basic principles of how the electronic circuit functions
11. describe the organisational policy on the repair or replacement of faulty components during the repair process
12. explain how to check that the replacement units/components meet the required specification/operating conditions
13. describe the methods of removing and replacing the faulty units/components from the equipment (unplugging, de-soldering, removal of screwed, clamped, edge connected, zero insertion force, and crimped connections)
14. describe the importance of removing faulty components, without causing damage to other components, wiring, or the surrounding structure
15. describe the methods of attaching identification marks/labels to removed components or connections, in order to assist with re-assembly
16. describe 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. explain 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. describe 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 no wire ends or solder blobs that could cause short circuits, and that all fuses/protection devices are installed)

19. describe the importance of making 'off-load' checks before proving the equipment with the electrical supply on
20. explain how to make adjustments to components/assemblies to ensure that they function correctly
21. describe 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. describe the problems that can occur with the repair activity, and how they can be overcome
23. describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials
24. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 035

Carrying Out Modifications to Communication-Electronic Systems

Level: 2

Credit value: 20

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to modify communication-electronic systems, sub-systems or assemblies, in accordance with approved procedures. The learner 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. The learner will be expected to remove and replace cables, add new cables and change the route of cables. The learner will also be expected to modify LRUs (line replacement units) within communication-electronic systems.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to modification of communication-electronic systems. The learner 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.

The learner will understand the safety precautions required when carrying out the modification activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out modifications to communication-electronic systems
2. Know how to carry out modifications to communication-electronic systems

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 35: Carrying Out Modifications to Communication-Electronic Systems (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 035

Carrying Out Modifications to Communication-Electronic Systems

Outcome 1

Carry out modifications to communication-electronic systems

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the modification activity:
 - obtain and use the correct issue of company and/or manufacturers' documentation
 - adhere to procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. follow the relevant modification schedule to carry out the required work
 5. produce modifications which comply with one of the following standards:
 - customer standards and requirements
 - company standards and requirements
 - BS, ISO and/or BSEN standards
 - Ministry of Defence (MoD)
 - manufacturers' standards and requirements
 6. carry out the modification activities within the limits of their personal authority
 7. carry out the modification activities in the specified sequence and in an agreed timescale
 8. 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
 9. 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
 10. report any instances where the modification activities cannot be fully met or where there are identified defects outside the planned schedule
 11. complete relevant modification records accurately, to include one of the following, and pass them on to the appropriate person:
 - job cards
 - maintenance log and action report

- modification record
- permit to work/formal risk assessment
- company-specific documentation

12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 035

Carrying Out Modifications to Communication-Electronic Systems

Outcome 2

Know how to carry out modifications to communication-electronic systems

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe 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. describe the health and safety requirements of the area in which the modification is to take place, and the responsibility these requirements place on them
3. describe the personal protective equipment and clothing to be worn during the modification activities
4. describe 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. explain 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. explain how to identify the components to be used; component identification systems (codes and component orientation indicators)
7. describe the preparations to be undertaken on the system, prior to carrying out the modification
8. describe the methods and techniques to be used for soldering and de-soldering, and the importance of adhering to them
9. describe the methods and techniques to be used for crimping and heat shrinking, and the importance of adhering to them
10. describe the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
11. describe the basic operation of the communication-electronic system, sub-system and assembly being modified
12. describe the different types of cable protection, and reasons for using each type
13. describe the various mechanical fasteners that will be used, and their method of installation
14. describe the importance of using the specified fasteners for the modification, and why they must not use substitutes
15. describe the quality control procedures to be followed during the modification operations
16. explain how to conduct any necessary checks to ensure the accuracy and quality of the modification
17. explain how to recognise defects (such as misalignment, ineffective fasteners, foreign object damage or contamination)
18. describe the problems that can occur with the modification operations, and how these can be overcome
19. describe the organisational procedures to be adopted for the safe disposal of waste of all types of materials
20. describe 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. describe the organisational policy on modification and how the process should be undertaken
22. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 036

Carrying Out Tests on Communication-Electronic Systems

Level: 2

Credit value: 20

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out checks and tests on communication-electronic systems, in accordance with approved procedures. The learner 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. The learner 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. The learner will be expected to take care that they 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 their role.

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

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying the necessary test procedures. The learner 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, the learner 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.

The learner 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 themselves and others against direct and indirect electric shock. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out tests on communication-electronic systems
2. Know how to carry out tests on communication-electronic systems

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 36: Carrying Out Tests on Communication-Electronic Systems (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 036

Carrying Out Tests on Communication-Electronic Systems

Outcome 1

Carry out tests on communication-electronic systems

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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
 - obtain and use the correct issue of company and/or manufacturers' testing documentation
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. follow the appropriate procedures for use of tools and equipment to carry out the required tests
 5. 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
 6. Set up and carry out the tests using the correct procedures and within agreed timescales
 7. 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
 8. 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

9. record the results of the tests in the appropriate format

10. 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

11. review the results and carry out further tests if necessary

Unit 036

Carrying Out Tests on Communication-Electronic Systems

Outcome 2

Know how to carry out tests on communication-electronic systems

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the testing activity is to take place, and the responsibility they place on them
2. describe their responsibilities under regulations relevant to the communication-electronic testing activities being undertaken
3. describe 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. describe the isolation procedures unique to communication-electronic systems
5. describe the specific safety precautions to be taken when carrying out formal inspection, safety checking and testing of communication-electronic equipment
6. describe the hazards associated with testing communication-electronic systems and with the equipment that is used, and how these can be minimised
7. describe the importance of wearing protective clothing and other appropriate safety equipment during the testing activities
8. describe the importance of keeping the work area clean and tidy, and free from waste and surplus materials
9. explain how the testing activities may effect the work of others, and the procedure for informing them of the work to be carried out
10. describe the procedures and precautions to be adopted to eliminate electrostatic discharge (ESD)
11. explain 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. explain how to determine suitable test points within a system, sub-system or assembly
13. explain how to set up and apply the appropriate test equipment
14. explain how to determine the calibration state of the equipment, and the actions to be taken if equipment is out of calibration
15. explain 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. describe the various testing methods and procedures, and how to apply them to different operating conditions
17. describe the documentation required, and the procedures to be followed at the conclusion of the testing
18. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 037

Carrying Out the Configuration of Communication-Electronic Systems

Level: 2

Credit value: 20

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out configuration tasks on communication-electronic systems, in accordance with approved procedures. The learner will be required to configure a range of communication-electronic systems, sub-systems or assemblies into a communication-electronic system. The learner will need to carry out the configuration activities to ensure that the system, sub-system or assembly performs to specified levels.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to the configuration of communication-electronic systems. The learner 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.

The learner will understand the safety precautions required when carrying out the configuration activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out the configuration of communication-electronic systems
2. Know how to carry out the configuration of communication-electronic systems

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 37: Carrying Out the Configuration of Communication-Electronic Systems (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

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Unit 037

Carrying Out the Configuration of Communication-Electronic Systems

Outcome 1

Carry out the configuration of communication-electronic systems

Assessment Criteria

Practical Skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all the following during the configuration activities:
 - obtain and use the correct issue of company publications and/or manufacturers' documentation
 - adhere to procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. follow all relevant setting up and operating specifications for the products or assets being configured
 5. follow the defined procedures and set up the equipment correctly ensuring that all operating parameters are achieved
 6. 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
 7. 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
 8. deal promptly and effectively with problems within their control and report those that cannot be solved
 9. check that the configuration is complete and that the equipment operates to specification
 10. 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

11. 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

12. complete all relevant documentation accurately and legibly

13. provide a record/report of the configuration outcome(s), using one of the following:

- job card
- company-specific reporting procedure
- specific configuration report

Unit 037

Carrying Out the Configuration of Communication-Electronic Systems

Outcome 2

Know how to carry out the configuration of communication-electronic systems

Assessment Criteria

Underpinning knowledge

The learner will be able to:

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

Unit 038

Assisting in the Installation of Communication-Electronic Systems

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of communication-electronic systems, in accordance with approved procedures. The learner will be required to use appropriate installation publications, orders and specifications to install the various systems, sub-systems or assemblies. The learner 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.

The learner's responsibilities will require them to comply with organisational policy and procedures for the installation activities undertaken, and to report any problems with the activities, components or equipment that they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all of the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying installation techniques and procedures for communication-electronic equipment. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of communication-electronic systems
2. Know how to assist in the installation of communication-electronic systems

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 38: Assisting in the Installation of Communication-Electronic Systems (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

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Unit 038

Assisting in the Installation of Communication-Electronic Systems

Outcome 1

Assist in the installation of communication-electronic systems

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation activity:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. follow all relevant instructions/documentation for the installation being carried out
 5. produce installations which comply with one of the following standards:
 - customer standards and requirements
 - company standards and requirements
 - BS, ISO and/or BSEN standards
 - Ministry of Defence (MoD)
 - Manufacturer's standards and requirements
 6. Use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
 7. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
 8. use all of the following installation methods and techniques:
 - levelling and aligning
 - earth bonding
 - taking electrostatic discharge (ESD) precautions
 - securing and locking
 9. make three of the following types of mechanical securing connections:
 - nuts and bolts
 - locking devices
 - screws
 - torque load bolts
 - quick-release fasteners
 10. 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
 11. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
 12. deal promptly and effectively with problems within their control and report those that cannot be solved
 13. dispose of waste items in a safe and environmentally acceptable manner
 14. assist in the completion of installation documentation
 15. 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
- specific company documentation

Unit 038

Assisting in the Installation of Communication-Electronic Systems

Outcome 2

Know how to assist in the installation of communication-electronic systems

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the specific safety practices and procedures that they 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. describe the health and safety requirements of the work area where they are carrying out the installation activities, and the responsibility these requirements place on them
3. describe the hazards associated with installing communication-electronic systems, and how they can be minimised
4. describe the personal protective equipment that they need to use during the installation activities
5. explain 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. describe the components, communication-electronic systems, sub-systems and assemblies to be installed
7. describe the various mechanical fasteners that will be used, and their method of installation
8. describe the importance of using the specified fasteners for the particular installation, and why they must not substitute others
9. describe the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved
10. describe the quality control procedures to be followed during the installation operations
11. describe the procedures for ensuring that they have the correct tools, equipment, components and fasteners for the activities
12. describe the techniques used to position, align, adjust and secure the components of the communications-electronic systems, without damage
13. describe the methods of lifting, handling and supporting the components/equipment during the installation activities
14. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
15. describe the procedure for the safe disposal of waste materials
16. explain how to conduct any necessary checks to ensure the system integrity, functionality, accuracy and quality of the installation
17. describe the tools and equipment used in the installation activities, and their calibration/care and control procedures
18. explain 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. describe the problems that can occur with the installation operations, and how these can be overcome
20. describe the recording documentation to be completed for the installation activities undertaken
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 039

Carrying Out Fault Location on Stairlift Equipment

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out efficient and effective location of faults on stairlift equipment, in accordance with approved procedures. The learner will be required to investigate faults on a range of AC or DC powered stairlifts, including straight, curved and hinged. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking full responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying fault location procedures to stairlift equipment. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location on stairlift equipment
2. Know how to carry out fault location on stairlift equipment

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 39: Carrying Out Fault Location on Stairlift Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 039

Carrying Out Fault Location on Stairlift Equipment

Outcome 1

Carry out fault location on stairlift equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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
 - obtain and use the correct issue of company and/or manufacturers' drawings and documentation
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. carry out fault location on all of the following AC or DC powered stairlifts:
 - straight
 - curved
 - hinged
4. locate faults that have resulted in two of the following breakdown categories:
 - intermittent action or circuit failure
 - partial failure/reduced performance
 - complete breakdown
5. review and use all relevant information on the symptoms and problems associated with the products or assets
6. investigate and establish the most likely causes of the faults
7. select, use and apply diagnostic techniques, tools and aids to locate faults using four of the following:
 - 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)
8. 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
9. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
 10. determine the implications of the fault for other work and for safety considerations
 11. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
 12. record details on the extent and location of the faults in an appropriate format
 13. 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

Unit 039

Carrying Out Fault Location on Stairlift Equipment

Outcome 2

Know how to carry out fault location on stairlift equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on them
2. describe the isolation procedures to be applied when installing or servicing stairlift equipment
3. explain 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. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
5. describe 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. explain how to use the various diagnostic aids to help identify the location of the fault
7. describe 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. explain how to evaluate sensory information (such as sight, sound, smell, touch)
9. explain how to assess evidence and evaluate the possible causes of faults/problems
10. explain how to use a range of fault diagnostic equipment to investigate the problem
11. describe the care, handling and application of measuring/test equipment (such as mechanical and electrical measuring instruments)
12. explain how to check that measuring/test equipment is within calibration, and that it is free from damage and defects
13. explain 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. describe the basic principles of how stairlift equipment functions, its operating sequence, the purpose of individual units/components and how they interact
15. describe the problems that can occur during the fault location activity, and how they can be minimised
16. describe the importance of completing the correct documentation following the maintenance activity
17. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 040

Carrying Out Servicing Activities on Stairlift Equipment

Level: 2

Credit value: 19

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying stairlift servicing procedures. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the servicing activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out servicing activities on stairlift equipment
2. Know how to carry out servicing activities on stairlift equipment

Guided learning hours

It is recommended that **56** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 40: Carrying Out Servicing Activities on Stairlift Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 040

Carrying Out Servicing Activities on Stairlift Equipment

Outcome 1

Carry out servicing activities on stairlift equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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
 - obtain and use the correct issue of drawings, job instructions and procedures
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. carry out servicing activities on all of the following types ac or dc powered stairlifts:
 - straight
 - curved
 - hinged
4. follow the relevant maintenance schedules to carry out the required work
5. 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, ISO BSEN standards
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed timescale
8. carry out all of the following servicing activities:
 - dismantling equipment to the appropriate level
 - make sensory checks (such as sight, sound, smell, touch)
 - checking continuity of protective conductors
 - setting, aligning and adjusting components
 - tightening fastenings to the required torque
 - remove excess dirt and grime
 - applying lubrication

- functionally testing the completed system
9. 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
 - carriage 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)
 - hinge/swivel motor (where appropriate)
 - limit switches (slow, stop and final)
 - chair, landing and auxiliary controls
10. 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
 - fixing of rail to stairs
 - warning labels
 - fixing of chair to carriage
 - chains and sprockets (where appropriate)
 - printed circuit boards (PCBs)
11. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
12. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:
- service record card
 - job card/corrective action report
 - company specific documentation
13. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 040

Carrying Out Servicing Activities on Stairlift Equipment

Outcome 2

Know how to carry out servicing activities on stairlift equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the servicing activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and/or lock-off or permit-to-work procedures that applies
3. describe the specific health and safety precautions to be applied during the servicing procedure, and their effects on others
4. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the servicing activity
6. explain how to obtain and interpret information from job instructions and other documents needed in the servicing process (such as drawings, specifications, manufacturers' manuals)
7. describe the operational safety checks that are applied, and the importance of following them correctly during servicing activities
8. describe 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. describe the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
10. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
11. describe the uses of mechanical and electrical measuring devices
12. explain 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. describe the importance of making visual checks before running the equipment under power
14. explain 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. describe the importance of servicing documentation and/or reports following the servicing activity, and how to complete them
16. describe the equipment operating and control procedures to be applied during the servicing activity
17. explain how to apply manual handling techniques when servicing stairlifts
18. describe the things that can go wrong when carrying out servicing of stairlifts, and what to do if they occur
19. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
20. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 041

Restoring Stairlifts to Service by Replacing or Repairing Components

Level: 2

Credit value: 23

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to restore stairlifts to usable condition by component repair or replacement, in accordance with approved procedures. The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying stairlift component repair or replacement procedures safely. The learner 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. The learner will also understand the organisational policy on repairing or replacing components, and its application.

The learner will understand the safety precautions required when carrying out the repair or component replacement activity, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Restore stairlifts to service by replacing or repairing components
2. Know how to restore stairlifts to service by replacing or repairing components

Guided learning hours

It is recommended that **77** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance Unit No 41: Restoring Stairlifts to Service by Replacing or Repairing Components (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 041

Restoring Stairlifts to Service by Replacing or Repairing Components

Outcome 1

Restore stairlifts to service by replacing or repairing components

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. replace or repair all of the following components:
 - carriage motor/gearbox
 - trailing cable
 - carriage rollers

plus 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
- hinge/swivel motor
- circuit protection devices (RCD or ELCB)
- sprockets and/or gears
- seatbelts
- springs (footrest or swivel)
- gas struts

- pulleys
 - indicator lights/units
 - upholstery
4. follow the relevant specifications for the component to be repaired
 5. 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, ISO and/or BSEN standards
 - customer requirements
 6. prepare the component for repair
 7. carry out the repairs within agreed timescale using approved materials and components and methods and procedures
 8. 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
 9. ensure that the repaired component meets the specified operating conditions
 10. produce accurate and complete records of all repair work carried out
 11. 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

Unit 041 Restoring Stairlifts to Service by Replacing or Repairing Components

Outcome 2 Know how to restore stairlifts to service by replacing or repairing components

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe 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 them
2. describe the isolation and/or lock-off or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the repair/replacement procedure, and their effects on others
4. describe the importance of wearing protective clothing and other appropriate safety equipment during repairing activities
5. describe 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. explain 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. describe the methods, techniques and company procedures to be followed for restoring stairlifts to service
8. describe the inspection and safety checks required, and the importance of following them correctly during replacement/repairing activities
9. describe 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. describe the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
11. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
12. describe the uses of mechanical and electrical measuring devices
13. explain how to make adjustments to components/assemblies to ensure that they function correctly (such as working clearance, setting travel, running and sliding conditions)
14. describe the importance of making visual checks before running the equipment under power
15. explain 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. describe the importance of completing replacement/repair documentation correctly
17. describe the equipment operating and control procedures to be applied during the repair/replacement activity
18. explain how to apply manual handling techniques when restoring stairlifts to service
19. describe the things that can go wrong when repairing or replacing stairlift components, and what to do if they occur
20. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 042

Carrying Out Fault Location on Service Lifts

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out efficient and effective location of faults on service lifts, in accordance with approved procedures. The learner will be expected to locate faults on service lifts such as traction, hydraulic, and direct drive. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking full responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying fault location procedures to service lifts. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location on service lifts
2. Know how to carry out fault location on service lifts

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 42: Carrying Out Fault Location on Service Lifts (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 042

Outcome 1

Carrying Out Fault Location on Service Lifts

Carry out fault location on service lifts

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the fault finding activity:
 - undertake the fault location process to cause minimal disruption to the customer
 - obtain and use the correct issue of company and/or manufacturers' drawings and documentation
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. carry out fault location on one of the following types of service lift:
 - hydraulic
 - direct drive
 - traction
4. locate faults that have resulted in two of the following breakdown categories:
 - intermittent problem
 - partial failure or reduced performance
 - complete breakdown
5. review and use all relevant information on the symptoms and problems associated with the products or assets
6. investigate and establish the most likely causes of the faults
7. select, use and apply diagnostic techniques, tools and aids to locate faults using four of the following:
 - 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)
8. 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

9. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
10. determine the implications of the fault for other work and for safety considerations
11. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault
12. record details on the extent and location of the faults in an appropriate format
13. 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

Unit 042

Outcome 2

Carrying Out Fault Location on Service Lifts

Know how to carry out fault location on service lifts

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which they are carrying out the fault finding investigation, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. explain 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. describe the safe working practices for lifts (as described in BS7255)
5. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
6. describe 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. explain how to use the various diagnostic aids to help identify the location of the fault
8. describe 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. explain how to evaluate sensory information (sight, sound, smell, touch)
10. explain how to assess evidence and evaluate the possible causes of faults/problems
11. explain how to use a range of fault diagnostic equipment to investigate the problem
12. describe the care, handling and application of measuring/test equipment (such as mechanical and electrical measuring instruments)
13. explain how to check that measuring/test equipment is within calibration, and that it is free from damage and defects
14. explain 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. describe the basic principles of how service lift equipment functions, its operating sequence, the purpose of individual units/components and how they interact
16. describe the problems that can occur during the fault location activity, and how they can be minimised
17. describe the importance of completing the correct documentation following the maintenance activity
18. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 043

Carrying Out Servicing of Service Lift Equipment

Level: 2

Credit value: 19

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying servicing procedures to service lifts. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the servicing activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out servicing of service lift equipment
2. Know how to carry out servicing of service lift equipment

Guided learning hours

It is recommended that **56** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 43: Carrying Out Servicing of Service Lift Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 043

Carrying Out Servicing of Service Lift Equipment

Outcome 1

Carry out servicing of service lift equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the servicing activity:
 - undertake the servicing activities to cause minimal disruption to the customer
 - obtain and use the correct issue of drawings, job instructions and procedures
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. carry out servicing activities on one of the following types of service lift:
 - hydraulic
 - direct drive
 - traction
4. follow the relevant maintenance schedules to carry out the required work
5. 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, ISO and/or BSEN standards
 - customer requirements
6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed timescale
8. 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)
9. 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
10. 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
11. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
12. complete relevant maintenance records accurately, to include one of the following, and pass them on to the appropriate person:
- job cards
 - company report
 - service log and action report
 - company-specific documentation
13. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 043

Carrying Out Servicing of Service Lift Equipment

Outcome 2

Know how to carry out servicing of service lift equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the servicing activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the servicing procedure, and their effects on others
4. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the servicing process
6. explain 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. describe the inspection and safety checks that are applied, and the importance of following them exactly during servicing operations
8. describe the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
9. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
10. describe the different drive systems, their operation, and associated components
11. describe the uses of mechanical and electrical measuring devices
12. explain how to make adjustments to components/assemblies to ensure that they function correctly (setting working clearance, setting travel, running and sliding conditions)
13. describe the importance of making checks before running the equipment under power
14. explain 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. describe the importance of servicing documentation and/or reports following the servicing activity, and how to generate them
16. describe the equipment operating and control procedures to be applied during the servicing activity
17. describe the things that can go wrong when carrying out servicing of service lifts, and what to do if they occur
18. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 044

Restoring Service Lifts to Service by Replacing or Repairing Components

Level: 2

Credit value: 23

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to restore service lifts to usable condition by repairing or replacing components, in accordance with approved procedures. The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying component repair/replacement procedures to service lifts. The learner 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.

The learner will understand the safety precautions required when carrying out the repair/replacement activity, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Restore service lifts to service by replacing or repairing components
2. Know how to restore service lifts to service by replacing or repairing components

Guided learning hours

It is recommended that **77** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 44: Restoring Service Lifts to Service by Replacing or Repairing Components (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 044

Restoring Service Lifts to Service by Replacing or Repairing Components

Outcome 1

Restore service lifts to service by replacing or repairing components

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
 2. carry out all of the following activities during the repair/replacement activity:
 - undertake the activities to cause minimal disruption to the customer
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
 3. 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)
4. follow the relevant specifications for the component to be repaired
 5. carry out repair or replacement of service lift components, in accordance with all of the following
 6. standards, as appropriate to the equipment being repaired:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - customer requirements
 7. prepare the component for repair
 8. carry out the repairs within agreed timescale using approved materials and components and methods and procedures
 9. 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
 10. ensure that the repaired component meets the specified operating conditions
 11. produce accurate and complete records of all repair work carried out
 12. complete one of the following servicing records, and pass it to the appropriate person
 - job cards
 - company-specific report
 - service log and action report

Unit 044

Restoring Service Lifts to Service by Replacing or Repairing Components

Outcome 2

Know how to restore service lifts to service by replacing or repairing components

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe 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 them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the repair/replacement procedure, and their effects on others
4. describe the importance of wearing protective clothing and other appropriate safety equipment during repair/replacement activities
5. describe 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. explain 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. describe the methods, techniques and company procedures to be followed for repairing/replacing components for service lifts
8. describe the inspection and safety checks that are applied, and the importance of following them exactly during replacement/repair operation
9. describe the methods and techniques used to dismantle/assemble service lift equipment (such as release of pressures/force, proof marking, extraction, pressing, alignment)
10. describe the methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lified' items such as seals and gaskets
11. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
12. describe the uses of mechanical and electrical measuring devices
13. explain how to make adjustments to components/assemblies to ensure that they function correctly (setting working clearance, setting travel, running and sliding conditions)
14. describe the importance of making checks before running the equipment under power
15. explain how to check that tools and equipment are free from damage or defects, and are in a safe and usable condition
16. describe the importance of preparing documentation and/or reports following the replacement/repairing activity, and how to generate them
17. describe the equipment operating and control procedures to be applied during the repair/replacement activity
18. explain how to use lifting and handling equipment in the repair/replacement process
19. describe the things that can go wrong when carrying out repairs to service lifts, and what to do if they occur
20. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 045

Installing Stairlifts

Level: 2

Credit value: 42

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to install stairlifts, in accordance with approved procedures. This will require the learner 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. The learner 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.

The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying procedures for stairlift installation. The learner 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. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Install stairlifts
2. Know how to install stairlifts

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 45: Installing Stairlifts (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 045

Installing Stairlifts

Outcome 1

Install stairlifts

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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
3. install all of the following AC or DC powered stairlifts:
 - straight
 - curved
 - hinged
4. 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
5. follow all relevant drawings and specifications for the installation being carried out
6. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's installation specification
 - customer requirements
 - company standards and procedures
 - BS, ISO and/or BSEN standards
7. use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
8. 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

9. install, position and secure the equipment and components in accordance with the specification

10. carry out all of the following activities during the installation:

- adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
- 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

11. 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

12. make both of the following connections to the installed equipment:

- mechanical connections
- electrical connections

13. ensure that all necessary connections to the equipment are complete

14. deal promptly and effectively with problems within their control and report those that cannot be solved

15. deal with two of the following conditions during the installation process:

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

16. check that the installation is complete and that all components are free from damage

17. 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
- continuity of protective conductors
- 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)

18. complete two of the following installation records, and pass it to the appropriate person:

- user guide
- installation work sheet
- company-specific documentation

Unit 045

Outcome 2

Installing Stairlifts

Know how to install stairlifts

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the specific safety practices and procedures that they need to observe when installing stairlifts (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
2. describe 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. describe the health and safety requirements of the work area where they are carrying out the installation activities, and the responsibility these requirements place on them
4. describe the hazards associated with installing stairlifts, and with the tools and equipment used, and how they can be minimised
5. describe the personal protective equipment that they need to use for the installation activities, and where it can be obtained
6. explain 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. describe the stairlift equipment to be installed, its function and operating procedures
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, special fixing devices)
10. describe the different stairlift power supplies and associated control systems
11. describe the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities
12. describe the types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, levelling and measuring devices)
13. describe the techniques used to position, align, level, adjust and secure the stairlift equipment
14. describe the methods of lifting, handling and supporting the stairlift equipment during the installation activities
15. describe the methods of connecting mechanical devices (such as carriage, chair, rail and rail furniture)
16. describe the methods and techniques used to connect stairlift equipment to power supplies
17. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
18. describe the procedure for the safe disposal of waste materials
19. describe the measuring equipment used to check and adjust the installed equipment
20. explain 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. describe the tools and equipment used in the installation activities, and their calibration/care and control procedures
22. describe the problems that can occur with the installation operations, and how these can be overcome

23. describe the documentation to be completed for the installation activities, and who to pass them to
24. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 046

Installing Service Lifts

Level: 2

Credit value: 42

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to install service lifts, in accordance with approved procedures. This will require the learner 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. The learner 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).

The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying installation procedures for service lifts. The learner 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. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Install service lifts
2. Know how to install service lifts

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 46: Installing Service Lifts (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 046

Installing Service Lifts

Outcome 1

Install service lifts

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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
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. follow all relevant drawings and specifications for the installation being carried out
6. produce installations which comply with all of the following standards, as appropriate to the equipment being installed:
 - equipment manufacturer's installation specification
 - BS, ISO and/or BSEN standards
 - customer requirements

- company standards and procedures
7. use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
 8. 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
 9. install, position and secure the equipment and components in accordance with the specification
 10. carry out all of the following activities during the installation:
 - adhere to procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations
 - 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
 11. 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
 - routeing and securing wires and cables
 12. make two of the following connections to the installed equipment:
 - mechanical connections
 - electrical connections
 - fluid power connections
 13. ensure that all necessary connections to the equipment are complete
 14. deal promptly and effectively with problems within their control and report those that cannot be solved
 15. deal with two of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
 16. check that the installation is complete and that all components are free from damage
 17. 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)
18. 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

Unit 046

Installing Service Lifts

Outcome 2

Know how to install service lifts

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the specific safety practices and procedures that they 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. describe 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. describe the health and safety requirements of the work area where they are carrying out the installation activities, and the responsibility these requirements place on them
4. describe the hazards associated with installing service lifts, and with the tools and equipment used, and how they can be minimised
5. describe the personal protective equipment that they need to use for the installation activities, and where replacements can be obtained if supplied personal protective equipment becomes worn or damaged
6. explain 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. describe the equipment to be installed, its operating procedures and function
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
10. describe the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities
11. describe 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. describe the techniques used to position, align, level, connect, adjust and secure the equipment
13. describe the methods of lifting, handling and supporting the equipment during the installation activities
14. Describe the methods of connecting equipment to power supplies
15. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
16. explain how to dispose of waste items in an environmentally safe acceptable manner, and leave the work area in a safe condition
17. explain 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. describe the tools and equipment used in the installation activities, and their calibration/care and control procedures
19. describe the problems that can occur with the installation operations, and how these can be overcome
20. describe the documentation to be completed for the activities, and who to pass them to
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 047

Assisting in the Installation of Mechanical Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of mechanical equipment, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out. The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying mechanical installation procedures. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of mechanical equipment
2. Know how to assist in the installation of mechanical equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 47: Assisting in the Installation of Mechanical Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 047

Assisting in the Installation of Mechanical Equipment

Outcome 1

Assist in the installation of mechanical equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the mechanical equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. follow all relevant instructions/documentation for the installation being carried out
5. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operating range
 - BS, ISO and/or BSEN standards
 - customer (contractual) standards and requirements
 - company standards and procedures
6. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
7. 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
8. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
9. 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)
10. 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
11. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
12. 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)

13. deal promptly and effectively with problems within their control and report those that cannot be solved
14. assist in dealing with two of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
15. 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
16. dispose of waste items in a safe and environmentally acceptable manner
17. assist in the completion of installation documentation to include one of the following:
 - installation records
 - company-specific documentation
 - job card

Unit 047

Assisting in the Installation of Mechanical Equipment

Outcome 2

Know how to assist in the installation of mechanical equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing mechanical equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documentation used in the installation activities (such as installation drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the basic principle of operation of the equipment being installed
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the various mechanical fasteners that will be used, and their method of installation (such as threaded fasteners, special securing devices, masonry fixing devices)
10. describe the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities
11. describe 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. describe the techniques used to position, align, level and adjust the equipment
13. describe the methods of lifting, handling and supporting the equipment during the installation activities
14. describe the methods of connecting to mechanical power transmission devices (such as belt and chain drives, couplings, clutches and brakes)
15. describe the methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
16. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
17. describe the procedure for the safe disposal of waste materials
18. explain how to identify installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
19. describe 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. describe the problems that can occur with the installation operations, and how these can be overcome
21. describe the fault-finding techniques to be used if the equipment fails to operate correctly

22. describe the recording documentation to be completed for the activities undertaken
23. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 048

Assisting in the Installation of Electrical/Electronic Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of electrical/electronic equipment, in accordance with approved procedures. The learner 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.

The learner 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, the learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out. The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying electrical/electronic installation procedures. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of electrical/electronic equipment
2. Know how to assist in the installation of electrical/electronic equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 48: Assisting in the Installation of Electrical/Electronic Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 048

Assisting in the Installation of Electrical/Electronic Equipment

Outcome 1

Assist in the installation of electrical/electronic equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the electrical/electronic equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. assist in the connection of equipment to two of the following types of electrical supply:
 - single phase

- direct current
 - three phase
 - low voltage (up to 115V)
5. follow all relevant instructions/documentation for the installation being carried out
 6. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
 - customer (contractual) standards and requirements
 - company standards and procedures
 7. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
 8. use two of the following instruments during the installation activities:
 - multimeter
 - insulation resistance tester
 - earth-loop impedance tester
 - other specific test equipment
 9. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
 10. 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)
 11. carry out four of the following cable termination activities:
 - stripping cable insulation/protection
 - routing 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
 12. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
 13. carry 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

14. deal promptly and effectively with problems within their control and report any that cannot be solved
15. assist in dealing with two of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
16. 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
17. dispose of waste items in a safe and environmentally acceptable manner
18. assist in the completion of installation documentation to include one of the following:
 - installation records
 - company-specific documentation
 - job card

Unit 048

Assisting in the Installation of Electrical/Electronic Equipment

Outcome 2

Know how to assist in the installation of electrical/electronic equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing electrical/electronic equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documentation used in the installation activities (such as installation drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the basic principle of operation of the equipment/circuits being installed
8. describe the different types of cabling used in the maintenance activities, and their methods of termination
9. describe the care, handling and application of electrical measuring instruments (such as multimeter, resistance tester, earth-loop impedance tester)
10. describe the methods of lifting, handling and supporting the equipment during the installation activities
11. explain 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. describe the techniques used to terminate electrical equipment (such as plugs, soldering, screwed, clamped and crimped connections)
13. describe the methods of attaching markers/labels to components or cables, to assist with identification
14. describe the tools and equipment used in the installation activities (such as cable stripping tools, crimping tools, soldering irons and torches, gland connecting tools)
15. explain how to make adjustments to components/assemblies to ensure that they function correctly
16. explain how to check tools and equipment are free from damage or defects, are in a safe and usable condition
17. describe the importance of making 'off-load' checks before proving the equipment with the electrical supply on
18. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
19. describe the calibration/care and control procedures for tools and equipment
20. describe the problems that can occur with the installation operations, and how these can be overcome
21. describe the fault-finding techniques to be used if the equipment fails to operate correctly

22. describe the recording documentation to be completed for the activities undertaken
23. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 049

Assisting in the Installation of Equipment to Produce an Engineered System

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of equipment to produce an engineered system, in accordance with approved procedures. The learner 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.

The learner 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, the learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying procedures for the installation of an engineered system. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of equipment to produce an engineered system
2. Know how to assist in the installation of equipment to produce an engineered system

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit 49: Assisting in the Installation of Equipment to Produce an Engineered System (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 049

Assisting in the Installation of Equipment to Produce an Engineered System

Outcome 1

Assist in the installation of equipment to produce an engineered system

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the engineered system:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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

4. follow all relevant instructions/documentation for the installation being carried out
5. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - BS7671/IEE wiring regulations
 - customer (contractual) standards and requirements
 - company standards and procedures
6. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
7. 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)
8. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques

9. 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)
10. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
11. 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
12. deal promptly and effectively with problems within their control and report those that cannot be solved
13. assist in dealing with two of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
14. 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
15. dispose of waste items in a safe and environmentally acceptable manner
16. assist in the completion of installation documentation
17. complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:
 - installation records
 - company-specific documentation
 - job card

Unit 049

Assisting in the Installation of Equipment to Produce an Engineered System

Outcome 2

Know how to assist in the installation of equipment to produce an engineered system

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe 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. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documentation used in the installation activities (such as installation drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the basic principles of how the system functions, and its operating sequence
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the methods of drilling holes in masonry for rag bolts and expanding bolts (including use of grouting and adhesives)
10. describe the various mechanical fasteners that will be used, and their method of installation
11. describe the methods of lifting, handling and supporting the equipment during the installation activities
12. describe the methods of levelling and aligning the equipment, and the types of tools, instruments and techniques used
13. describe the methods of connecting to mechanical power transmission devices (such as shafts, couplings belt and chain drives)
14. describe the different types of cabling used in the installation activities, and their methods of termination
15. describe the different types of wiring enclosures that are used (to include conduit, trunking and traywork systems)
16. describe the installation and termination of a range of electrical components (such as plugs, switches, sockets, lighting and fittings)
17. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
18. describe the care, handling and application of ohmmeters, multimeters and other electrical measuring instruments
19. describe the methods of assembling and installing pipework, hoses and fittings
20. explain how to recognise a range of fluid power components
21. explain how to identify the contaminants and the problems they can create, and the effects and likely symptoms of contamination in the system
22. explain how to identify the process instrumentation and associated peripherals (such as pressure, flow, temperature)

23. explain how to identify the PLC systems and associated peripheral devices (such as input/output (I/O) devices)
24. explain 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. explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage)
26. describe the problems that can occur with the installation operations, and how these can be overcome
27. describe the fault-finding techniques to be used if the equipment fails to operate correctly
28. describe the recording documentation to be completed for the activities undertaken
29. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 050

Assisting in the Installation of Instrumentation and Control Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of instrumentation and control equipment, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying installation procedures to instrumentation and control equipment. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and they will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of instrumentation and control equipment
2. Know how to assist in the installation of instrumentation and control equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 50: Assisting in the Installation of Instrumentation and Control Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 050

Assisting in the Installation of Instrumentation and Control Equipment

Outcome 1

Assist in the installation of instrumentation and control equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the instrumentation and control equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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)
4. follow all relevant instructions/documentation for the installation being carried out
5. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS7671/IEE wiring regulations

- BS, ISO and/or BSEN standards
 - customer (contractual) standards and requirements
 - company standards and procedures
6. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
 7. 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
 8. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
 9. 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
 10. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
 11. 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

12. deal promptly and effectively with problems within your control and report those that cannot be solved

13. assist in dealing with two of the following conditions during the installation process:

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

14. 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

15. dispose of waste items in a safe and environmentally acceptable manner

16. assist in the completion of installation documentation

17. complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:

- installation records
- company-specific documentation
- job card

Unit 050

Assisting in the Installation of Instrumentation and Control Equipment

Outcome 2

Know how to assist in the installation of instrumentation and control equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during installation process
6. explain how to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the basic principles of how the equipment functions, and its operating sequence
8. describe 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. describe the identification of instrument sensors (including how to identify their markings, calibration information, component values, operating parameters and working range)
10. describe 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. explain how to carry out visual checks of the instruments (checking for leaks, security of joints and physical damage)
12. describe the methods of attaching identification marks/labels to components or cables
13. describe the methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
14. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
15. describe the procedure for the safe disposal of waste materials
16. explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
17. describe 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. describe the problems that can occur with the installation operations, and how these can be overcome
19. describe the fault finding techniques to be used if the equipment fails to operate correctly
20. describe the recording documentation to be completed for the activities undertaken
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 051

Assisting in the Installation of Fluid Power Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of fluid power equipment, on mobile or static plant, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying fluid power installation procedures. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of fluid power equipment
2. Know how to assist in the installation of fluid power equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 51: Assisting in the Installation of Fluid Power Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 051

Assisting in the Installation of Fluid Power Equipment

Outcome 1

Assist in the installation of fluid power equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the fluid power equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. assist in the installation of one of the following types of fluid power systems:
 - pneumatic
 - hydraulic
 - vacuum
4. follow all relevant instructions/documentation for the installation being carried out
5. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - customer (contractual) standards and requirements
 - company standards and procedures
6. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
7. use three of the following types of equipment during the installation activities:
 - pressure testing devices
 - flow testing devices
 - mechanical measuring devices
 - bleeding devices
 - alignment devices
 - electrical measuring devices
 - timing devices
 - fluid sampling device
 - flushing blocks/rigs
8. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
9. assist in the installation of six of the following fluid power components:
 - rigid pipework

- filters
- reservoirs/storage receivers
- compressors
- accumulators
- lubricators
- gaskets and seals
- regulators
- pumps
- receivers
- switches
- hoses/tubing
- cylinders
- valves
- actuators
- sensors
- pressure intensifiers
- other (specify)

10. 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)

11. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification

12. 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 any moving parts are clear of obstruction and/or are guarded

plus: assist in carrying out two of the following:

- filling the system using the correct cleanliness control procedures
- 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

13. deal promptly and effectively with problems within their control and report those that cannot be solved

14. assist in dealing with two of the following conditions during the installation process:

- installations with no faults
- partial system malfunction
- complete malfunction of the system

15. 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, circuit diagrams, function diagrams)
 - fault finding technique (such as six point, half-split, unit substitution, fault cause remedy, sequence chart)
 - function testing the installation/running equipment self-diagnostics
16. dispose of waste items in a safe and environmentally acceptable manner
17. assist in the completion of installation documentation to include one of the following:
 - installation records (such as test and system performance data)
 - company-specific documentation
 - job card

Unit 051

Assisting in the Installation of Fluid Power Equipment

Outcome 2

Know how to assist in the installation of fluid power equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing fluid power equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain 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. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
8. describe the methods of drilling holes for rag bolts and expanding bolts (including the use of grouting and adhesives)
9. describe the various mechanical fasteners that will be used, and their method of installation (including threaded fasteners, dowels, special securing devices, masonry fixing devices)
10. describe the basic principles of how the equipment functions, and its operating sequence
11. explain how to identify the various components that are to be installed (such as valves, cylinders, actuators, sensors, pumps)
12. explain how to determine the direction of flow through components, and their position within the system
13. describe the application and fitting of seals
14. explain how to identify the contaminants and the problems they can create, and the effects and likely symptoms of contamination in the system
15. describe the techniques used to ensure the safe and correct start-up of the system
16. describe the techniques used to ensure that correct checks are made on the system
17. describe the techniques used to fault-find the system
18. describe the procedures to follow to fill the hydraulic reservoirs correctly
19. describe the need to establish the cleanliness level of oil in the hydraulic reservoirs
20. describe the techniques used during the setting and testing of the fluid power equipment (such as controlled release of pressures/force, checking for correct actuator and valve movement, checking the correct sequencing)
21. describe the procedures for ensuring that they have the correct tools, equipment and consumables for the installation activities
22. describe the types of tools and instruments used to position, secure and connect the equipment (such as spanners, pipe benders, torque wrenches, alignment devices, pressure testing devices)

23. describe the methods of lifting, handling and supporting the equipment during the installation activities
24. describe the methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and any fuel supplies)
25. describe the procedure for the safe disposal of waste materials
26. describe 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
27. describe the completion of documentation for the activities undertaken
28. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 052

Assisting in the Installation of Process Control Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of process control equipment, in accordance with approved procedures. The learner 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. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying installation procedures for process controllers. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of process control equipment
2. Know how to assist in the installation of process control equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 52: Assisting in the Installation of Process Control Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 052

Assisting in the Installation of Process Control Equipment

Outcome 1

Assist in the installation of process control equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the process controller equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. assist in the installation of one of the following process controllers:
 - fixed I/O units
 - rack mount controller units
 - modular controller units
5. follow all relevant instructions/documentation for the installation being carried out
6. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
 - company standards and procedures
 - customer (contractual) standards and requirements
7. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
8. 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

9. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques

10. 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

11. 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)

12. 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
- routeing and securing wires and cables
- heat shrinking (devices and boots)
- crimping (tags and pins)
- stripping cable insulation/protection
- adding cable end fittings

13. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification

14. carry out all of 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

15. deal promptly and effectively with problems within their control and report those that cannot be solved

16. assist in dealing with two of the following conditions during the installation process:

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

17. 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

18. dispose of waste items in a safe and environmentally acceptable manner

19. assist in the completion of installation documentation to include one of the following:

- installation records
- company-specific documentation
- job card

Unit 052

Assisting in the Installation of Process Control Equipment

Outcome 2

Know how to assist in the installation of process control equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing process control equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the methods of drilling holes for rag bolts and expanding bolts (including the use of grouting and adhesives)
8. describe the various mechanical fasteners that will be used, and their method of installation
9. describe the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities
10. describe the types of tools, instruments and techniques used to position align, level, secure and adjust the equipment
11. describe the methods of lifting, handling and supporting the equipment during the installation activities
12. describe the basic principles of how the system functions, and its operating sequence
13. describe the techniques used to connect PLC equipment (plugs, soldering, screwed, clamped and crimped connections)
14. describe the use of BS7671/IEE wiring, and other, regulations when selecting wires and cables, and when carrying out tests on systems
15. describe the devices and systems for storing programs
16. describe the different types of interface cards
17. describe the numbering system and codes used for identification of inputs and outputs
18. explain how to interpret a program within the process controller for specific elements
19. explain how to make adjustments to components to ensure that they function correctly
20. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
21. explain 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. explain how to recognise installation defects (such as dry connections, communication difficulties, ineffective fasteners, foreign object damage or contamination)

23. describe 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. describe the problems that can occur with the installation operations, and how these can be overcome
25. describe the fault-finding techniques to be used if the equipment fails to operate correctly
26. describe the recording documentation to be completed for the activities undertaken
27. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 053

Assisting in the Installation of Emergency Electrical Power Generation Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of emergency electrical power generation equipment, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying installation procedures to emergency power generation equipment. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of emergency electrical power generation equipment
2. Know how to assist in the installation of emergency electrical power generation equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 53: Assisting in the Installation of Emergency Electrical Power Generation Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 053

Assisting in the Installation of Emergency Electrical Power Generation Equipment

Outcome 1

Assist in the installation of emergency electrical power generation equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the emergency electrical power generation equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. assist in the installation of one of the following types of emergency power generation equipment:
 - turbine alternator sets
 - piston engine alternator sets
 - generators
4. follow all relevant instructions/documentation for the installation being carried out
5. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - customer (contractual) standards and requirements
 - company standards and procedures
6. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
7. 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

8. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
9. 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
10. 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
11. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
12. 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)
13. 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
14. deal promptly and effectively with problems within their control and report those that cannot be solved
15. assist in dealing with two of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
16. 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

17. dispose of waste items in a safe and environmentally acceptable manner

18. assist in the completion of installation documentation to include one of the following:

- installation records
- company-specific documentation
- job card

Unit 053

Assisting in the Installation of Emergency Electrical Power Generation Equipment

Outcome 2

Know how to assist in the installation of emergency electrical power generation equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing emergency electrical power generation equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
8. describe the methods of drilling holes for rag bolts and expanding bolts (including the use of grouting and adhesives)
9. describe the various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, dowels, special securing devices, masonry fixing devices)
10. describe the torque loading requirements on the fasteners, and what to do if these loadings are exceeded or not achieved
11. describe the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities
12. describe 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. describe the methods of lifting, handling and supporting the equipment during the installation activities
14. describe the methods of connecting to mechanical power transmission devices
15. describe the methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
16. describe the basic principles of how the equipment functions, and its operating sequence
17. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
18. describe the procedure for the safe disposal of waste materials
19. explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
20. describe 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. describe the problems that can occur with the installation operations, and how these can be overcome
22. describe the fault finding techniques to be used if the equipment fails to operate correctly
23. describe the recording documentation to be completed for the activities undertaken
24. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 054

Assisting in the Installation of Environmental Pollution Control Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of environmental pollution control equipment, in accordance with approved procedures. The learner 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 (CO₂ 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying mechanical installation procedures. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of environmental pollution control equipment
2. Know how to assist in the installation of environmental pollution control equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 54: Assisting in the Installation of Environmental Pollution Control Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 054

Assisting in the Installation of Environmental Pollution Control Equipment

Outcome 1

Assist in the installation of environmental pollution control equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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
3. assist in the installation of one of the following types of environmental pollution control equipment:
 - air pollution control equipment (such as decarbonisation (CO₂ 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)
4. 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
5. follow all relevant instructions/documentation for the installation being carried out
 6. 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
 7. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
 8. 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
 9. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
 10. 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
 11. 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

12. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification

13. 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

14. deal promptly and effectively with problems within their control and report those that cannot be solved

15. assist in dealing with two of the following conditions during the installation process:

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

16. 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

17. dispose of waste items in a safe and environmentally acceptable manner

18. assist in the completion of installation documentation to include one of the following:

- installation records
- company-specific documentation
- job card

Unit 054

Assisting in the Installation of Environmental Pollution Control Equipment

Outcome 2

Know how to assist in the installation of environmental pollution control equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe 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. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and to the particular plant and site installation details
4. describe the hazards associated with installing environmental pollution control equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the basic principles of how the equipment functions, and its operating sequence
8. describe the methods and techniques used to position, assemble, align and secure the plant and equipment
9. describe the methods of making holes for floor fixing bolts (including the use of various fittings, grouting and adhesives)
10. describe the various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
11. describe the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities
12. describe the methods of lifting, handling and supporting the equipment
13. describe the checks, tests, corrections and adjustments to ensure proper equipment safety, integrity, operation and accuracy
14. describe the connecting of equipment to external supplies (such as electric, air, water and gas)
15. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
16. describe the procedure for the safe disposal of waste materials
17. identify defects (such as leaks, misalignment, component looseness, damage, or contamination)
18. describe the importance of ensuring that the completed installation is left in a safe, clean and damage-free state
19. describe the dangers of leaving any exposed potential energy sources (these must be made safe)
20. describe the typical problems that can occur during the installation, and how these can be overcome
21. describe the fault finding techniques to be used if the equipment fails to operate correctly
22. describe the recording documentation to be completed for the activities undertaken

23. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 055

Assisting in the Installation of Workplace Environmental Control Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of workplace environmental control equipment, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying installation procedures to workplace environmental control equipment. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of workplace environmental control equipment
2. Know how to assist in the installation of workplace environmental control equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 55: Assisting in the Installation of Workplace Environmental Control Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 055

Assisting in the Installation of Workplace Environmental Control Equipment

Outcome 1

Assist in the installation of workplace environmental control equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the workplace environmental control equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. 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
5. follow all relevant instructions/documentation for the installation being carried out
 6. produce installations which comply with all of the following, as applicable to the equipment being installed:
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - company standards and procedures
 - customer standards and requirements
 7. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
 8. 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
 9. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
 10. 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)
 11. 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
12. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
13. 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
14. deal promptly and effectively with problems within their control and report those that cannot be solved
15. assist in dealing with two of the following conditions during the installation process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
16. 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
17. dispose of waste items in a safe and environmentally acceptable manner
18. assist in the completion of installation documentation to include one from the following:
- installation records
 - company-specific documentation
 - job card

Unit 055

Assisting in the Installation of Workplace Environmental Control Equipment

Outcome 2

Know how to assist in the installation of workplace environmental control equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing workplace environmental control equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation process
6. explain how to obtain and interpret information from drawings and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the procedures for ensuring that they have the correct tools, equipment and fasteners for the installation activities
8. describe the types of tools and instruments used to position, secure and align the equipment
9. describe the techniques used to position, align, level, adjust and secure the equipment
10. describe the methods of lifting, handling and supporting the equipment during the installation activities
11. describe the basic principles of how the equipment functions, and its operating sequence
12. describe the techniques used to assemble electrical equipment (plugs, soldering, screwed, clamped and crimped connections)
13. describe the use of IEE wiring, and other, regulations when selecting wires and cables, and when carrying out tests on systems
14. explain how to make adjustments to components to ensure that they function correctly
15. describe the methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, gas and water supplies)
16. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
17. describe the devices and systems for storing programs
18. explain how to conduct any necessary checks to ensure the equipment integrity, functionality, accuracy and quality of the installation
19. explain how to recognise installation defects (such as leaks, poor seals, misalignment, foreign object damage or contamination)
20. describe the problems that can occur with the installation operations, and how these can be overcome
21. describe the fault finding techniques to be used if the equipment fails to operate correctly
22. describe the recording documentation to be completed for the activities undertaken
23. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 056

Assisting in the Installation of Heating and Ventilation Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of heating and ventilation equipment, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying heating and ventilation installation procedures. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of heating and ventilation equipment
2. Know how to assist in the installation of heating and ventilation equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 56 Assisting in the Installation of Heating and Ventilation Equipment (Level 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 056

Assisting in the Installation of Heating and Ventilation Equipment

Outcome 1

Assist in the installation of heating and ventilation equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the heating and ventilation equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. assist in the installation of equipment for one of the following types of heating and ventilation system:
 - liquid
 - gaseous
 - solid fuel
 - renewable energy
 - electrical
4. 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)

5. follow all relevant instructions/documentation for the installation being carried out
6. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - BS7671/IEE wiring regulations
 - customer (contractual) standards and requirements
 - company standards and procedures
7. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
8. 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
9. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
10. 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
11. 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
12. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
13. 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

14. deal promptly and effectively with problems within their control and report those that cannot be solved

15. assist in dealing with two of the following conditions during the installation process:

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

16. 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

17. assist in the completion of installation documentation to include one of the following:

- installation records
- company-specific documentation
- job card

Unit 056

Assisting in the Installation of Heating and Ventilation Equipment

Outcome 2

Know how to assist in the installation of heating and ventilation equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing heating and ventilation equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the basic principles of how the equipment functions, and its operating sequence
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the methods of drilling holes for rag bolts and expanding bolts (including the use of grouting and adhesives)
10. describe the various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
11. describe the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities
12. describe the techniques used to position, align, level, adjust and secure the equipment
13. describe the methods of lifting, handling and supporting the equipment during the installation activities
14. describe the methods of connecting equipment to service supplies (such as electrical, compressed air, oil and fuel supplies)
15. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
16. describe the procedure for the safe disposal of waste materials
17. explain 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. explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
19. describe 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. describe the problems that can occur with the installation operations, and how these can be overcome
21. describe the fault finding techniques to be used if the equipment fails to operate correctly

22. describe the recording documentation to be completed for the activities undertaken
23. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 057

Assisting in the Installation of Air Conditioning and Ventilation Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of air conditioning and ventilation systems equipment, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying heating and ventilation installation procedures. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of air conditioning and ventilation equipment
2. Know how to assist in the installation of air conditioning and ventilation equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 57: Assisting in the Installation of Air Conditioning and Ventilation Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 057

Assisting in the Installation of Air Conditioning and Ventilation Equipment

Outcome 1

Assist in the installation of air conditioning and ventilation equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the air conditioning and ventilation equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. assist in the installation of equipment for two of the following types of air conditioning and ventilating system:
 - remote air conditioning generation
 - local air conditioning distribution
 - air conditioning control
4. 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)

5. follow all relevant instructions/documentation for the installation being carried out
6. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - BS7671/IEE wiring regulations
 - customer (contractual) standards and requirements
 - company standards and procedures
7. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
8. 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
9. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
10. 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
11. 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
12. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
13. 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

14. deal promptly and effectively with problems within their control and report those that cannot be solved

15. assist in dealing with two of the following conditions during the installation process:

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

16. 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

17. dispose of waste items in a safe and environmentally acceptable manner

18. assist in the completion of installation documentation to include one of the following:

- installation records
- company-specific documentation
- job card

Unit 057

Assisting in the Installation of Air Conditioning and Ventilation Equipment

Outcome 2

Know how to assist in the installation of air conditioning and ventilation equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing air conditioning and ventilation equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. Describe the basic principles of how the equipment functions, and its operating sequence
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the methods of drilling holes for rag bolts and expanding bolts (including the use of grouting and adhesives)
10. describe the various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, special securing devices, masonry fixing devices)
11. describe the procedures for ensuring that they have the correct tools, equipment and fasteners for the installation activities
12. describe the techniques used to position, align, level, adjust and secure the equipment
13. describe the methods of lifting, handling and supporting the equipment during the installation activities
14. explain how to make adjustments to components to ensure that they function correctly
15. describe the methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
16. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
17. describe the procedure for the safe disposal of waste materials
18. explain 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. explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage, or contamination)
20. describe 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. describe the problems that can occur with the installation operations, and how these can be overcome

22. describe the fault finding techniques to be used if the equipment fails to operate correctly
23. describe the recording documentation to be completed for the activities undertaken
24. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 058

Assisting in the Installation of Compressed Air Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of compressed air equipment and systems, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying the installation of compressed air equipment procedures. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of compressed air equipment
2. Know how to assist in the installation of compressed air equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 58: Assisting in the Installation of Compressed Air Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 058

Assisting in the Installation of Compressed Air Equipment

Outcome 1

Assist in the installation of compressed air equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the compressed air equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. assist in the installation of equipment for two of the following types of compressed air system:
 - compressed air generation
 - compressed air distribution
 - compressed air control
4. assist in the installation of eight of the following compressed air system components:
 - pipework
 - hoses
 - pumps
 - driers
 - motors
 - compressors
 - silencers
 - actuators
 - regulators
 - valves
 - control equipment
 - gauges/indicators
 - manifolds
 - monitoring equipment
 - filters
 - sensors
 - lubricators
 - safety devices
 - electrical wiring and connectors
 - electrical components
 - gaskets and seals
 - other components (specify)

5. follow all relevant instructions/documentation for the installation being carried out
6. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - BS7671/IEE wiring regulations
 - customer (contractual) standards and requirements
 - company standards and procedures
7. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
8. 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
9. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
10. 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
11. 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
12. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
13. 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
14. deal promptly and effectively with problems within their control and report those that cannot be solved
15. assist in dealing with two of the following conditions during the installation process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
16. 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
17. assist in the completion of installation documentation to include one of the following:
- installation records
 - company-specific documentation
 - job card

Unit 058

Assisting in the Installation of Compressed Air Equipment

Outcome 2

Know how to assist in the installation of compressed air equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the installation activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing compressed air equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the basic principles of how the equipment functions, and its operating sequence
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the methods of drilling holes for rag bolts and expanding bolts (including the use of grouting and adhesives)
10. describe the various mechanical fasteners that will be used, and their method of installation (including, threaded fasteners, dowels, special securing devices, masonry fixing devices)
11. describe the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities
12. describe 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. describe the techniques used to position, align, level, adjust and secure the equipment
14. describe the 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. describe the correct pipes, hoses and other equipment to accommodate the various pressure ranges
16. explain how to make adjustments to components to ensure that they function correctly
17. describe the methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air oil and fuel supplies)
18. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
19. describe the procedure for the safe disposal of waste materials
20. explain 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. explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
22. describe 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. describe the fault finding techniques to be used if the equipment fails to operate correctly
24. describe the recording documentation to be completed for the activities undertaken
25. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 059

Assisting in the Installation of Waste/Foul Water Distribution Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of waste/foul water distribution systems and equipment, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying installation procedures for waste/foul water distribution equipment. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of waste/foul water distribution equipment
2. Know how to assist in the installation of waste/foul water distribution equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 59: Assisting in the Installation of Waste/Foul Water Distribution Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 059

Assisting in the Installation of Waste/Foul Water Distribution Equipment

Outcome 1

Assist in the installation of waste/foul water distribution equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the waste/foul water distribution equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. assist in the installation of equipment for one of the following types of waste water distribution system:
 - waste/effluent
 - foul water
 - storm water
4. install and connect two of the following types of pipe:
 - plastic
 - iron
 - copper
 - clay
5. follow all relevant instructions/documentation for the installation being carried out
6. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - company standards and procedures
 - customer (contractual) standards and requirements
7. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
8. use two of the following instruments during the installation activities:
 - alignment devices
 - levelling devices
 - multimeter

- measuring devices
 - pressure testing devices
 - flow testing devices
9. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
10. 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)
11. 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)
12. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
13. 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
14. deal promptly and effectively with problems within their control and report those that cannot be solved
15. assist in dealing with two of the following conditions during the installation process:
- installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment

16. 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

17. assist in the completion of installation documentation to include one of the following:
 - installation records
 - company-specific documentation
 - job card

Unit 059

Assisting in the Installation of Waste/Foul Water Distribution Equipment

Outcome 2

Know how to assist in the installation of waste/foul water distribution equipment

Assessment Criteria

Underpinning Knowledge

The learner will be able to:

1. describe 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. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing waste/foul water distribution equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain 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. describe the basic principles of how the equipment functions, and its operating sequence
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives
10. describe the techniques used to position, align, level, adjust and secure the pipework and equipment
11. describe the importance of orientation and flow of certain components/equipment
12. describe the methods of lifting, handling and supporting the equipment during the installation activities
13. describe the types and applications of the different types of pipework systems (such as copper, plastic, lead, iron, clay)
14. describe the applications of the different types of couplings, and how to make watertight connections between pipes and other components
15. describe the types of contaminants in water systems, and the associated problems they can cause
16. describe the applications of the different pipework and equipment cleaning procedures (rod, water jet, solvents)
17. explain how to make adjustments to components, to ensure that they function correctly
18. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
19. describe the procedure for the safe disposal of waste materials
20. explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
21. describe 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. describe the problems that can occur with the installation operations, and how these can be overcome
23. describe the fault finding techniques to be used if the equipment fails to operate correctly
24. describe the recording documentation to be completed for the activities undertaken
25. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 060

Assisting in the Installation of Fresh Water Distribution Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of fresh water distribution systems and equipment, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying installation procedures for fresh water distribution equipment. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of fresh water distribution equipment
2. Know how to assist in the installation of fresh water distribution equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 60: Assisting in the Installation of Fresh Water Distribution Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 060

Assisting in the Installation of Fresh Water Distribution Equipment

Outcome 1

Assist in the installation of fresh water distribution equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following activities during the installation:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. Assist in the installation of equipment for one of the following types of fresh water distribution system:
 - mains cold water
 - cold down service
 - non-mains supplies
 - hot water supplies
4. assist in the installation and connection of two of the following types of pipe:
 - plastic
 - clay
 - iron
 - copper
5. 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)
6. follow all relevant instructions/documentation for the installation being carried out
 7. produce installations which comply with all of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's operation range
 - BS, ISO and/or BSEN standards
 - company standards and procedures
 - customer (contractual) standards and requirements
 8. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
 9. use three of the following instruments during the installation activities:
 - alignment devices
 - measuring devices
 - pressure testing devices
 - flow testing devices
 - bleeding equipment
 - multimeter
 10. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
 11. 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)
 12. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
 13. 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
 14. deal promptly and effectively with problems within their control and report those that cannot be solved
 15. assist in dealing with two of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
 16. 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

17. dispose of waste items in a safe and environmentally acceptable manner

18. assist in the completion of installation documentation to include one from one of the following:

- installation records
- company-specific documentation
- job card

Unit 060

Assisting in the Installation of Fresh Water Distribution Equipment

Outcome 2

Know how to assist in the installation of fresh water distribution equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe 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. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing fresh water distribution equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain 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. describe the basic principles of how the equipment functions, and its operating sequence
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives
10. describe the techniques used to position, align, level, adjust and secure the pipework and equipment
11. describe the importance of orientation and flow of certain components/equipment
12. describe the methods of lifting, handling and supporting the equipment during the installation activities
13. describe the types and applications of the different pipework systems (such as copper, plastic, lead, iron, clay)
14. describe the applications of the different types of couplings, and how to make watertight connections between pipes and other components
15. describe the types of contaminants in water systems, and the associated problems they can cause
16. describe the applications of the different pipework and equipment cleaning procedures (rod, water jet, solvents)
17. explain how to make adjustments to components, to ensure that they function correctly
18. describe the methods of connecting equipment to service supplies (such as electrical, fluid power, compressed air, oil and fuel supplies)
19. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
20. describe the procedure for the safe disposal of waste materials
21. explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)

22. describe 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. describe the problems that can occur with the installation operations, and how these can be overcome
24. describe the fault finding techniques to be used if the equipment fails to operate correctly
25. describe the recording documentation to be completed for the activities undertaken
26. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 061

Assisting in the Installation of Refrigeration Equipment

Level: 2

Credit value: 48

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to assist in the installation of refrigeration equipment, in accordance with approved procedures. The learner 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.

The learner 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 their permitted authority, and assisting others to ensure that the installed equipment functions to the required specification.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The installation activity may be carried out as a team effort, but they must demonstrate a significant personal contribution to the installation activities, in order to satisfy the requirements of the standard, and the learner must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying installation of refrigeration equipment procedures. The learner 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.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Assist in the installation of refrigeration equipment
2. Know how to assist in the installation of refrigeration equipment

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No: 61 Assisting in the Installation of Refrigeration Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 061

Assisting in the Installation of Refrigeration Equipment

Outcome 1

Assist in the installation of refrigeration equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the installation of the refrigeration equipment:
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - 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
3. 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
4. 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
5. follow all relevant instructions/documentation for the installation being carried out
6. 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
 - BS7671/IEE wiring regulations
 - BS, ISO and/or BSEN standards
7. use the correct tools and equipment for the installation operations, and check that they are in a safe and usable condition
 8. 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
 9. assist in the installation, positioning and securing of the equipment, using appropriate methods and techniques
 10. 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)
 11. 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
 12. carry out and/or assist in checking the installation, and make any adjustments in accordance with the specification
 13. 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

14. deal promptly and effectively with problems within their control and report those that cannot be solved
15. assist in dealing with two of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
16. 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
17. assist in the completion of installation documentation
18. complete the relevant paperwork, to include one of the following, and pass it to the appropriate people:
 - installation records
 - company-specific documentation
 - job card

Unit 061

Assisting in the Installation of Refrigeration Equipment

Outcome 2

Know how to assist in the installation of refrigeration equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the specific safety practices and procedures that they need to observe when installing refrigeration equipment (including any specific legislation, regulations/codes of practice for the activities, equipment or materials)
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the installation procedure, and their effects on others
4. describe the hazards associated with installing refrigeration equipment, and with the tools and equipment used, and how they can be minimised
5. describe the importance of wearing protective clothing and other appropriate safety equipment during the installation
6. explain how to obtain and interpret information from job instructions and other documents needed in the installation process (such as drawings, specifications, manufacturers' manuals, BS7671/IEE regulations, symbols and terminology)
7. describe the basic principles of how the equipment functions, and its operating sequence
8. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
9. describe the methods of securing to masonry, and the use of mechanical fasteners, joint compounds and adhesives
10. describe the techniques, tools and instruments used to position, align, level, adjust and secure the equipment
11. describe the methods of lifting, handling and supporting the equipment during the installation activities
12. describe the types of primary and secondary refrigerants, and methods of purging and charging the system
13. describe the methods of testing equipment and systems for leaks
14. explain 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. explain how to make adjustments to components to ensure that they function correctly
16. describe the methods of connecting equipment to service supplies (such as electrical, fluid, compressed air, oil and fuel supplies)
17. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
18. describe the procedure for the safe disposal of waste materials
19. explain how to recognise installation defects (such as leaks, poor seals, misalignment, ineffective fasteners, foreign object damage or contamination)
20. describe 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. describe the problems that can occur with the installation operations, and how these can be overcome

22. describe the fault finding techniques to be used if the equipment fails to operate correctly
23. describe the recording documentation to be completed for the activities undertaken
24. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 062

Carrying Out Fault Location on Lifting Platforms

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out efficient and effective location of faults on powered lifting platforms, in accordance with approved procedures. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, either alone or in conjunction with others, taking full responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying fault location procedures to lifting platforms. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location on lifting platforms
2. Know how to carry out fault location on lifting platforms

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 62: Carrying Out Fault Location on Lifting Platforms (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

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Unit 062

Carrying Out Fault Location on Lifting Platforms

Outcome 1

Carry out fault location on lifting platforms

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the fault finding activity:
 - undertake the fault location process to cause minimal disruption to the customer
 - obtain and use the correct issue of company and/or manufacturers' drawings and documentation
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - ensure the safe isolation of equipment (such as electrical, mechanical)
 - provide safe access and working arrangements for the area where the fault finding is taking place
 - carry out the fault location activities, using approved procedures
 - identify the fault or faults, 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
3. locate faults that have resulted in two of the following breakdown categories:
 - intermittent problem
 - partial failure or reduced performance
 - complete breakdown
4. review and use all relevant information on the symptoms and problems associated with the product or asset
5. investigate and establish the most likely causes of the fault or faults
6. select, use and apply diagnostic techniques, tools and aids to locate faults using all of the following:
 - information gathered from the person who reported the fault(s), including the customer
 - fault finding techniques (such as six point, half-split, input/output, unit substitution)
 - diagnostic aids (such as manuals, flowcharts, 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)
7. use three of the following types of test equipment to aid fault location:
 - measuring instrument/devices
 - multimeter
 - continuity tester
 - insulation resistance tester
 - self diagnostic systems
 - other specific test equipment

8. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
9. determine the implications of the fault or faults for other work and for safety considerations
10. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault or faults
11. record details on the extent and location of the fault or faults in an appropriate format
12. provide a record of the outcomes of the fault location, using one of the following:
 - company-specific documentation
 - service record card
 - step-by-step outcome analytical report
 - corrective action report

Unit 062

Carrying Out Fault Location on Lifting Platforms

Outcome 2

Know how to carry out fault location on lifting platforms

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which they are carrying out the fault finding investigation, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. explain 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. describe the safe working practices for lifts (as described in BS7255)
5. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
6. describe the hazards associated with carrying out fault location activities on lifting platforms (such as live electrical components, stored energy, misuse of tools), and how they can be minimised
7. explain 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)
8. describe the basic principles of how the lifting platform functions, its operating sequence, the purpose of the individual units/components and how they interact
9. explain how to use the various diagnostic aids to help identify the location of the fault
10. describe the various fault location techniques that can be used, and how they are applied (such as six point, half-split, input/output, unit substitution)
11. explain how to evaluate sensory information (sight, sound, smell, touch)
12. explain how to assess evidence and evaluate the possible causes of faults/problems
13. explain how to use a range of diagnostic equipment to investigate the problem
14. describe the care, handling and application of measuring/test equipment (such as mechanical and electrical measuring instruments)
15. explain how to check that the measuring/test equipment is within calibration, and that it is free from damage and defects
16. describe the problems that can occur during the fault location activity, and how they can be minimised
17. describe the importance of completing the correct documentation following the fault diagnostic activity
18. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 063

Installing Lifting Platforms

Level: 2

Credit value: 42

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to install powered lifting platforms, in accordance with approved procedures. This will require the learner to check the site for the proposed installation, and to ensure that the required installation tools and any specified components and site services are available, so that the installation can be carried out safely and efficiently. The learner will then be expected to install the lifting platform and check that it operates satisfactorily. 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).

The learner 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. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve, or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, either alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out. The installation activity may be carried out as a team effort, but the learner must demonstrate a significant personal contribution to the installation activities in order to satisfy the requirements of this occupational standard, and they must demonstrate competence in all the areas required by the standard.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying installation procedures for lifting platforms. The learner 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. The learner will also understand the installation methods and procedures used, and their application, in sufficient depth to be able to carry out the installation and to ensure that the installed equipment functions to specification.

The learner will understand the safety precautions required when carrying out the installation activities, especially those for ensuring the safe isolation of services. The learner will be required to demonstrate safe working practices throughout, and will understand their responsibility for taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Install lifting platforms
2. Know how to install lifting platforms

Guided learning hours

It is recommended that **161** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 63: Installing Lifting Platforms (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

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Unit 063

Installing Lifting Platforms

Outcome 1

Install lifting platforms

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following before installing the lifting platform:
 - 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 in such a way as to cause minimal disruption to the customer
3. install seven of the following lifting platform components/subassemblies:
 - shaft structures
 - guides
 - aperture frames
 - hydraulic system (such as power pack, valves, springs, ram, piping)
 - traction system (such as ac, dc and ropes)
 - carriage assembly (such as doors, gates, ramp, lighting, safety devices)
 - track trolley (such as chassis, interlocks and trim)
 - bridging steps
 - electrical controls (such as safety devices, landing controls, remote controls, carriage controls)
 - ancillary equipment (such as warning signs, company specific options)
4. follow all relevant drawings and specifications for the installation being carried out
5. produce installations that comply with one of the following, as appropriate to the equipment being installed:
 - equipment manufacturer's installation specification
 - customer requirements
 - company standards and procedures
 - BS, ISO and/or BSEN standards
6. use the correct tools and equipment for the installation operations and check that they are in a safe and usable condition
7. use three of the following tools during the installation activities:
 - straight edges
 - alignment devices (such as spirit level, laser equipment)
 - measuring instruments (such as electrical, mechanical)
 - plumb lines
 - tapes and measures
 - self-diagnostic equipment

8. install, position and secure the equipment and components in accordance with the specification
9. carry out all of the following activities during the installation:
 - adhere to procedures or systems in place for risk assessment, coshh, personal protective equipment and other relevant safety regulations
 - prepare components and assemblies for installation
 - ensure the safe isolation of services during installation (such as hydraulic, mechanical, electrical)
 - 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
10. apply installation methods and techniques, to include six of the following:
 - marking out of locating and securing positions
 - positioning the equipment
 - aligning the equipment
 - levelling the 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
11. ensure that all necessary connections to the equipment are complete
12. make the following connections to the installed equipment:
 - connections to power supply

plus two more from the following:

 - mechanical connections
 - electrical component connections
 - fluid power connections
13. deal promptly and effectively with problems within their control and report those that cannot be solved
14. deal with two of the following conditions during the installation process:
 - installations with no faults
 - partial equipment malfunction
 - complete malfunction of equipment
15. check that the installation is complete and that all components are free from damage
16. 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)

17. complete the relevant paperwork, to include all of the following, and pass it to the appropriate person:

- product user guide/maintenance guide
- installation work sheet
- company-specific documentation
- test and examination certification
- customer handover documentation (acceptance cert)

Unit 063

Outcome 2

Installing Lifting Platforms

Know how to install lifting platforms

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the specific safety practices and procedures that they need to observe when installing lifting platforms (including any specific legislation, safe working practices for lifts (such as BS7255), regulations/codes of practice for the activities, equipment or materials)
2. describe 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. describe the health and safety requirements of the work area where they are carrying out the installation activities, and the responsibility these requirements place on them
4. describe the hazards associated with installing lifting platforms, and with the tools and equipment used, and how they can be minimised
5. describe the personal protective equipment that they need to use for the installation activities, and where replacements can be obtained if supplied personal protective equipment becomes worn or damaged
6. explain 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. describe the lifting platform equipment to be installed, its operating procedures and function
8. describe the different drive systems, their operation, and associated components (such as traction, hydraulic, screwdriver, airbag)
9. describe the methods of marking out the site for positioning the equipment, and the tools and equipment used for this
10. describe the various mechanical fasteners that will be used (including, threaded fasteners, special securing devices, masonry fixing devices), and their method of installation
11. describe the procedures for ensuring that they have the correct tools, equipment, and fasteners for the installation activities
12. describe the types of tools and instruments used to position, secure and align the equipment (such as spanners, wrenches, levelling and alignment devices, measuring devices)
13. describe the techniques used to position, align, level, connect, adjust and secure the equipment
14. describe the methods of lifting, handling and supporting the equipment during the installation activities
15. describe the methods of connecting equipment to power supplies
16. explain why electrical bonding is critical, and why it must be both mechanically and electrically secure
17. explain how to dispose of waste items in an environmentally safe acceptable manner, and how to leave the work area in a safe condition
18. explain 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)
19. describe the tools and equipment used in the installation activities, and their calibration/care and control procedures
20. describe the problems that can occur with the installation operations, and how these can be overcome
21. describe the documentation to be completed for the activities, and to whom to pass them

22. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 064

Carrying Out Servicing of Lifting Platforms

Level: 2

Credit value: 19

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out servicing activities of powered lifting platforms, 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 lifting platforms such as traction, hydraulic, and direct drive. The learner 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 lifting platform.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner 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. The learner will be expected to work to instructions, either alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying servicing procedures to lifting platforms. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner will know how the lifting 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, the learner 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.

The learner will understand the safety precautions required when carrying out the servicing activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out servicing of lifting platforms
2. Know how to carry out servicing of lifting platforms

Guided learning hours

It is recommended that **56** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 64: Carrying Out Servicing of Lifting Platforms (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

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Unit 064

Outcome 1

Carrying Out Servicing of Lifting Platforms

Carry out servicing of lifting platforms

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the servicing activity:
 - undertake the servicing activities in such a way as to cause minimal disruption to the customer
 - use the correct issue of drawings, job instructions and servicing procedures
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - ensure the safe isolation of equipment (such as hydraulic, mechanical, electrical)
 - ensure safe access and working arrangements for the servicing area
 - follow the approved lifting platform servicing schedule
 - reinstate and return the lifting platform 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
3. follow the relevant maintenance schedules to carry out the required work
4. carry out the servicing operations, in accordance with all of the following, as appropriate to the equipment being serviced:
 - organisational guidelines and codes of practice
 - equipment manufacturer's operating range
 - customer requirements
 - BS, ISO and BSEN standards
5. carry out the maintenance activities within the limits of their personal authority
6. 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 and insulation checks
 - 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
7. carry out the maintenance activities in the specified sequence and in an agreed timescale
8. check eight of the following for operational safety, security and condition, in line with manufacturers' specifications:
 - overspeed governor
 - drive gear
 - rope/pulley system

- levelling devices
 - safety edges
 - safety gear
 - guide shoes and linkages
 - landing controls
 - remote controls
 - doors/gates
 - hydraulic system (such as pump, valves, hoses and reservoir)
 - safety devices
 - interlocks and key switches
 - emergency lowering devices
 - door locks
9. check ten of the following for damage, wear, security and condition, in line with manufacturers' specifications:
- pulleys
 - drums
 - controls
 - ramps
 - panels
 - push buttons/indicators
 - isolator
 - seat
 - communication equipment
 - trim
 - chassis
 - motor
 - lifting ropes
 - trailing cable
 - guide bracket and fixings
 - lighting
 - warning notices/labelling (incl. SWL or maximum load notice)
 - hydraulic hoses
 - fire/smoke seals
 - battery backup
10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
11. complete the relevant maintenance records accurately, including one of the following, and pass them on to the appropriate person
- job card
 - company report
 - service log or report
12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 064

Outcome 2

Carrying Out Servicing of Lifting Platforms

Know how to carry out servicing of lifting platforms

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the servicing activity is to take place, and the responsibility these requirements place on them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the servicing procedure, and their effects on others
4. describe the hazards associated with carrying out the servicing of lifting platforms (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. describe the importance of wearing protective clothing and other appropriate safety equipment during the servicing process
6. explain 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. describe the inspection and safety checks that are applied, and the importance of following them exactly during servicing operations
8. describe the methods of checking that components are fit for purpose, and how to identify defects and wear characteristics
9. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
10. describe the different drive systems, their operation, and associated components (such as traction, hydraulic, screwdriver, airbag)
11. describe the uses of mechanical and electrical measuring devices
12. explain how to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel, running and sliding conditions)
13. describe the importance of making checks before running the equipment under power
14. explain 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. describe the importance of completing servicing documentation and/or reports following the servicing activity, and how to generate them
16. describe the equipment operating and control procedures to be applied during the servicing activity
17. describe the things that can go wrong when carrying out servicing of lifting platforms, and what to do if they occur
18. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
19. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 065

Restoring Lifting Platforms to Service by Replacing or Repairing Components

Level: 2

Credit value: 23

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to restore powered lifting platforms to usable condition by repairing or replacing components, in accordance with approved procedures. The learner will be required to restore a range of lifting platforms, such as traction, hydraulic, and direct drive, to operational condition by repairing or replacing assemblies/sub-assemblies and components. The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people. The learner will be expected to work to instructions, either alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying component repair/replacement procedures to lifting platforms. The learner 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.

The learner will understand the safety precautions required when carrying out the repair/replacement activity, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Restore lifting platforms to service by replacing or repairing components
2. Know how to restore lifting platforms to service by replacing or repairing components

Guided learning hours

It is recommended that **77** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 65: Restoring Lifting Platforms to Service by Replacing or Repairing Components (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

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Unit 065

Restoring Lifting Platforms to Service by Replacing or Repairing Components

Outcome 1

Restore lifting platforms to service by replacing or repairing components

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
 2. carry out all of the following during the repair/replacement activity:
 - undertake the activities in a way that causes minimal disruption to the customer
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - ensure the safe isolation of equipment (such as mechanical, electrical, 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 lifting platform 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
 3. follow the relevant specifications for the component to be repaired
 4. carry out repair or replacement of lifting platform 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
 - customer requirements
 - BS, ISO and/or BSEN standards
 5. prepare the component for repair
 6. carry out the repairs within agreed timescale using approved materials and components and methods and procedures
 7. replace or repair four of the following lifting platform components:
 - hydraulic pump unit
 - electrical motor
 - lift controller equipment
 - rope/pulley system
 - door gates (such as manual or automatic)
 - hydraulic components (such as valves, hoses and connections)
- plus eight more from the following:
- electrical wiring and cables
 - solenoids
 - safety devices (such as switches, interlocks, fuses)
 - pulleys and drums
 - brakes

- ramps
- seats
- trim
- chassis
- panels
- aperture
- fire/smoke seals
- bridging steps
- overspeed governors
- sling drive
- ropes
- guide shoes/rollers
- guides and fixings
- residual current devices
- safety gear
- printed circuit boards (PCBs)
- controls (landing call stations)
- push buttons/indicators
- interlocks/key switches

8. 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

9. ensure that the repaired component meets the specified operating conditions

10. produce accurate and complete records of all repair work carried out

11. complete one of the following servicing records, and pass it to the appropriate person

- job card
- company report
- service log or report

Unit 065

Restoring Lifting Platforms to Service by Replacing or Repairing Components

Outcome 2

Know how to restore lifting platforms to service by replacing or repairing components

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe 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 them
2. describe the isolation and lock-off procedure or permit-to-work procedure that applies
3. describe the specific health and safety precautions to be applied during the repair/replacement procedure, and their effects on others
4. describe the importance of wearing protective clothing and other appropriate safety equipment during repair/replacement activities
5. describe the hazards associated with carrying out repairs on lifting platforms (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
6. explain where to obtain, and how to interpret job instructions and other relevant documents used in the repair/replacement activities (such as drawings, specifications, manufacturers' manuals, maintenance schedules)
7. describe the methods, techniques and company procedures to be followed for repairing/replacing components for lifting platforms
8. describe the inspection and safety checks to be applied, and the importance of following them exactly during replacement/repair operation
9. describe the methods and techniques used to dismantle/assemble lifting platform equipment (such as release of pressures/force, proof marking, extraction, pressing, alignment)
10. describe the methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lified' items such as seals and gaskets
11. describe the basic principles of how the lifting platform functions, its operating sequence, the working purpose of individual units/components and how they interact
12. describe the uses of mechanical and electrical measuring devices
13. explain how to make adjustments to components/assemblies to ensure that they function correctly (such as setting working clearance, setting travel, running and sliding conditions)
14. describe the importance of making checks before running the lifting platform under power
15. explain how to check that tools and equipment are free from damage or defects, and are in a safe and usable condition
16. describe the importance of preparing documentation and/or reports following the replacement/repairing activity, and how to generate them
17. describe the equipment operating and control procedures to be applied during the repair/replacement activity
18. explain how to use lifting and handling equipment in the repair/replacement process
19. describe the things that can go wrong when carrying out repairs to lifting platforms, and what to do if they occur
20. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
21. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 066

Carrying Out Fault Location Activities on Assistive Technology Systems and Equipment

Level: 2

Credit value: 26

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to locate faults on assistive technology systems and equipment, in accordance with approved procedures. The learner will be required to locate faults on equipment such as manual and powered wheelchairs, buggies and scooters, postural support systems, hoists, personal communication aids, walking aids, adjustable beds, pressure relief and distribution equipment, telecare alarm systems, aids for daily living, environmental control systems, associated battery charging systems for assistive technology systems and equipment.

The learner 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.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people (such as the reporting of any actual or potential safety related problems to the appropriate regulatory body). The learner will be expected to work to instructions, either alone or in conjunction with others, taking full responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will provide an informed approach to applying fault location procedures to assistive technology systems and equipment. The learner will have an understanding of the basic fault location methods and techniques used, and their application. The learner 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.

The learner will understand the safety precautions required when carrying out the fault location activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out fault location activities on assistive technology systems and equipment
2. Know how to carry out fault location activities on assistive technology systems and equipment

Guided learning hours

It is recommended that **49** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 66: Carrying Out Fault Location Activities on Assistive Technology Systems and Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

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Unit 066

Carrying Out Fault Location Activities on Assistive Technology Systems and Equipment

Outcome 1

Carry out fault location activities on assistive technology systems and equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. 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 procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - ensure the safe isolation of equipment (such as mechanical, electrical, gas, air or fluids)
 - ensure that safe access and working arrangements have been provided for in the area where the fault finding is taking place
 - carry out the fault location activities, using approved procedures
 - identify the fault(s), and consider appropriate corrective action
 - in conjunction with others, take actions to resolve the problem(s)
 - dispose of waste items in a safe and environmentally acceptable manner
 - leave the work area in a safe and tidy condition
3. carry out fault location on two of the following types of assistive technology system and equipment:
 - manual wheelchairs, buggies and wheeled commodes
 - powered wheelchairs and scooters
 - powered aids for daily living (such as bath lifts, riser and recliner chairs)
 - pressure redistribution and relief devices (such as alternating pressure cushions, mattresses and overlays)
 - environmental control systems (such as telephones, intercom systems, remote controlled equipment)
 - walking aids and other non powered aids for daily living (such as kitchen aids, grab rails and shower seats)
 - posture support systems (such as modular and custom made)
 - hoists
 - personal communication aids
 - adjustable beds
 - telecare alarm systems
4. locate faults that have resulted in two of the following breakdown categories:
 - intermittent problem
 - partial failure
 - complete breakdowns
5. review and use all relevant information on the symptoms and problems associated with the product or asset
6. investigate and establish the most likely causes of the fault or faults

7. select, use and apply diagnostic techniques, tools and aids to locate faults using four of the following:
 - information gathered from the person that reported the fault
 - fault finding techniques (such as six point, half-split, input/output, unit substitution)
 - diagnostic aids (such as service manuals and records, troubleshooting guides, equipment diagnostics)
 - instruments (such as multimeter, mechanical measuring devices, portable appliance tester)
 - inspecting (such as checking for breakages, wear/deterioration, overheating, missing parts, loose fittings)
 - operating/using equipment (such as manual switching off and on, operating/using equipment, test buttons)
8. complete the fault diagnosis within the agreed time and inform the appropriate people when this cannot be achieved
9. determine the implications of the fault or faults for other work and for safety considerations
10. use the evidence gained to draw valid conclusions about the nature and probable cause of the fault or faults
11. record details on the extent and location of the fault or faults in an appropriate format
12. complete one of the following maintenance records, and pass it to the appropriate person:
 - scheduled maintenance report
 - corrective maintenance report
 - other company-specific report

Unit 066

Carrying Out Fault Location Activities on Assistive Technology Systems and Equipment

Outcome 2

Know how to carry out fault location activities on assistive technology systems and equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety requirements of the area in which the fault location is to take place, and the responsibility these requirements place on them
2. describe the statutory and advisory documentation relating to medical devices (such as Medical Devices Regulations, British and European standards, regulatory agency guidance and safety warnings)
3. describe the statutory documentation relating to lifting equipment and electrical safety checks (such as the lifting operations and lifting regulations and portable appliance testing)
4. describe the appropriate working practices, and the need to respect the patient and carer in the patient environment, at home or in the community (where appropriate)
5. describe the importance of reporting any 'adverse incidents' with the equipment to the regulatory authority
6. describe the isolation and lock-off procedure or permit-to-work procedure that applies in the work area
7. describe the importance of wearing protective clothing and other appropriate safety equipment during fault location activities
8. describe the hazards associated with carrying out fault location on assistive technology systems and equipment (such as moving parts, handling oils and greases, stored pressure/force, misuse of tools), and how they can be minimised
9. describe the procedure to be adopted to establish the background of the fault(s)
10. explain how to use the various diagnostic aids to help identify the location of the fault(s)
11. describe the various fault location techniques that can be used, and how they are applied (such as six point, half-split, input/output, unit substitution)
12. explain how to evaluate sensory information (such as sight, sound, smell, touch)
13. explain how to assess evidence and evaluate the possible causes of faults/problems
14. explain how to use a range of fault diagnostic equipment to investigate the problem(s)
15. describe the importance of carrying out electrical safety tests on medical equipment, and the implications if this is not carried out (where appropriate)
16. describe 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)
17. explain how to check that measuring/test equipment is within calibration, and that it is free from damage and defects
18. explain 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/servicing reports, graphical symbols)
19. describe the basic principles of how the assistive technology system and equipment functions, its operating sequence, the purpose of individual units/components and how they interact
20. describe the problems that can occur during the fault location activity, and how they can be minimised

21. explain how to evaluate the likely risk to themselves and others, and the effects the fault(s) could have on the overall process or system
22. describe the importance of completing the correct documentation following the fault location activity
23. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 067

Carrying Out Scheduled Servicing Activities on Assistive Technology Systems and Equipment

Level: 2

Credit value: 19

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out scheduled servicing activities on assistive technology systems and equipment, in accordance with approved procedures. The learner will be required to carry out scheduled servicing on a range of assistive technology systems and equipment such as manual and powered wheelchairs, buggies and scooters, postural support systems, hoists, personal communication aids, walking aids, adjustable beds, pressure relief and distribution equipment, telecare alarm systems, aids for daily living, environmental control systems, associated battery charging systems for assistive technology systems and equipment

The learner's responsibilities will require them to comply with organisational policy and procedures for the servicing tasks undertaken, and to report any problems with the servicing process, tools or equipment used that they cannot personally resolve, or that are outside their permitted authority, to the relevant people (such as the reporting of any actual or potential safety related problems to the appropriate regulatory body). The learner 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 before handing over to the end user. The learner will be expected to work to instructions, either alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying scheduled servicing procedures to assistive technology systems and equipment. The learner will have an understanding of the process of implementing scheduled servicing tasks, the importance of carrying them out at specific times, and of recording the outcomes and actions taken. In addition, the learner will be expected to report where the outcomes identify the need for further investigation or servicing work.

The learner will understand the safety precautions required when carrying out the servicing tasks, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

The learner will understand the safety precautions to be observed when handing over the maintained and/or installed equipment. The learner will be required to demonstrate safe working practices throughout, and will understand the responsibility they owe to themselves and others in the workplace/area.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out scheduled servicing activities on assistive technology systems and equipment
2. Know how to carry out scheduled servicing activities on assistive technology systems and equipment

Guided learning hours

It is recommended that **56** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 67: Carrying Out Scheduled Servicing Activities on Assistive Technology Systems and Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

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Unit 067

Carrying Out Scheduled Servicing Activities on Assistive Technology Systems and Equipment

Outcome 1

Carry out scheduled servicing activities on assistive technology systems and equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the scheduled servicing activities:
 - undertake the servicing activities in such a way as to cause minimal disruption to normal working
 - use the correct issue of drawings and servicing documentation
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - ensure the correct equipment decontamination procedure has been adhered to before and after the maintenance activity (where appropriate)
 - confirm with the authorised person that the equipment is ready for carrying out the scheduled servicing
 - ensure the safe isolation of equipment (such as mechanical, electrical, gas, air or fluids)
 - ensure that safe access and working arrangements have been provided for the servicing area
 - carry out the scheduled servicing 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
3. carry out scheduled servicing activities on two of the following:
 - manual wheelchairs, buggies and wheeled commodes
 - powered wheelchairs and scooters
 - powered aids for daily living (such as bath lifts, riser and recliner chairs)
 - pressure redistribution and relief devices (such as alternating pressure cushions, mattresses and overlays)
 - environmental control systems (such as telephones, intercom systems, remote controlled equipment)
 - walking aids and other non powered aids for daily living (such as kitchen aids, grab rails and shower seats)
 - posture support systems (such as modular and custom made)
 - hoists
 - telecare alarm systems
 - adjustable beds
 - personal communication aids
4. follow the relevant servicing schedules to carry out the required work
5. carry out servicing of assistive technology systems and equipment in accordance with both of the following:
 - organisational guidelines and codes of practice

- equipment manufacturer's servicing information
6. carry out the servicing activities within the limits of their personal authority
 7. carry out the servicing activities in the specified sequence and in an agreed timescale
 8. carry out all of the following scheduled servicing activities:
 - monitoring the condition/deterioration of components
 - reviewing and checking equipment function and/or operation
 - recording the results of the scheduled servicing activity
 - reporting or taking action with regard to any defects that require immediate attention (such as replacing non-'lived' components)

plus six more from the following:

- removing excessive dirt and grime
 - removing any covers, casings or guarding
 - making visual checks (such as sight, sound, smell, touch)
 - replacing 'lived' consumables (such as labels, covers, seals, hoses, connectors, switches, batteries)
 - checking that any safety equipment or controls are operating correctly
 - checking the operation of instrumentation (such as gauges, sensors and indicators)
 - making adjustments to components and connections
 - checking/tightening fastenings to the required torque
 - replenishing greases or other fluids (where appropriate)
 - carrying out electrical safety tests using the appropriate equipment
9. report any instances where the servicing activities cannot be fully met or where there are identified defects outside the planned schedule
 10. complete the relevant servicing records accurately, to include one of the following, and pass them on to the appropriate person:
 - job card
 - specific company documentation
 - permit to work/formal risk assessment
 11. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 067

Carrying Out Scheduled Servicing Activities on Assistive Technology Systems and Equipment

Outcome 2

Know how to carry out scheduled servicing activities on assistive technology systems and equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety, infection control and de-contamination requirements of the work area and equipment being serviced, and the responsibility these requirements place on them
2. describe the appropriate working practices, and the need to respect the patient and carer in the patient environment, at home or in the community (where appropriate)
3. describe the statutory and advisory documentation relating to medical devices (such as Medical Devices Regulations, British and European standards, regulatory agency guidance and safety warnings)
4. describe the statutory documentation relating to lifting equipment and electrical safety checks (such as the lifting operations and lifting regulations and portable appliance testing)
5. describe the importance of reporting any 'adverse incidents' with the equipment to the regulatory authority
6. describe the isolation procedure or permit-to-work procedure that applies to the equipment being serviced
7. describe the specific health and safety precautions to be applied during the scheduled servicing activities, and their effects on others
8. describe the importance of wearing protective clothing and other appropriate safety equipment during the servicing activities
9. describe the hazards associated with carrying out scheduled servicing activities on assistive technology systems and equipment (such as handling greases, stored pressure/force, misuse of tools), and how they can be minimised
10. explain how to obtain and interpret information from job instructions and other documentation used in the servicing activities (such as drawings, specifications, manufacturers' manuals, servicing schedules, symbols and terminology)
11. describe the various checks to be carried out during the scheduled servicing procedure
12. describe the procedure for obtaining the consumables to be used during the scheduled servicing activity
13. describe the methods of checking that components are fit for purpose, and the need to replace 'lived' items
14. describe the importance of carrying out electrical safety tests on medical equipment, and the implications if this is not carried out (where appropriate)
15. explain how to check that any replacement components meet the required specification/operating conditions
16. explain how to make appropriate sensory checks (such as sight, sound, smell and touch)
17. describe the appropriate testing instructions to be adopted during the servicing activity
18. explain how to make adjustments to components/assemblies to ensure that they function to specification
19. describe the basic principles of how the assistive technology equipment functions, its operating sequence, the working purpose of individual units/components and how they interact

20. explain how to complete scheduled servicing records/logs/reports, in accordance with company policy and procedures
21. describe the equipment operating and control procedures, and how to apply them in order to carry out scheduled servicing
22. describe the problems that can occur whilst carrying out the scheduled servicing tasks, and how they can be avoided
23. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
24. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Unit 068

Carrying Out Maintenance and Repair Activities on Assistive Technology Systems and Equipment

Level: 2

Credit value: 35

NDAQ number: 501/0377/5

Unit aim

This unit covers the skills and knowledge needed to prove the competences required to carry out maintenance activities on assistive technology systems and 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 assistive technology systems and equipment, such as manual and powered wheelchairs, buggies and scooters, postural support systems, hoists, personal communication aids, walking aids, adjustable beds, pressure relief and distribution equipment, telecare alarm systems, aids for daily living, environmental control systems, associated battery charging systems for assistive technology systems and equipment.

The learner will be expected to cover a range of maintenance activities, such as isolating equipment, labelling components, dismantling components to the required level, setting and adjusting components, replacing 'lived' items, replacing or repairing components, carrying out functional checks and safety checks before handing over to the end user.

The learner's responsibilities will require them 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 they cannot personally resolve or that are outside their permitted authority, to the relevant people (such as the reporting of any actual or potential safety related problems to the appropriate regulatory body).

The learner 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. The learner will be expected to work to instructions, either alone or in conjunction with others, taking personal responsibility for their own actions, and for the quality and accuracy of the work that they carry out.

The learner's knowledge will be sufficient to provide a sound basis for their work, and will enable them to adopt an informed approach to applying maintenance procedures to assistive technology equipment. The learner will have an understanding of dismantling and reassembly methods and procedures, and their application. The learner 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, the learner 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.

The learner will understand the safety precautions required when carrying out the maintenance activities, especially those for isolating the equipment. The learner will also understand their responsibilities for safety, and the importance of taking the necessary safeguards to protect themselves and others in the workplace.

Learning outcomes

There are **two** learning outcomes to this unit. The learner will be able to:

1. Carry out maintenance and repair activities on assistive technology systems and equipment
2. Know how to carry out maintenance and repair activities on assistive technology systems and equipment

Guided learning hours

It is recommended that **98** hours should be allocated for this unit, although patterns of delivery are likely to vary.

Details of the relationship between the unit and relevant national standards

This unit has been derived from National Occupational Standard Engineering Maintenance and Installation Unit No 68: Carrying Out Maintenance and Repair Activities on Assistive Technology Systems and Equipment (Suite 2).

Support of the unit by a sector or other appropriate body

This unit is endorsed by SEMTA.

Assessment

This unit must be assessed in a work environment and must be assessed in accordance with the 'Common Requirements for National Vocational Qualifications (NVQ) in the QCF' which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Additional assessment requirements have been published by SEMTA. These additional assessment requirements are set down in SEMTA's Engineering Maintenance and Installation Level 2 unit assessment strategy which can be downloaded from SEMTA's website:

http://www.SEMTA.org.uk/training_providers__awarding/national_occupational_standard/qca_assessment_requirements.aspx

Unit 068

Carrying Out Maintenance and Repair Activities on Assistive Technology Systems and Equipment

Outcome 1

Carry out maintenance and repair activities on assistive technology systems and equipment

Assessment Criteria

Practical skills

The learner will be able to:

1. work safely at all times, complying with health and safety and other relevant regulations and guidelines
2. carry out all of the following during the maintenance activities:
 - plan the maintenance activities so as to minimise disruption to normal working
 - use the correct issue of company and/or manufacturers' drawings and maintenance documentation
 - adhere to procedures or systems in place for risk assessment, COSHH, personal protective equipment and other relevant safety regulations
 - ensure the correct equipment decontamination procedure has been adhered to before and after the maintenance activity (where appropriate)
 - provide safe access and working arrangements for the maintenance area
 - ensure that the equipment is safe to work on before carrying out maintenance activities
 - carry out the maintenance activities, using appropriate techniques and procedures
 - return the equipment to service on completion of the maintenance activities
 - dispose of waste items in a safe and environmentally acceptable manner, and leave the work area in a safe condition
3. carry out maintenance activities on two of the following types of assistive technology systems and equipment:
 - manual wheelchairs, buggies and wheeled commodes
 - powered wheelchairs and scooters
 - powered aids for daily living (such as bath lifts, riser and recliner chairs)
 - pressure redistribution and relief devices (such as alternating pressure cushions, mattresses and overlays)
 - environmental control systems (such as telephones, intercom systems, remote controlled equipment)
 - walking aids and other non powered aids for daily living (such as kitchen aids, grab rails and shower seats)
 - posture support systems (such as modular and custom made)
 - hoists
 - personal communication aids
 - adjustable beds
 - telecare alarm systems
4. follow the relevant maintenance schedules to carry out the required work
5. service assistive technology equipment to one or more of the following quality and accuracy standards:
 - organisational guidelines and codes of practice
 - equipment manufacturer's instructions
 - equipment meets CE marking and, where appropriate, BS7671/IEE wiring regulations

6. carry out the maintenance activities within the limits of their personal authority
7. carry out the maintenance activities in the specified sequence and in an agreed timescale
8. carry out twelve of the following maintenance activities, as applicable to the equipment being maintained:
 - isolating the equipment
 - checking components for serviceability
 - dismantling/disconnecting equipment to the appropriate level
 - checking the condition of warning labels
 - tightening fastenings to the required torque
 - disconnecting and reconnecting wires and cables
 - checking cable identification markers
 - removing electrical/electronic units/components
 - removing mechanical units/components
 - replacing damaged/defective/missing components
 - repairing damaged or defective components
 - soldering and de-soldering
 - replacing all 'lifer' items
 - setting and adjusting components
 - replacing or checking lubricants
 - making visual checks before functional testing or powering up
 - carrying out electrical safety tests using the appropriate equipment
 - functionally testing the maintained equipment
9. replace or repair a range of components, to include ten of the following:
 - cables and connectors
 - electronic modules
 - overload protection devices
 - power supplies
 - actuators
 - timers
 - display/indication units
 - bulbs or LEDs
 - locking and retaining devices
 - posture belts
 - switches
 - sensors
 - transformers
 - motors
 - hydraulic units
 - drive belts
 - pulleys
 - seals
 - valves
 - pumps
 - bearings
 - gauges
 - brake assemblies
 - foot supports
 - control leavers
 - interface devices
 - wheels
 - hoses/pipework
 - battery chargers
 - seating
 - posture supports
 - pressure relief covers, interlinings or mattresses
 - lifting slings
 - structural components (such as bed or wheelchair frames)
 - guards or casings

- upholstery
10. report any instances where the maintenance activities cannot be fully met or where there are identified defects outside the planned schedule
 11. complete the relevant maintenance records accurately, to include all of the following, and pass them on to the appropriate person
 - job cards
 - servicing logs or reports
 - other specific documentation
 12. dispose of waste materials in accordance with safe working practices and approved procedures

Unit 068

Carrying Out Maintenance and Repair Activities on Assistive Technology Systems and Equipment

Outcome 2

Know how to carry out maintenance and repair activities on assistive technology systems and equipment

Assessment Criteria

Underpinning knowledge

The learner will be able to:

1. describe the health and safety, infection control and de-contamination requirements of the work area and equipment being maintained, and the responsibility these requirements place on them
2. describe the statutory and advisory documentation relating to medical devices (such as medical devices Regulations, British and European standards, regulatory agency guidance and safety warnings)
3. describe the statutory documentation relating to lifting equipment and electrical safety checks (such as the lifting operations and lifting regulations and portable appliance testing)
4. describe the appropriate working practices, and the need to respect the patient and carer in the patient environment, at home or in the community (where appropriate)
5. describe the importance of reporting any 'adverse incidents' with equipment, to the regulatory authority
6. describe the hazards associated with carrying out maintenance activities on assistive technology systems and equipment (such as handling oils, greases, misuse of tools, using damaged or badly maintained tools and equipment, not following laid-down maintenance procedures), and how to minimise them
7. describe the importance of wearing protective clothing and other appropriate safety equipment during the maintenance process
8. explain how to obtain and interpret information from job instructions and other documentation used in the maintenance activities (such as drawings, specifications, manufacturers' manuals, BS 7671/IEE regulations, symbols and terminology)
9. describe the isolation procedure that applies to the maintenance activities (such as electrical isolation, removal of fuses)
10. describe the methods of checking that components are fit for purpose, how to identify defects and wear characteristics, and the need to replace 'lifer' items (such as seals, sensors, batteries and belts)
11. describe the basic principles of how the equipment functions, its operating sequence, the working purpose of individual units/components and how they interact
12. describe the care and use of measuring or diagnostic equipment (such as mechanical measuring devices, electrical measuring instruments, and other specific measuring or testing devices)
13. describe the techniques used to dismantle/reassemble mechanical/electromechanical equipment (such as mechanical fittings, unplugging, de-soldering, removal of crimped connections)
14. describe the methods of removing and replacing components without causing damage to the equipment or other components
15. explain how to make adjustments to components/assemblies to ensure that they function correctly
16. describe the importance of making visual checks before using or operating the equipment

17. describe the importance of carrying out electrical safety tests on medical equipment, and the implications if this is not carried out
18. explain 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
19. describe the importance of completing maintenance documentation and/or reports following the maintenance activity, and how to generate them
20. describe the equipment operating and control procedures to be applied during the maintenance activity
21. explain how to use lifting and handling equipment in the maintenance activity
22. describe the things that can go wrong when carrying out routine maintenance, and what to do if they occur
23. describe the organisational procedure(s) to be adopted for the safe disposal of waste of all types of materials
24. describe the extent of their own responsibility and to whom they should report if they have any problems that they cannot resolve

Useful contacts

Type	Contact	Query
UK learners	T: +44 (0)844 543 0033 E: learnersupport@cityandguilds.com	<ul style="list-style-type: none"> • General qualification information
International learners	T: +44 (0)20 7294 2885 F: +44 (0)20 7294 2413 E: intcg@cityandguilds.com	<ul style="list-style-type: none"> • General qualification information
Centres	T: +44 (0)844 543 0000 F: +44 (0)20 7294 2413 E: centresupport@cityandguilds.com	<ul style="list-style-type: none"> • Exam entries • Registrations/enrolment • Certificates • Invoices • Missing or late exam materials • Nominal roll reports • Results
Single subject qualifications	T: +44 (0)20 7294 8080 F: +44 (0)20 7294 2413 F: +44 (0)20 7294 2404 (BB forms) E: singlesubjects@cityandguilds.com	<ul style="list-style-type: none"> • Exam entries • Results • Certification • Missing or late exam materials • Incorrect exam papers • Forms request (BB, results entry) • Exam date and time change
International awards	T: +44 (0)20 7294 2885 F: +44 (0)20 7294 2413 E: intops@cityandguilds.com	<ul style="list-style-type: none"> • Results • Entries • Enrolments • Invoices • Missing or late exam materials • Nominal roll reports
Walled Garden	T: +44 (0)20 7294 2840 F: +44 (0)20 7294 2405 E: walledgarden@cityandguilds.com	<ul style="list-style-type: none"> • Re-issue of password or username • Technical problems • Entries • Results • GOLA • Navigation • User/menu option problems
Employer	T: +44 (0)121 503 8993 E: business_unit@cityandguilds.com	<ul style="list-style-type: none"> • Employer solutions • Mapping • Accreditation • Development Skills • Consultancy

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